NEW RCA-7868 NOVAR POWER PENTODE OFFERS OUTSTANDING DESIGN ADVANTAGES

With this new tube RCA brings all the advantages of novar design to high-fidelity circuitry.

RCA-7868 is a high-pervenance 9-pin novar power pentode for output stages of hi-fi audio amplifiers, phonographs and radio receivers. You'll get up to 44 watts of power output from a pair of them in Class AB1 push-pull service in audio amplifiers.

RCA-7868 is the first hi-fi tube type in RCA's new novar line of large, all-glass 9-pin receiving tubes. Its cost to you is less than that of any equivalent tube regardless of base configuration.

RCA-7868 has all the advantages of novar design, the only all-glass, integral-base receiving tube design to offer:

Larger internal lead diameter—for strong cage support and high thermal conductivity for very effective heat dissipation.

Wider spacing between pins (0.172")—to minimize the possibility of voltage breakdown, hence greater reliability.

Pin length of 0.335"—for firm retention of tube in socket.

Pin circle diameter of 0.687"—large enough to permit use of both T9 and T12 envelopes.

RCA Dark Heater—found exclusively in RCA receiving tubes...additional assurance of reliability.

RCA 7868 has two base-pin connections each for grids #1 and 2; special radiator on siderods of grid #2 assures cooler operation.

Take full advantage of this major contribution to audio technology. See your RCA Field Representative for full details...or write: Commercial Engineering, Section RCA Electron Tube Division, Harrison, N. J.

The Most Trusted Name in Electronics
FM-Stereo: Time-Division Approach
Product Detector for FM-Stereo
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Light Listening
Record Revue
Jazz and All That

Audioclinic
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At last, Stereo Multiplex is here... and, once again, Sherwood is first... ready immediately with a brilliant combination of Sherwood's "high rated" FM tuner design plus all circuitry necessary to receive the new FCC-approved FM multiplex stereo... two 32-watt amplifiers, two phono/tape pre-amplifiers and all controls necessary for playing records, tape or TV. The S-8000 Receiver needs only the addition of speakers to complete a basic system for FM stereo listening enjoyment. Overall size, just 16 x 4 x 14 inches deep.

Sherwood's dramatic Correlaire Furniture Modules are the perfect setting for your Sherwood hi-fi components. Choose from sixteen interchangeable modules, styled with a contemporary flair in hand-rubbed Walnut and Pecan woods. Have truly flexible room arrangements. A beautiful four-color brochure is yours for the asking.

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Record stereo... play stereo... with the new Concord model 401

Why settle for a tape player when you can own a Concord 401 stereo tape recorder for no more cost. With the 401 you can record a library of 25 one hour stereo tapes for less than $50.00 compared with the cost of over $300.00 for the equivalent in pre-recorded music.

The Concord 401 stereo tape recorder offers superb sound quality in an advanced design precision instrument. The 401 contains both stereo record and playback pre-ampifiers. Records stereo anywhere, plays through any fidelity system.

Features: 4-track stereo and monaural recording, sound on sound recording, two VU meters, individual channel controls, electrostatic remote control. Mounts vertically or horizontally—ideal for custom installations. Frequency response, 30-16,000 cycles ± 2 DB at 7½ Ips, flutter and wow, less than .18%.

Price including custom carrying case $249.50.

Write Today: Send for Concord's booklet "401—All the Facts" regarding the quality and versatility of the 401 Stereo Tape Recorder.

Dear Reader—
I really must congratulate you. You have been very good about enclosing stamped, self-addressed envelopes with your letters. This helps me to get answers back to you in the shortest possible time. You see, I answer all letters, even when your question is used in "Audio Clinic." If I did not follow this procedure, some of you would wait a long time for your answers because of the delay between the receipt of a letter and the publication date of the material in that letter.

I note, too, an increasing interest in my other column, "Audio Techniques." I have quite a number of suggestions and they will make interesting reading, I believe. Newcomers to audio probably don't know about this feature which appears intermittently. The purpose of "Audio Techniques" is to allow readers who have found short-cuts in building electronic equipment, have developed unusual test procedures, or ideas which can make experimentation with electronics a little easier, can share their ideas with other readers. Send any such information to me at the address shown; many others will profit from your knowledge. J. G.

Ignition Noise Reduction

Q. I use an AM-FM tuner. I live on a busy street and I get a lot of ignition noise when listening to FM. The station I listen to is about 90 miles away. I use a TV antenna, a yagi with a rotator, which I direct towards the station. Is there any modification I can make in the tuner to stop ignition noise? If I use 72-ohm coaxial lead-in, how can I make an impedance match to the 300-ohm balanced input on my tuner? William T. Cramer, Stockton, California.

A. There is no internal modification which can help the tuner to reduce the noise output when the signals are too weak to saturate the limiters. However, there are external changes which may help. You can add an FM booster to increase the strength of the desired signal, giving it a better chance to saturate the limiters. You could try using 300-ohm shielded twin lead. This cable has properties somewhat like those of the 72-ohm coaxial line you mentioned, with the added advantage that the cable is still balanced.

If you prefer the 72-ohm line, you must use a matching transformer at the antenna and another one at the receiver in order that the required 300-ohm impedance will be met at both places. (Such transformers are available from your local parts jobber.)

Moving the antenna as far from the street as possible will sometimes reduce ignition noise in the tuner.

It may even be necessary to use an antenna cut exactly to the frequency you most wish to hear in order to obtain maximum gain at this dial setting.

R. F. Interference in Home Music Systems

Q. I have constructed an integrated stereo amplifier-preamplifier. I am experiencing some trouble, however, in that, with the amplifier operating, I get an interfering station in the background. Am I correct in assuming that I have a ground loop or a tuned circuit somewhere in the hookup? The interference exists with no input to, or after, the preamplifier stage. By switching to only one preamplifier and feeding through both amplifiers, I still get it. My question is how shall I trace this down and eliminate the trouble? William H. Ross, Dearborn, Michigan.

A. This question is really one which deserves an entire article. All I can do here is to point out some of the places which are likely to cause interference and you will have to do your best to trace the particular cause associated with your equipment.

Oxidation is a major cause of interference. Such oxidation can occur in switch contacts, tube socket contacts, and poor soldering connections. These latter troubles are especially common in ground leads. Oxidation can also occur at the contacts of the input connections. Use contact cleaner on switches and tube sockets, and check all solder connections.

Some interference can come directly into the heater string and be coupled into unaltered cathodes. This string, in turn, gets its signal from the power line via the power transformer. Bypass the heaters to ground with 0.01 µF capacitors. (Any capacitors associated with interference elimination should be of either mica or...
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Garrard's LABORATORY SERIES Type A Automatic Turntable has become America's number one record player in only nine months.
"MATCHED TWIN" CERAMIC MIKES...

for superior stereo recording!

Now you can capture live stereo sound at its natural best...with Sonotone's new, improved "Matched Twin" ceramic microphones. These superlative new matched mikes...Model "CM-T10A"...were designed to give you the greatest possible clarity in your stereo recording.

Here's how. Each mike in a "Matched Twin" set has a rugged, rubber-encased ceramic transducer that's immune to temperature and humidity extremes; plus a lifetime damping grid. Every "CM-T10A" pair is acoustically matched at the factory to a tolerance of ±2 decibels. Jacked into any stereo recorder, they feed flat 50 to 11,000 cycles signal at professional quality output level of -56 decibels. Sonotone's "Matched Twins" are easy to handle, too.

For stereo sound at its natural best, buy "Matched Twin" mikes by Sonotone. Unequaled for performance...and for true stereo enjoyment. (For even greater sensitivity, buy Sonotone's matched twins—CM-T11A—with frequency range of 80-9,000 cycles and an increased sensitivity of -53 decibels.) Both models retail at $35.50 per matched pair. Matching Table Stand: $4.00 each.

ceramic construction because such units are not inductive at radio frequencies.) If both sides of the heater string are above ground, each side must be bypassed to the chassis. Chokes of about 10 turns can be wound on high-value 2-watt resistors, and these chokes can be placed in series with the offending leads.

Some manufacturers omit the use of line bypass capacitors in their equipment in order to eliminate shock to the user if he should inadvertently come into contact with the chassis of this equipment and the ground, or with another chassis. Use the bypass capacitors even though the possibility of shock is then likely. Such shocks are not dangerous and may be avoided if connections are made or broken with the a.c. line cord removed from the socket.

In addition to bypassing, interference filters are often of help. Be sure that the filter you use is a good one. I have seen some which are nothing more than straight-through connections between input and output, with some plaster of Paris as weight. (This latter attribute is the only useful thing about such filters, for they are then useful paperweights.) There are two types of interference filters. One is the brute-force type and one is the tunable type. This latter is to be preferred if its tuning range includes the frequency of the interfering station.

Connect the equipment to a good ground—radiator or water pipe. This may help, but it may also increase the interference. This is the case when there is oxidation present at joints of the piping.

One method of determining the source of the interference is to short out successive grids from the input of the preamplifier stage and working right up to the output. During this process you may find one which, when shorted, eliminates some of the trouble, but also leaves some residual unwanted signal. This will indicate that the interference is coming in at least two grids. If there is any direct coupling between stages, short this circuit by means of a large capacitor, but remember that this capacitor must be mica or ceramic. (This is necessary in order to prevent B-plus from being shorted out, possibly damaging the amplifier.)

After the offending stage(s) has been discovered, try a bit of shielding if none is employed in this circuitry. Shorten up the leads from the coupling capacitor as much as possible. If the foregoing is unsuccessful, you will have to get somewhat fancier.

What is the impedance of the offending stage (input impedance)? Let us say that it is a quarter meg. Choose a grid bypass capacitor whose reactance at 50,000 or 100,000 cps is also equal to a quarter megohm. If its use still does not help you, or at any rate not enough help, put an inductance in series with the offending lead which is equal to a quarter megohm at 50,000 or 100,000 cps. If this too does not work, then resort to series tuned circuits across the grid lead and/or parallel tuned circuits in series with the grid circuit. (The tuning of these circuits will depend upon the frequency of the interfering

Sonotone

(Continued on page 102)

4 AUDIO • AUGUST, 1961

AmericanRadioHistory.Com
two problem-solvers from AKG:

for multiplex...

AKG D 88 Duplex Dynamic Cardioid Microphone, for stereo announce and control-room use, puts the voice square in the middle of the two channels. Two matched dynamic systems in a single housing deliver equal inputs to both circuits (X-Y) with very smooth response, making D 88 the only single answer for economical, quality multiplex announcing. D 88/200 (for 200-Ohm inputs) only $46.50!

for quality remotes...

AKG C 60 Miniature Condenser Microphone, with light-weight DC Power Pack and capsules for omni and cardioid modes.

If you've always wanted condenser quality in the field, but have been discouraged by its cost and the inconvenience of AC power supply — those days are over!

C 60 breaks the price barrier, cuts loose from AC cables, and in performance equals mikes costing far more. Capsules for omni (CK 26) and cardioid (CK 28) are instantly interchangeable — response is smooth from 20 to 30,000 cycles — special head circuitry gives freedom from blasting, even with close-mike overloads at high levels.

B 60 DC transistorized Power Pack weighs a pound, serves many hours on a single recharge. Alternately, N 60 EA AC Power Supply is for indoor use.

Price? C 60 with either capsule, plus B 60 or N 60 EA Power Supply, with necessary cables — only $259.50.

For added versatility: effective windscreen W 60 — long-arm fishpole FP3 — resilient suspension hanger H 60 — and shoulder strap for Power Pack in remote pickups. For indoor use: rack-mounting AC Power Supply N 60 R4 for close-mike techniques, economically powers four C 60's from a single panel with outputs High Unbalanced, plus Balanced 600, 200, and 50 Ohms.

A-B test a C 60 in omni or cardioid mode against any other mike at any price at your AKG Dealer — and you'll want several! For further information, write USA import and service agents: Electronic Applications, Inc., Stamford, Connecticut/1203) DA 5-1574.
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The turntable that adjusts for perfect pitch!

Thorens compensates for variations in house current and recording systems; gives the truest reproduction with all your records, old or new. Adjustment is so fine that records can be used to accompany live vocal and instrumental performances. Swiss precision engineering ensures longer record life, performance to match the finest components you will ever own. See your Thorens dealer soon for expert attention and high fidelity service.

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LETTERS

Unhappy Recordist

Six:

Here is your card for the tape survey. Yet you do not have any space to ask why I do not buy more recorded tapes, assuming I have two $500 "tape recorders."

The reason is that it is too much unnecessary to turn the tape over at the end of a short reel. Years ago I had a recorder that reversed automatically with a piece of tin-foil on the tape.

There is no reason why in this advanced age of tape machines we cannot have what was had ten years ago. Let's have a tape player that plays the tape one way, then reverses and plays it the other way with another head, and when this is done, let it shut itself off.

Manufacturers keep trying to sell tape recorders, never realizing that we may have one already and there is nothing to record anyway.

KEITH LA BAR,

179 N. Martel Ave.
Los Angeles 56, California

(There is at least one machine on the market which will play both directions automatically. Probably the reason there are not more of them is that enough people do not think it important. We agree with you, however. As to having nothing to record, though, we cannot agree. Ed)

Center Fill and Phasing

Six:

I have been reading and enjoying AUDIO regularly, but mutily, for the past twelve years. I can no longer hold my silence.

E. A. Snape III composed an interesting and informative article about loudspeaker phasing, but he omitted two points that I feel belong in any such piece.

First, stereo "localization," or "center fill," or "the curtain of sound," or whatever we choose to call it, is not the only thing affected by misphasing. Regardless of the number of microphones used in recording, and the resulting upper-range distortions resulting from multichannel mixing, low frequencies are generally in phase on stereo discs. If they weren't, the vertical modulations for deep, heavy bass would be too much for many pickups to cope with, and might even dig through the disc's lacquer surface (on the original master) into its metal base. So, while the upper ranges may not appear to be significantly affected by misphasing, cancellation of low-bass response is noticeable when playback speakers are out of phase.

Secondly, listening for center fill-in (or bass response) is, as Mr. Snape points out, a perfectly legitimate way of phasing speakers, but there is a much simpler and surer phasing check that can be used for any speakers that are small enough to move. Simply move the speakers face to face, as close together as possible, play a monaural recording through both channels (with their levels balanced), and disconnect one wire from either speaker. If they are in phase, disconnecting the wire will cause a slight reduction in the volume of sound coming from between the speakers. If they are out of phase, though, the speakers will be cancelling each other's output quite effectively, so disconnecting one will cause a pronounced increase in their combined sound output. If volume increases when one speaker is disconnected, reverse the connections to it; otherwise, just restore the disconnected lead.

K. Gordon Holt,

Golf View & Rose Valley Rds.
Wallingford, Pa.

AUDIO • AUGUST, 1961
MODEL EQ-252-A
GRAPHIC EQUALIZER

7 POSITIONS FOR ULTIMATE CONTROL
OF SPECTRAL QUALITY IN RECORDING, TV-BROADCAST AND MOTION PICTURES

FEATURES
7 Selected Positions of Variable Hi-Lo Equalization and Attenuation.
Gold plated, Noise-free, Switching through ±8 db in 1 db steps during active use.
Hum-free performance through toroid coils from -70 to +24 dbm.
No tubes or power required—all passive Bridge T circuits in one integrated unit.
Small size: 3½" x 10½" x 5¾" deep.

The Langevin Model EQ-252-A Graphic Equalizer fulfills the critical need for multiple control at the subjectively important points of the audio range. It employs miniaturized, military quality, gold plated, etched circuitry in each of the 7 plug-in filter units, resulting in a passive assembly requiring no tubes or power supplies. Only input and output connections are required. Sliding Levers permit 8 db of equalization and 8 db of attenuation in 1 db steps at 50, 130, 320, 800, 2000, 5000 and 12,500 cps during the program through noise-free gold-plated switching. Modern controls give quiet operation at -70 up to +24 dbm.

Filter assemblies use sealed toroid coils for hum-free operation. Careful design delivers ±½ db accuracy. Overlap from one filter to the next gives combined flat output when levers are in a straight line in any equalized or attenuated position (see curves). Special frequencies are available to order; overlap may or may not provide combined flat output between adjacent positions as the standard frequencies shown have been calculated for this effect. In zero position each or all filters are flat (resistive only, 16 db loss) from input to output. Because all passive circuitry is used there is no distortion when operated up to plus 24 dbm. Impedance is 600 ohms in and out; for other impedances use Langevin line to line transformers, Model TF-602-C. The model EQ-252-A is limited to 600 ohms impedance for the reason that lower impedances would double the size of the equalizer components every time the impedance is halved.

SPECIFICATIONS
Circuit: Bridge T, Impedance: 600/600 ohms, Insertion Loss: 16 db; Operating Level: -70 to +24 dbm; Positions: 7, with 8 db of equalization and 8 db of attenuation at 50, 130, 320, 800, 2000, 5000 and 12,500 cps in 1 db steps; Distortion: none; Coils: Sealed toroids, Power Requirements: none; Response: See curves; Panel Finish: Black, satin finish, non-halation, anodized aluminum; Terminals: solder type, turreted; Filter Sections: 7 plug-in, printed circuit type; Size: 3½" high by 10½" long by 5¾" deep overall.

ORDERING INFORMATION
Model EQ-252-A Graphic Equalizer equipped with red knobs, complete with mounting hardware and instructions. Weight, net 9 lbs.; 14 lbs. shipping. Price, Net $475.00.

Recommended Accessories
When lower impedances than 600 ohms are required, use the following matching coils in and out:

FREE Write Today! $1.00 Value—84 Page Professional Audio Equipment Catalogue covering Low-Level Amplifiers, Limiters, Power Amplifiers, Variable and Fixed Equalizers, High and Low Pass Filters, VU Meters and Panels, Plug-in Patchcords, Jacks and Jackstrips, Telephone Keys, Transformers, Precision Instrument Switches and complete line of new Langevin Attenuators, Pan-Pots, Straight Line and Rotary Mixers, VU Range Extenders and many others.

"Over thirty-five years of audio progress"

Langevin
A Division of Sonotec Incorporated

503 South Grand Avenue • Santa Ana, California

audio • August, 1961
Bernie Green: Futura
RCA Victor LSA 2376

This release in the "Stereo Action" series is more venturesome than the earlier RCA examples of sound in motion. The first release was based on the solo instrumental by electronic means while "Politics of the Mind" was based on the solo voice. The second release is a broadening of the scope of the series. The title track, "Futura," is a reworking of a song by Henry Mancini. The session was conducted by Nelson Riddle.

Frank Sinatra: "Ring-a-ding ding"
Reprise R 1001

Sinatra makes his first appearance here on the label he has recorded since his earliest days as the milking or the studio but there is a raw hard drive in his work and that of the accompanying orchestra concerning "The Next" and "The Only"
Sinatra's latest approach also makes his label the longest on the West Coast and for that reason, I must say that this recent release is mentioned in the label's lineup. It is a departure from the group's more relaxed and danceable style of the past few releases.

The Happiest Girl in the World (Original Broadway Cast)
Kapp KDL 8500

Toward the close of a Broadway season that has seen only a handful of shows displaying a profit, two musicals have proved successful. The first is "Carival," the top show at the Kreller label. It is the same release as the one in Hotmail. This is the second release in the series of the same name. The success of the album has been partly due to its being so much like the original London production. The album is the same as the one on LP, as clear as the air on Mount Olympus used to be.

Donnybrook (Original Broadway Cast)

Several choruses have recorded the campfire songs included in this releasing release. Roger Wagner has wisely decided that there should be no room for self-conscious virtuosity on the treble line. They're all here—Love's Old Sweet Song, in the Glory, Flower Bowl, Adorn, Afri, etc. A light touch of handy and the occasional purr of an accordian are the only instrumentals included in this album. The rhythm section keeps the vocal line stretching from speaker to speaker. Add to the performance a singing job of cornet and vocal solo and a pleasant note for today's hurled pace.

Bobby Montez: Viva!
World Pacific S 1404

The stereo market today has plenty of record labels capable of presenting small groups in excellent sound. Few of these small labels can claim more than two hits. However, they are not the exception in the world of records. The world of records is a place where great voices and gentle humor of Eddie Foy is the album's outstanding attraction. A survivor of a famous song and dance family in the days of vaudeville, Foy makes no attempt to emulate Harry Bradley in the role of a County Ken. Foy's marriage broker, a rather self-centered individual, manages to raise meddling in other people's affairs to a fine and thoroughly gratifying point.

The symbol © indicates the United Stereo Tapes 4-track 7½ ips tape number.

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65-Watt FM-Multiplex Receiver

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$359.50*

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FM-AM-Multiplex Receiver

A high quality receiver with outstanding stereo FM-AM and Multiplex tuners, for monophonic FM and AM; stereo FM and stereo FM-AM. The Stereo Master Audio Control and 65-watt stereo amplifier, plus exclusive Stereo Beam make the Fisher 800-B the finest in its class.

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Whatever your transformer needs, Peerless can design to your specification and deliver in quantity. In addition to the units shown here, Peerless has solved these special problems:

**Miniature Inductance Unit, 4.85 henrys (±2%) at 150 ma, DC**
**Miniature 400-cycle Filament Power Transformer for airborne operation**
**Miniature Power Transformer, 3-phase, 400 cps to 1, 2 and 3-phase**
**Miniature Audio Input Transformer, low-level input**
**Miniature Hermetically-Sealed Output Transformer, 400 cps, high level**

**LOW VOLTAGE, HIGH CURRENT AUDIO OUTPUT TRANSFORMER 16595**

Single-phase, oil-immersed unit rated at power level of 26KVA. Frequency response of ±.5 db from 20 cps to 5 KC. Above resonant frequency, at 28 KC, attenuation slope and phase shift are smooth and without irregularity. Suited to such applications as driving high-power shaker tables.

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Small size for such superb performance. Frequency response, 1 db: 10 to 25,000 cps. Primary balanced to attenuate longitudinal currents in excess of 50 db. Secondary may be used single-ended or in push-pull. Electrostatic shield between primary and secondary has 90 db electromagnetic shielding. Maximum operating level, +8 dbm.

Whatever your transformer needs, Peerless engineers can design to any military or commercial specification and manufacture in any quantity. See REM for complete catalogue of standard units or write for information to Dept. A-8-PE.

- The entire process was still in a primitive state.
- That was the period when most of us were debating how far to plunge in the cost of a second channel and making our decisions on the basis of the stereo sound then available on the best of the two-track tapes.
- By the time the moving-magnet pickups came along, stereo discs began to show some promise—particularly in the jazz and pop field where the groove was coping with only a small group of instruments. World Pacific is one label of that period that deserves credit today for some of the very finest, wide-range stereo discs.
- The latest releases from the West Coast prove that World Pacific still clings to a front position. As Bobby Montez and his quintet of Latin instrumentals work through their streamlined interpretations of Mambo and Cha Cha, any decent system will reveal some very interesting audio features. The Mambo vibes have none of the thick, tubby sound generally associated with the instrument in normal recordings. Even more impressive on a top-notchsystem is the definition of Ray Rivera's conga drums and the timbales of Mike Gutierrez. It's no great trick to maintain the individual identity of these instruments when they're situated at the outer edges of the stereo layout. Only an extremely good stereo disc can achieve this sort of definition when the two instruments are almost side-by-side on the audio. The occasional vocal accompaniment is more concerned with release of the group's good spirits than it is with the presentation of understandable lyrics. If a suggestion is in order now that most of the problem of the stereo disc have been worked out, that's a record that could be kept on hand to check separation even if you're not interested in Latin music.

Doris Day: Bright and Shiny

Columbia 00 CQ 377

Always a resolute source of good cheer on records, Doris Day has enough extra impact on tape to warrant a word of caution. There may, after all, be days when you are not in the mood for all the concentrated happiness Miss Day radiates in front of stereo mikes. Perhaps the first and last tunes in this collection illustrate this point to best advantage. Imagine the reaction of a real grumpy shopper-fo-toes when he checks a list of tunes that starts with Bright and Shiny and ends with something called Twinkle and Shimmy. Luckily, the rest of the lineup offers some favorites with more reassuring titles—Singin' in the Rain, On the Sunny Side of the Street and I Want to Be Happy. Neil Hefti is in charge of a small and indeterminate orchestra that is kept pretty much in the background. Listeners who have associated Hefti only with the bands of Woody Herman and Count Basie may be puzzled by the use of an electric organ in the arrangement of Keep Smiling—until they realize that exceedingly few Doris Day recordings are purchased on the basis of their arrangement.

Benny Goodman Swings Again

Columbia 00 CQ 359

The sound in this recording was no better than average when it first came out in disc form. Tape shows a slight improvement in a session mixed on-the-spot before an audience at Ciro's in Hollywood. There is a heightened sense of presence when one usually gets in tape playback—despite the acoustics of a room of only indiffent quality. In his latest swing around the nation, Benny Goodman is really travelling light these days. Backed by a versatile nine-man group, he is now in a position to meet his payroll while working almost any location. Many of the tunes heard in this reel will conjure up memories of the heavily-manned Goodman bands of former days. The most effective recreation of the past occurs in the old favorite Stomp, Stomp, Stomp. In his latest arrangement, Benny relies heavily on xylophone and the imaginative use of fewer instruments to get over his points. This performance, deft though it is, can never erase the full- sonic effect of the spine-tingling power he had.

(Continued on page 99)
"I'm ready... are you... to play and record FM MULTIPLEX STEREO CASTS?...

...says JULIE LONDON... "My Roberts Gives Me Professional Performance!"

ONLY THE ROBERTS "990" STEREO tape recorder

combines these advanced features:
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are chosen by discriminating movie stars and recording artists for personal home entertainment and rehearsal applications

ONLY THE ROBERTS "440" STEREO tape recorder

Has "MAGIC REPLAY" self contained stereo speakers, automatic shut-off plus many other "Never Before" features.

$499.50

Available as deck and pre-amp package: $649.50

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Audio • August, 1961
BELTONE'S BINAURAL

A few months back I renewed an old dream with some enthusiasm, for I had conceived idly of the then somewhat impractical idea of a binaural hearing-aid, a double one that for many people might restore two-eared hearing. Two of the old bulky hearing aids would indeed have been an impractical and expensive no go for most deaf people. So I passed up a patent application and forgot about it.

In the experience of transistor technology and miniature batteries, came the eyeglass type of hearing aid, and in the relatively bulky, binaural hearing aid, one complete system in each wing of the spectacles.

A Beltone executive read my article and wrote me a note inquiring if our binaural glasses dated from as far back (if I remember rightly) as 1956, I thought, was it not so? I said, let him come on and he wrote back and said I'm sending you one. So for some odd weeks, on and off, I've been trying to see like a deaf person with a Beltone Bolero binaural hearing aid. Black-frame glasses and people won't believe there are no lenses in them until I poke a finger through the lens holes. No lenses, two complete hearing systems, one for each ear, with separate mikes, amplifiers, sound transducers, separate volume controls and on/off switches. This Bolero that I have been trying is not the latest model, and it is one of two alternative types that are available from Beltone, this one conveying sound from a transducer inside the glasses frame via a plastic tube to the ear. The other type puts the transducer itself outside the ear in a small unit, connected by a thin electrical cord. I gather it costs more, though prices were not mentioned in my Beltone correspondence. (I suppose that a third type might be the bone conduction arrangement, but I have not yet tried a binaural model of this type.)

Not Deaf Enough

I must say first that the main trouble for such people as me is to get deaf enough. I'm not deaf or even semi-deaf, though I have a fair degree of hearing loss, and I don't notice it. I don't need high amplification, and I quickly found that when the Beltone plug was missing, the transducer itself could not be used. I could restore approximately normal sound volume by turning the units just barely beyond the zero point on the volume control. Higher levels—they went very much higher—produced appallingly loud noises (and sometimes feed-back when the ear plug was left loose) which were more than I could take. At top volume, my own voice soared at me, a slight scrape of a pencil on a piece of paper was monstrously loud, and to drum one's fingers idly on a wooden desk was to set off machine gun rat-a-tat-tat. A loudish sound like a door closing or a book dropped a foot or so on the floor practically burst my ear drums. Some gain! (There are other models with volume controls which are inaudible to normal hearing.)

I tried ramming cotton in my ears, with the earpiece on top, but the difference was not important. Same effects, though I could turn the volume up a bit higher. Maybe wet cotton soaked in oil—but this was going to far. I want to keep my ears intact and unmoled.

A preliminary observation. For the normally comparative ear, such as mine, a natural binaural sound is not appreciable only when the volume was almost literally the same as the "natural" one. Higher volume not only did monstrous things to normal sounds but also exaggerated the perception of room-echo and other semi-extraneous noises. Binaural perception was exaggerated too, of course, but not in a helpful way, as far as I could figure.

Just how a habitually deaf person would react to these factors I don't know, and I am intrigued to find out. I had thought of an objective level-setting test, say a clock ticking, with adjustment for threshold audibility at a certain distance. (The deaf person really doesn't know what is a "normal" volume and in any case must learn to live with any sound as though it were a brand new experience.) But, so far, I have not run into any truly objective deaf person, a candidate is 86 and frail; I decided that he was not a fit person to perpetuate harsh experiments upon.

Now at this point I must indicate clearly that my experiments with these hearing-aid glasses are intended merely to find out for me whatever I happen to find out, in purely personal terms. I am not in a position to study the vast amount of professional work that has been completed in the hearing field (nor are you likely to want to read it); I am interested as you are, in the idea of binaural hearing, in the practical results of this ingenious approach to a semblance of natural two-eared sound, in the implications and side effects of the non-deaf. That's plenty.

If I merely have discovered personally what is well enough known to the experts in the field, well, I'm happy. If by chance I run into something solid and constructive—the outsider who may just possibly be the forester who has not even known about the trees—then I'm even more than happy. Naif said, and thanks to Belton for giving me a chance to play.

Normal and Loud

Yes, there is no doubt that this Beltone aid does provide a considerable measure of true binaural differentiation. And this even though the response curve of the system is highly eccentric, with a cut-off not far above 4000 cps and a rolled-down bass end. Even so, there is enough left to make the natural hearing available—the sense of normal spatial liveliness, of direction (along with the coordinated eyes), the clearing-up of noisy confusion when multiple sounds are experienced all at once, as in a restaurant or a discussion between numerous people.

I can say this safely, I think, even though it is true that some sound, namely low tones, gets by the ear plug and directly into my ears for a partially "natural" binaural hearing, even though my own perceptions are directly related to the natural hearing I use for comparison; whereas a deaf person has variably little to go on, as mentioned above, and must interpret the effects of the glasses without any direct comparison at all, or with variably vague memories of past binaural experience as his only guide.

I was able to wear my glasses, set at a reasonable sound level, for an hour or so at a time, and though the sound is not at all natural in tone quality due to the special curve lacking in lows and highs, I found I could actually forget the glasses after a while, even in coffee, even in a crowded restaurant. The stereo effect, via two separated loudspeakers, may actually be perceived via a binaural hearing aid, through microphones and ear plugs.

Interesting. I could easily distinguish the right-speaker material from the left-speaker sound and the blend was wholly natural, in spite of the relatively poor response curve of the hearing aids. Could the difference between stereo and binaural be made plainer?

I tried for awhile to see whether I could adjust over a period of time to abnormally loud volume levels, for I am confident that I could. That is to say, after a fashion. But we are not interested in a rather frightening extreme of ear-fatigue and general physical exhaustion. Dreadful strain. I now can use binaurally perceptive deaf person can so quickly become tired in confusing sound-situations, why so many deaf persons prefer to turn off their hearing aids most of the time and rely on guesswork and/or lip reading. The extra-loud volume was harsh, distressingly unlovely, really painful when any strong sound came along; I soon learned to wince and shudder even at the possibility of a loud noise about to happen.

It is well known, I think, that in their efforts to compensate for the inadequacies of our mono hearing, people tend to turn their hearing aid volume levels much too high. This helps in a way—but it also leads to quick pain and exhaustion. We do the same thing in our mono phono-graph reproduction (and stereo too); we compensate for our intuitive sense of the loss of true sound separation by turning up volume for more definition and impact. In direct readings, most symphonies are heard far louder at the usual living room volume than from a concert hall seat in a big hall. We need the extra loudness, to overcome the mono (and stereo) absence of binaural separation. We need close-up microphoning, selectively favoring close-up soloists over...
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NEAT

NEAT ONKO DENKI CO., LTD.
4-Ichome, Kanda, Hatagaocho, Chiyoda-ku, Tokyo, Japan

Hearing Education

Beltone is particularly aware of the problem that interests me most of all—binaural hearing and education. The biggest difficulty with any hearing aid system is that the user must be educated to make use of it. Again and again after long deafness, must be re-educated. Loud discriminations must be re-cultivated, sometimes even for people who have never had normal hearing at all. Unfortunately so, and the worst because glib advertising too easily persuade deaf people that they can enjoy all the wonders of full hearing in a trice.

Their first reaction is almost bound to be one of hideous distress, and so much the worse if the naive listener has been led to expect heaven-in-an-instant.

Orientation and re-orientation are major problems for education in every area where our acquired sense interpretation has been in some way stunted or damaged. Like learning to walk for a polio victim, learning to hear again after a hearing loss is a painfully slow and most unpleasant process. It should never be otherwise described.

Thus Beltone, sneaking a wee bit to the need for advertising's characteristic "positive values," starts off with a joyous ping—"You'll soon discover (ugh, that fatal word!) that your new Bolero opens up wonderful new ways to the enjoyment of a full life—even if you thought you were previously too deaf to be helped." OK, true enough as far as it goes. But Beltone gets down to specifics very quickly. No instant results...

"First two weeks listen carefully to one person for at least fifteen minutes each day. With practice you'll hear and understand more easily everyday. Watch as you listen to the person speaking to you. This will help you understand more easily... Church and theater. Don't use your Beltone at either of these places for at least the first two weeks. It takes time to become completely adjusted to your aid (perhaps as long as 60 days). Be patient... be confident..."

In other words, a new user of a binaural hearing aid may have to keep at it for two full months before he begins to settle down to true binaural living. That is a realistic estimate of the terrible agony of adjustment—worth it in ultimate rewards—which is usually nearest for most people who really want to re-learn to hear in the normal manner. A sobering thought, but a realistic and hopeful one. Sixty days is nothing after perhaps years, an eternity, of virtual deafness, or of one-eared mono-hearing with all its distressing jumble of indeterminate noises.

Naturally, I myself have not had to learn anything, except perhaps to adjust to the inevitably less perfect binaural effect of your playing as compared to my own functioning ears. My experience is all comparative; the deaf person's is all sheer learning-from-scratch. To learn binaural hearing with these glasses is like the learning of a language by a child—direct, without either comparison or translation.

Peaks and Whistles

I do not want to underestimate the enormous ingenuity of these hearing aids. Astounding—even in this somewhat out-of-date model that I am at this very moment wearing (and listening binaurally to the loud chatter of my typewriter). A battery half the size of a dime, an amplifier in the thin part of the spectacle frame up front, a microphone like a quarter-cube of sugar in the end of the frame behind the ear, a tiny plastic tube that carries the relatively huge sound from the ear to the believably compact, though other models are still smaller; remarkably long-lived (I haven't used my first set of batteries yet) and extraordinarily powerful. When the thing goes into feedback you can hear the whistle fifteen or twenty feet away. Even with no more than rudimentary sound, this double-eared gadget would rate as a technological miracle.

And so I went on to proceed to a few questionings, always keeping this last miraculous achievement in mind. I tried the glasses on my consultant friend Jan Syrjala, a pretty sharp electrical-audio engineer, and we came to some common thoughts, combining observations.

Why the highly restricted, strongly peaked tonal response? No highs, no lows, and a peak that is so pronounced that I can actually whistle the pitch at which all sound "rings"—including these typewriter keys as I type and listen through the hearing aid. A high "whoaee," slightly metallic and shrill. It's even hard to determine the level of transistor noise (some is inevitable with such high gain) because of the persistent ringing sound added to everything. Several possible explanations occur as to this curve.

1. The curve is at least in part pre-mediated. Most people lose their hearing from the top down. As in low-cost phonographs and the like, a mid-range peak makes for maximum conveyance of intelligibility minus higher highs.

As an argument, I don't like it. Remember the days when phonograph records were limited in tonal range and/or peak in response? Nowadays, the records are cut to standard curves and the adjustment if any is left to the playing equipment. The same, I'd say, might be true in a general way for hearing—and I've heard say that the idea of individually "tailored" hearing aid curves is losing ground.

In any case, the loud whistle, the metallic "edge" of tone is to me very tiring, and strains the ear with extra peak volumes in the exaggerated range.

2. With the requirements of maximum gain and maximum miniatrization through transistors, it is easy to imagine that no matter response simply is not practical. Better a large gain and a peaky sound than not enough gain for practical use.
The Altec 250SU Stereo Console was developed and operating well before FCC made FM Stereo a reality. Today, many 250SU Consoles successfully serve stereo and monophonic operations in AM, FM, TV, and Recording Studios.

If you are converting to Multiplex Stereo, let the testimony of time help you select your new stereo console. It's a good way to know that the "bugs" are out...a good way to know that every important feature and convenience has been added. A few are listed below.

- MINIATURE PLUG-IN COMPONENTS: Preamplifiers, amplifiers, and utility input devices are of the same size to readily fit the built-in pre-wired mounting trays on the Console. These units are also available separately for special requirements.
- INPUT LEVEL SELECTION: The 250SU has ten input positions, each with a "bus" switch and mixer attenuator. Any of these positions may be used for high level, low level, or any combination of sources by plug-in of proper Altec input device.
- SELECTABLE OUTPUT FUNCTIONS: The Console comes wired for universal service with single channel, dual channel, or two/three channel operation. The desired functions are obtained by using the necessary number of Altec plug-in amplifiers.
- HIGHEST STUDIO QUALITY: 250SU performance exceeds FCC, NAB, EIA, and all recording standards. Plug-in components are tube operated for optimum studio quality and greatest dynamic range at lowest noise levels. The premium tubes used are pre-aged and may be tested individually by push-button facilities.

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ALTEC LANSING CORPORATION
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1515 South Manchester Ave., Anaheim, Calif. / New York / Los Angeles

Audio • August, 1961
3. It would seem likely that the plastic tube used in my pair of hearing aid binaural glasses is a highly restrictive acoustic conductor. Perhaps it is impossible to get a better response via such a tubular system—which no doubt has other advantages including that of simplicity and reasonable cost. Beldon’s fancier system, again, uses an earplug transducer feeding directly into the ear itself, with no plastic tubes. Perhaps the response is better in that model. It should be worth the extra cash if so—if you have the proper response yourself. (But remember, of course, the essential of binural separation do come through this tube system, peaks or no. For a person with no binural hearing and no high response, this relatively ugly sound could be worlds better than no hearing at all.)

Listening to the Rear

I wonder about the mike positions in these glasses. They are placed so that in effect you hear backwords, out of the back of your head. The spectacle arms curve sharply inward, above and behind the ears, the mike faces out sideways and angled to the rear, at about a half inch from their extreme ends. Jan Szymala was sitting with his back to an open window that faced on a noisy city street when we noticed this. He exclaimed that he heard entirely too much street noise and not enough of my voice—I was speaking directly towards him and towards the window at his back.

In effect, his ears were reversed. They “looked” backwards, toward the rear, out the window.

It would seem as though the pair of mikes could be mounted somehow further forward, and preferably out in front near the eyes, in the direc- tion of the eyes, person-to-person front reception in a conversation and minimize the rearward pickup of incidental noise. Whether this is feasible in a practical sense I do not know. It may have been done in other models.

Stereo

I have a final generalization to make concerning ear-education. It is necessary to relearn to hear, when you are deaf, learn to make “normal” discriminations between desired sounds and background interference via the binural facility. You have the facility itself as soon as you put on your binural glasses. But at first you cannot use it, as a person who has had two-eyed vision restored to him is at first unable to fuse his eyes’ two images and cannot judge distance accurately. The growing baby learns these things too, from scratch. Wholly new experiences, newly discovered sense facilities, and at first no ability at all to use them. The small infant reaches for things a room’s distance away: his eyes roll, he sees crossed-eyed, learns to gauge depth and distance only by slow degrees. So it is with the re-learning process as well.

Now I have been thinking a lot lately that this very factor applies to stereo listening and can account for a large part of our misunderstandings as to stereo’s value. We just don’t hear it. We haven’t learned.

Of course you think you can judge stereo sound right off, the very first time. Aren’t you musical? Haven’t you listened to records for years? I say that you can indeed judge a large part of a stereo sound—the mono part. That’s considerably more than half the sound in most records and often a lot more still.

We can be quite specific here. Every bit of sound that is cut laterally into the stereo disc groove is entirely familiar to your ears after long listening practice. The mono signal, cut laterally, will tell the mono elements in the recorded sound—most of the sound. Of course you can judge it.

But what of the vertically cut sound, the difference signal, the stereo increment?

Well, a lot of people say they can’t hear any difference between mono and stereo records. It could be the equipment, of course, especially when the two loudspeakers are not more than three feet apart. But more likely, I say, is the simple lack of discrimination in the listener’s mind—perhaps an experienced music listener whose ears have never experienced this particular set of recorded sound clues before.

Naturally, they don’t operate for him as they should, given extended listening practice. He just doesn’t hear the stereo. Not unless it is crudely “ping-pong.” Our stereo demonstrations have joyfully taken care of that sort of all-out whacking of the ears, the discriminating music listener still has to go out and learn to hear real stereo in its own best terms, which are not ping-pong at all.

How about learning to hear binural recordings, made exclusively for earphone listening? No problem! You have virtually nothing to learn, for your binural recording is merely a reproduction of the sound you could have heard on the spot. Only the sense of time—the “present” —and of location—what and most important, the concurring sense-elements of sight and even of touch, are missing. These lacks—lack of sense of direction off, but they can’t spoil the natural liveliness and distance-perception of true binural hearing.

Now if the deaf person is to understand that he, too, may achieve a semi-natural hearing perception if he’ll work hard at learning it, Belltone will be assured a whole of a future.

Shrieking Birds

P.S. On an impulse, I suddenly decided to try the Bolero binural hearing aid out of doors—with interesting results.

It was a warm, balmy evening and first I set about mowing the lawn with my hand mower. After some hastily volume adjustments I got the mower into proper aural perspective and went to work full lift. It still sounded like a mower, and the familiar noise of mower wheels banging against rocks or clanging over flagstones was quite normal and comfortably familiar via the ear plugs. But there was at the time a bird song contest going on overhead—the nesting season, and a band of rival tofflers (wars of small chestnut-sided warblers!—well, warblers anyhow) were outwitting each other as hard as they could.

I soon became aware that the birds, via my hearing aids, were unusually potent. Their songs positively glowed with warmth and I found I could easily distinguish between their various locations, this tree and the next. Binural, all right, and very loud. Of course! Their muggers fitted right into the area of peaked response on my earphone glasses, somewhere above 3000 cps fundamental. (You can generally hear more of the high overtones on small-bird calls anyhow, so not much coloration was absent.)

I tried turning up the volume, and the lawn mower became a small diesel tractor.
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266 Glenwood Avenue, Bloomfield, N. J.
EDITOR'S REVIEW

PRODUCT PREVIEW TIME

August has become the traditional month for our annual Product Preview issue which has been hailed by both manufacturer and audiofan as a goldmine of information. We are pleased to continue the tradition with this issue, and trust it will meet with the same hearty acceptance.

For those who like to have a compendium of information such as this Product Preview all in one place, and possibly of a more convenient size, we are offering a reprint of this entire section in the form of the new AUDIOGUIDE, which will be published on September 1. And in addition to the Product Preview, the AUDIOGUIDE will contain reprints of all the articles on FM stereo that have appeared in the magazine itself for the last three months. This impressive total of eight articles is by far the most complete coverage of the subject that has appeared anywhere, and some of the material contained in these articles has never been published anywhere else at all.

We believe that the AUDIOGUIDE will become a welcome and useful and convenient addition to your library.

THE HIGH FIDELITY SHOWS

Comes now the time of the year when the hi-fi shows begin to appear, interest gets greater, and the average audiofan looks forward to the fall season and plenty of new equipment which he has planned, during the summer doldrums, on adding to his lineup. This year, of course, there is the "something new has been added" in the form of FM-Stereo. So far there have not been enough stations on the air to bring forth a number of do-it-yourself projects with home-constructed adapters, but we look forward to some new and interesting circuitry when the stations finally catch up with the manufacturers.

The first of the fall hi-fi shows is to be held in Chicago, August 25-27, at the Morrison Hotel. The second, and the largest for the season, is New York, opening to the public at the New York Trade Show Building on September 14 and running through the 17th. This show is presented by the Institute of High Fidelity Manufacturers, and is expected to coincide with the inauguration of FM-Stereo broadcasting in New York.

The next show after New York is in Toronto, and is to be held October 18-21, and this is followed by one in Philadelphia at the Benjamin Franklin Hotel October 27-29. The last show of the year is at Minneapolis November 16-18 at the Dyckman Hotel. This show is sponsored by the Audio Division of the Paul Bunyan Chapter of the Electronic Representatives Association.

As usual, Audio will be represented at all of them.

THE PICAFARAD

Ever since Audio first appeared—more than fourteen years ago—the form "μf" has been used to indicate microfarads. Many other publications have used this term interchangeably for the more common "mμf" but Audio has always tried to be consistent with the use of the Greek μ. European publications have long used the form "pf" for the same quantity, with these letters representing "picafarads".

The picafarad has been accepted in the U. S. as the standard form for one millionth of a millionth of a farad since it is simpler to use and it follows a whole series of prefixes covering the multiple powers of 10.

Although not the first to make a studied attempt to follow the new standard, Audio now moves in that direction. Henceforth, the abbreviation "pf" will be used in all articles and schematics to indicate this value. There is, however, one possible exception to this rule—some articles are already in type and the schematics have already been drawn and the line cuts made. In short, for some three or four articles which are ready for inclusion in coming issues it is possible that the old form may appear. But all new material will bear the designation "pf" whenever applicable.

It will, that is, unless there is another epidemic of gremlins which always seem to show up whenever we announce a forthcoming change.

CONTOUR CONTROLS

We were recently intrigued by the announcement by one of the larger package manufacturers that they had a "New for 1962" exclusive development which was described as being a "full fidelity background listening control." This device is purported to eliminate bass loss, treble cut out, and low-level fade out. The advertisement said further that "ordinary hi-fi loses bass at low levels—ordinary hi-fi loses treble at low levels." Without question, an earthshaking discovery—by a package manufacturer.

All us high fidelity component people have known about Fletcher-Munson compensation, contour control, or whatever it may be called, for years. The methods of providing the compensation and the reasons therefor were first described in the May, 1948, issue of this magazine in an article by David Bomberger, and further elaborated on as a continuous control in the February, 1949, issue. Since then various other articles have presented the same principle with different "hardware."

Seriously, though, we believe that the loudness control did more to put hi-fi fidelity into the living room than any other single element. Prior to it, all hi-fi fans played their rigs at performance level to achieve the proper balance, and performance level is too high for most people.

It's good to know that at least one of the package companies has found out about this, though.

18 AUDIO • AUGUST, 1961
Exclusive Assurance of Quality

Only the Stanton Fluxvalve can provide the exclusive and patented features which make it the finest pickup available.

The significance of a document...a Letters Patent conferring exclusive rights and privileges on an individual to manufacture and vend an invention both new and useful...further signifies a most important responsibility upon that individual.

Endowed with this responsibility, Pickering & Company pioneered—through their outstanding participation in stereophonic development—the Stanton Stereo Fluxvalve, the very first (and only) stereo cartridge incorporating the revolutionary T-Guard stylus.

But this was only the beginning—through continued development—major advances in stereo pickup design were brought about by the use of Pickering & Company's long experience...special skills and exclusive techniques.

Thus; less than one year after the introduction of the stereo record, Pickering & Company introduced the Model 380 Stanton Stereo Fluxvalve. And, in a few short months, the 380 earned its reputation from the experts as—"The finest stereo pickup ever tested".

Isn't it time you found the true answer to stereo as it was meant to be?

We urge you to go to your dealer for a 380 Fluxvalve Demonstration—we know you will find its quality of performance almost beyond belief.

For those who can hear the difference...
FM-Stereo: Time-Division Approach

CARL G. EILERS

Here is an explanation of time-division FM-stereo by one of the innovators of the approach. He explains the approach in mathematical terms as well as by means of a specific FM-stereo demodulator.

The system of FM stereophonic broadcasting which has been adopted by the Federal Communications Commission had its inception in a time-division multiplex switching system between left and right stereophonic program sources.

In a time-division multiplex switching system a switching rate is chosen to be at least twice the highest frequency of modulation to be transmitted. If one analyzes the signal mathematically it becomes apparent that the signal basically consists of sum (L+R) and difference (L−R) components. If the switching waveform is a square wave, as shown in Fig. 1, then the sum of the left and right stereophonic channels appears as audio modulation on the main radiated carrier and the difference between the left and right stereophonic channels appears as a suppressed carrier amplitude modulation of a series of odd harmonics of the switching rate.

Equation (1) describes the resulting modulation function of the radiated carrier:

\[
\frac{(L+R)}{2} + \frac{2(L-R)\cos\omega_ct - 2(L-R)\cos \frac{3\omega_ct}{3\pi} + 2(L-R)\cos \frac{5\omega_ct}{5\pi} - \ldots}{3\omega_ct + 2(L-R)\cos5\omega_ct - \ldots} = M(t)
\]

Eq. (1)

Since the fundamental subcarrier term contains all the necessary stereophonic information in the form of (L−R) modulation and, in order to prevent radiation outside the 200,000 eps channel and, further, in order to allow for the possible addition of an SCA background music channel, it is desirable to limit the spectrum of the modulation to the necessary stereophonic components. We can then describe a new composite modulating function:

\[
(L+R) + (L-R)\cos\omega_ct = M'(t)
\]

Eq. (2)

where: \(M'(t)\) is the new modulating function

It will be noted that the maximum peak-to-peak amplitudes of the sum (L+R) audio and the difference (L−R) modulated subcarrier are equal. It is also true but not obvious that the composite modulation function maximum peak-to-peak amplitude is equal to the maximum of either of the components alone. Thus, the FM transmitter may be fully modulated with (L+R) audio and then fully modulated with the (L-R) subcarrier without having to reduce the modulation percentage for either component as applied to the radiated carrier. This interleaving property of the sum (L+R) and difference (L−R) signals is directly related to the original concept of time-division multiplexing between left and right stereophonic signals.

The photographs of Fig. 2 illustrate the concept of interleaving. The upper photograph displays the sum (L+R) audio component of the composite modulating signal. The radiated carrier deviation is ±75,000 eps. The center photograph displays the difference (L-R) subcarrier component. In the lower portion of the photograph is shown the result of the addition of these two components which make up the composite modulating signal. It is evident that the maximum peak-to-peak amplitudes are identical for all three photographs.

The photographs of Fig. 3 show the makeup of the modulating signal when a left only signal is applied to the FM transmitter. For this illustration the audio modulating frequency was higher than that of Fig. 2, so that the actual subcarrier cycles may be viewed. It may be noted that the subcarrier reverses phase each time the zero axis is crossed. This shows that the suppressed carrier type of modulation is taking place.

For clarity, the pilot subcarrier is not
includet in the photographs of Fig. 2 and Fig. 3.

**Stereophonic Subcarrier Demodulation Methods**

Since the stereophonic system that has been described is a sum and difference system, the left and right signals may be derived by demodulating the stereophonic subcarrier by the use of a synchronous detector for recovery of the \((L-R)\) modulation and then matrixing at audio frequencies with the main channel \((L+R)\) modulation.

Left and right signals may also be derived directly in one operation of the composite modulation. In order to illustrate this method of demodulation refer to Fig. 4.

(A) of Fig. 4 shows the composite waveform of a time-division multiplexed signal. The envelopes of both the left and right signals are clearly discernable. (B) shows the difference \((L-R)\) component of the time-division multiplexed signal with a superimposed suppressed carrier amplitude modulated subcarrier being modulated by difference \((L-R)\) audio. The similarity between the two waveforms is evident. (C) shows the sum \((L+R)\) component of the time-division multiplexed signal. The addition of the suppressed carrier component of (C) results in the waveform shown in (D). Once again, the envelopes of both the left and right signals are clearly discernable.

If the composite waveform shown in (D) of Fig. 4 and repeated in (A) and (C) of Fig. 5 were sampled with two interleaved unit impulse functions, as shown in (B) and (D) of Fig. 5, synchronized to 35,000 eps, the carrier tips of the left signal would be followed by one of the interleaved set of unit impulse functions and the carrier tips of the right signal would be followed by the other set of unit impulse functions. Thus, it is possible to recover the left and right stereophonic signals from the composite waveform using a direct method of demodulation.

We will now illustrate a method of left and right stereophonic signal derivation using partial demodulation and partial matrixing. This method is directly related to the original concept of time-division multiplex demodulation. If one multiplies the composite modulating function \(M'(t)\) with \(1 + \frac{4}{\pi} \cos \omega_c t\), the result would be partial demodulation for the left channel:

\[
[(L+R)+(L-R)\cos \omega_c t] [1+\frac{4}{\pi} \cos \omega_c t] = (L+R) + \frac{4}{\pi} (L-R) \cos 2\omega_c t + \ldots \ldots \ldots
\]

\[
(L+R) + \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos 2\omega_c t \right) = 2L + \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos 2\omega_c t \right) = (L+R) + \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos 2\omega_c t \right)
\]

Eq. (3)

If one multiplies the composite modulating function \(M'(t)\) with \(1 - 2 \cos \omega_c t\), the result would be demodulation for recovery of the right channel:

\[
[(L+R)+(L-R)\cos \omega_c t] [1-2 \cos \omega_c t] = (L+R) - 2(L-R) \cos \omega_c t + \ldots \ldots
\]

\[
(L+R) - 2(L-R) \left( \frac{1}{2} + \frac{1}{2} \cos \omega_c t \right) = 2R - \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos \omega_c t \right)
\]

Eq. (4)

There is no electronic waveform which corresponds to the multiplier: \(1 + 2 \cos \omega_c t\). However, a square wave may be used which corresponds to the multiplier:

\[
1 + \frac{4}{\pi} \cos \omega_c t
\]

A half sine wave may also be used which corresponds to the multiplier: \(1 + \frac{2}{\pi} \cos \omega_c t\). Since the squarewave function is easily derived electronically, this would seem an appropriate multiplier to explore further.

If one multiplies the composite modulating function \(M'(t)\) with \(1 + \frac{4}{\pi} \cos \omega_c t\), the result would be partial demodulation for the left channel:

\[
[(L+R)+(L-R)\cos \omega_c t] [1+\frac{4}{\pi} \cos \omega_c t] = (L+R) + \frac{4}{\pi} (L-R) \cos 2\omega_c t + \ldots \ldots \ldots
\]

\[
(L+R) + \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos 2\omega_c t \right) = (L+R) + \frac{4}{\pi} (L-R) \left( \frac{1}{2} + \frac{1}{2} \cos 2\omega_c t \right)
\]

Eq. (5)

It is obvious by examining this result that the sum \((L+R)\) signal is somewhat larger than the difference \((L-R)\) signal, thus resulting in mostly left but some right signal in the left channel.

If a sum \((L+R)\) signal having an amplitude: \(-1 + \frac{2}{\pi}\) is added to the above partially matrixed left channel, the result would be:

\[
(L+R) + \frac{2}{\pi} (L-R) + (L+R) (-1 + \frac{2}{\pi}) = \frac{4}{\pi} L
\]

This \((L+R) (-1 + \frac{2}{\pi})\) signal is readily
available because it is an inverted main channel signal.

Likewise, if one multiplies the composite modulating function $M'(t)$ with:

$$I = \frac{4}{\pi} \cos \omega_{sc}t,$$

the result would be partial demodulation for the right channel:

$$[(L + R) + (L - R) \cos \omega_{sc}t][I - \frac{4}{\pi} \cos \omega_{sc}t]$$

$$= (L + R) - \frac{4}{\pi} (L - R) \cos 2\omega_{sc}t + \ldots$$

$$= (L + R) - \frac{4}{\pi} (L - R) (1 + \cos 2\omega_{sc}t)$$

$$= (L + R) - 2 \frac{4}{\pi} (L - R)$$  \hspace{1cm} \text{Eq. (6)}

Again, the sum $(L + R)$ signal is somewhat larger than the difference $(L - R)$ signal, thus resulting in mostly right but some left signal in the right channel.

Once again, if a sum $(L + R)$ signal having an amplitude $-1 + \frac{2}{\pi}$ is added to the above partially demodulated right channel, the result would be:

$$I = \frac{4}{\pi} \cos \omega_{sc}t$$

$$= (L + R) + (L + R) (1 - \frac{2}{\pi}) = \frac{4}{\pi}.$$  \hspace{1cm} \text{Eq. (5)}

Multiplication by a square wave may be accomplished using an electronic switch operated in synchronism with the modulated subcarrier signal, thus becoming a synchronous demodulator. Such a demodulator may take on many forms—one of which is shown in Fig. 6.

In this case the synchronous demodulator is a beam deflection tube, 6AR8A, which has: one electron stream, two anodes, two deflection plates, and one control grid. The composite stereophonic signal is applied to the control grid of any SCA background channel which may be present has been removed with a low-pass filter type of trap.

The deflection plates of the beam deflection tube are driven by a push-pull sinewave source generated by an oscillator-doubler circuit having an output frequency of 38,000 cps. A sufficient amount of sinewave drive is applied so that switching of the beam results in essentially a square wave of anode current. In this way the products of the two polarities of square wave and the composite stereophonic signal are generated.

At one anode the product of one polarity of square wave function and the composite stereophonic signal appearing at the control grid is formed for the left channel, as shown in Eq. (5). Similarly, at the other anode the product of the opposite polarity of square wave function and the composite stereophonic signal appearing at the control grid is formed for the right channel, as shown in Eq. (6). The addition of a sum $(L + R)$ signal having an amplitude $-1 + \frac{2}{\pi}$ is accomplished by the 500 ohm variable matrix adjustment in the cathode circuit of the beam deflection tube demodulator, as shown in Fig. 6. Thus, the combination demodulator and matrix network accomplishes the complete derivation of left and right signals. The necessary deemphasis in left and right channels is achieved by simply adding a 1500 pf capacitor at the matrix outputs.

The push-pull sinewave drive which is applied to the deflection plates of the beam deflection demodulator tube is generated by an oscillator frequency doubler combination, as shown in the carrier regenerator portion of Fig. 6. The oscillator operates at a frequency of 19,000 cps. The anode circuit of this carrier oscillator is tuned to the second harmonic, or 38,000 cps. The tube acts as an electron-coupled oscillator and frequency doubler.

Magnetically coupled to the oscillator tank circuit is another parallel resonant tank which is in the anode circuit of the modified cathode follower, shown at the left in Fig. 6. This parallel resonant circuit is tuned to the 19,000 cps subcarrier frequency, thus forming a tuned amplifier for extracting the pilot subcarrier from the composite stereophonic signal appearing at the grid of the cathode follower.

(Continued on page 98)
Product Detector for FM-Stereo

F. L. MERGNER

Borrowing from single-sideband techniques, this adaptor uses a product detector to achieve almost infinite selectivity with little phase shift.

During stereophonic transmissions the monophonic signal, comprising the sum of left and right channels is available without further demodulation at the discriminator or ratio detector output of an FM tuner. Several different methods, however, can be employed to recover the L-R subcarrier information. Either time-division multiplex or AM detectors of various types may be used to recover this information. In an audio matrix, using a resistive sum and difference network, the final L and R channels are derived and after proper demphasis fed to an audio amplifier. In addition to the stereophonic program, the newly approved multiplex system permits the transmission of an SCA channel for background music and similar information. The SCA channel, frequency-modulating a carrier of 67,000 cps, contains information which is in no way related to the adjacent stereo programs transmitted at the same time over the same station. To avoid interference like “spitting” and “whistling” between both programs, the F.C.C. requires the transmitting stations to maintain at least 60-db separation, even under conditions of maximum modulation. On the receiving end this value should be maintained because 60 db of protection (equal to a voltage ratio of 1000:1) can be considered just high enough to prevent annoying crosstalk of the SCA channel into quiet passages of a stereophonic program (and vice versa). As the SCA channel is adjacent in frequency to the upper sidebands of the L-R subcarrier, ways must be found to secure a high degree of selectivity between both channels. Band-pass filters with a sufficient number of sections can be designed to achieve this end, but they are costly and bulky. In addition they introduce in the L-R channel a large amount of phase shift, which must be compensated for, in order to achieve in-phase matrixing with all frequencies of the L+R channel for a high degree of stereo separation.

Demodulating the Subcarrier Signal

The problems mentioned above made it necessary to investigate other means of achieving sufficient selectivity without introducing excessive phase shift. Linear or square-law demodulation of the subcarrier permits an improvement in selectivity equal to the square of the ratio of both carrier amplitudes. Logarithmic demodulation and product detectors, however, have in theory inherent selectivity equal to infinity. The first type is rarely used because in practice it is very difficult to achieve good logarithmic demodulator characteristics. Product detectors, however, are widely used in single-sideband receivers, where they contribute greatly to superior performance. This detection process requires a tube with two separate grids and with linear \( V_g/I_p \) characteristics. The recovered subcarrier of 38,000 cps is fed to one grid, the L-R sidebands to another. As long as the above requirements on the detector linearity are met, no demodulation of interfering frequencies will occur. In practice, however, some slight deviation from a perfectly straight characteristic is unavoidable, which might lead to a small amount of cross-modulation between the subcarrier and SCA channels.

In spite of these practical limitations, the degree of selectivity afforded by the product detector is still superior to other methods of detection. Therefore, a simple two-section filter having a band-pass from 23,000 to 53,000 cps for the L-R sidebands provides sufficient crosstalk protection. In addition, the series arm of the band-pass filter can be tuned to an anti-resonance at 67,000 cps, the frequency of the SCA channel, to steepen the response of this filter at frequencies above 53,000 cps.

A short mathematical discussion of the demodulation process in a product detector might be of interest. The composite stereophonic signal available at the multiplex of an FM-tuner is:

\[
E(t) = \left[ A(t) + B(t) \right] + \left[ A(t) - B(t) \right] \cos \omega_s t
\]

Where \( A(t) = \) instantaneous left channel signal,

\( B(t) = \) instantaneous right channel signal,

\( \omega_s = 2\pi f_s, \ f_s = 38,000 \text{ cps} \)

The 23,000 to 53,000 cps band-pass
Fig. 3. Schematic diagram of MPX-100.
filter passes the A-B information only, therefore the signal at grid No. 1 of the product detector is:

\[ A(t) - B(t) \] \cos \omega_0 t \]

Signal at grid No. 3 of the product detector:

\[ \cos \omega_0 t \]

Product of both signals:

\[ \cos^2 \omega_0 t \left[ A(t) - B(t) \right] + \frac{1 + \cos 2 \omega_0 t \left[ A(t) - B(t) \right]}{2} \]

The underlined portion of this equation, containing the second harmonic of \( \omega_0 \), can be filtered out. Because of the 180 deg. phase reversal in the product detector tube, the remaining demodulated signal becomes:

\[ -\frac{1}{2} \left[ A(t) - B(t) \right] \]

This signal is then matrixed directly 180 deg. out-of-phase with the L + R signal to produce the final stereophonic information.

The Adaptor

The Fisher multiplex adaptor, Model MPX-100, is shown front view in Fig. 1 and rearview in Fig. 2. The schematic diagram is shown in Fig. 3 and the block diagram in Fig. 4. The signal from the multiplex output of the FM tuner reaches two modified cathode followers (V1), one of which feeds a 15,000 cps low-pass filter and passes the L + R signals only to a matrixing network. The tuned plate circuit of the same cathode-follower filters and amplifies the 19,000 cps pilot carrier, feeding it to a second high gain amplifier (V2). This in turn synchronizes a 19,000 cps Hartley oscillator (V3), whose double-tuned plate circuit filters out the 38,000 cps carrier required for the detection of the L - R sidebands. A band-pass filter connected to the second cathode-follower, permits only the L - R sidebands to reach grid No. 1 of the product-detector tube (V4).

At the detector output a sharp series-tuned filter removes the 38,000 cps carrier and only the demodulated L - R audio signals are passed to one arm of the resistive matrixing network. The other arm receives and R - L signal of equal amplitude through a wide-band phase inverter stage (V5). The 75 \( \mu \)s de-emphasis network separating both sections of the balanced matrix equalizes the frequency response and removes any remainder of the 38,000 cps carrier. Careful alignment of all tuned circuits and correct setting of the balance control as well as the selection of close-tolerance parts will ensure equal levels and minimum phase shift between main and subcarrier modulation frequencies. This is of prime importance, because only 3 deg. of phase difference and \( \pm 0.3 \) db of amplitude variations between the main channel signal and the subcarrier sideband envelope will result in not more than 29.7 dB of separation. These, for example, are the values, which the F.C.C. requests all stations to maintain during stereo transmissions. It is only natural that the adaptor should not deteriorate the stereo separation.

A closer look at the schematic diagram, Fig. 3, reveals an interesting feature of the MPX-100. A front panel light, designated "Stereo Beacon," is lit whenever a station transmits a stereo program. Reverting back to the block diagram it can be seen that this light is connected to a 19,000 cps amplifier and relay stage. The pilot carrier is transmitted only during stereo programs and activates a relay, which in turn switches on the light. The same switch also opens the L - R audio channel connected to the matrixing network. The advantages of this circuit are obvious. When tuning from station to station the lamp is lit only when a stereo program is on the air. There is no need to switch back and forth between mono and stereo positions on your amplifier and listen to the speakers, to determine the nature of a program. The switch, therefore, can be left in the FM-stereo position at all times and the MPX-100 will automatically provide the correct signal. During stereo transmissions, the light is on, the switch open and the L - R signals will reach the matrixing network, to form together with L + R signals the final L and R stereo information. During monophonic operation, because no pilot signal is present the relay is not activated the light is off, the L - R channel switch is closed, and only L + R monophonic signals will reach the output. But here one problem still remains. When tuning between stations, hiss and noise is high enough in amplitude to activate the relay in the same way as does the 19,000 cps pilot carrier. To prevent the relay amplifier from being affected by this noise, a portion of it is amplified in a stage, tuned to 100,000 cps, rectified and fed to a bridge circuit, where it blocks the relay tube completely. On station, the noise disappears and the voltage derived from the rectified 19,000 cps pilot carrier is high enough to unblock this stage.

A few more circuit refinements are incorporated in MPX-100. Feed-through (Continued on page 102)
Filters For FM-Stereo

NORMAN H. CROWHURST

When the regenerated subcarrier and the main carrier are rejoined in the FM-stereo decoder they must be in phase with each other within 3 degrees. In order to effect this, several of the filters and circuits must be phase-linear.

The choice of system for FM-stereo caught many people in the industry by surprise and, whichever variety of receiver circuit individual designers may favor, they have been finding themselves in filter design problems, somewhat different from problems encountered before in audio circuits. Of course, the basic design of a stereo adapter is audio, although the tuner end is r.f. But, given a wide-band tuner, that can demodulate the FM carrier linearly when it carries modulation frequencies up to 53,000 cps (without SCA subcarrier, or 75,000 cps with a subcarrier), the handling of that demodulated signal to reconstruct undistorted stereo is a problem in audio engineering.

Other articles have explained basic approaches used in receiver adapter circuits. What we are concerned with here is solving the various problems posed by the filters that will be needed. Audio engineers have long been familiar with crossover filters, and to some extent with band-pass, band-reject, and in-derived filters; but time delays, the requirement of phase-linearity and the phase adjustment of regenerated subcarriers is a new subject to them.

Time Delays

Time delays filters are needed to equalize for delays, either along lines, or in other filters. Delay filters to compensate for difference in the transmission time along lines, are a transmission man's headache, and need not be considered here. At the transmission end, the problem is simpler in one respect: the filter can be of standard form, using as many components, with whatever cost and precision, is necessary for the job. At the receiver, the cost of this kind of filter would price the receiver or adapter out of the market, so other methods are sought. Fortunately, as we shall see, phase compensation is relatively simple, once the basic requirements of phase linearity have been met.

Basic Design: Low-Pass Filter

Considering the low-pass filter first will clarify some of the issues involved, such as what is meant by phase linear and how to achieve it. Let's consider first a simple "half-section" arrangement, as shown at Fig. 1. The half-section design derived from classic filter design approach, using the image impedance concept. For such a filter to realize its theoretical response, it must be terminated at a specified end, say the output, with a theoretical impedance value; when this is done, the impedance reflected to the input terminals is an identical one (Fig. 2).

What is usually overlooked in this approach is that this image impedance is a resistance of almost constant value through the pass range, passing through zero or infinity (according to configuration) at cut-off frequency, to become a reactance in the rejection or attenuation range. Only by terminating such a filter with an impedance that fulfills this condition, would its calculated response be achieved.

This is usually overcome by terminating a filter with sections whose image impedance shows minimum deviation from constant up as close as possible to cutoff frequency, so that termination with a constant resistance will minimize deviation from calculated response. In effect, we finish up with a double approximation situation.

The approach is made much simpler
by being more direct. Instead of starting with an assumed terminating impedance which can never be realized, only approximated, we start with an assumed terminating resistance, which we can eventually put a value to, and get out of the resistor box.

First let's clarify what we mean by phase-linear. The usual response is plotted against the usual frequency scale, which is logarithmic. To these scales, any low-pass filter will have a curved "tangent-law" response, of the type shown at Fig. 3. The curves are for three sets of values, each with the same 90 deg. phase reference frequency. At this frequency, the value of each reactance is identical and the relation to the terminating resistance at this frequency can identify differences in response. Curve (A) is for reactances each equal to terminating resistance at cutoff curve (B) is for the constant resistance case, where each reactance is \( V/2 \) times the terminating resistance; curve (C) is for reactances each twice the terminating resistance.

Plotted this way, none of the phase responses is linear. But we are concerned with phase linearity from the viewpoint of the relations between various side-bands of a subcarrier, which are determined by their sum and difference from the subcarrier frequency. So we must use a linear frequency scale, if we want to represent corresponding pairs of side-bands as equidistant on either side of the subcarrier.

Replotting phase responses this way, we take the same three sets of values and the results are shown at Fig. 4. The corresponding amplitude or attenuation responses, using a db against log frequency scale, are shown at Fig. 5. Notice that the middle curve (B), using the so-called "constant-resistance" values, maintains maximum flatness up to the 3-db rolloff point (or cutoff frequency) and deviates from phase linearity by considerably less than 2 deg. over the range from zero to cutoff frequency.

The phase linearity, as well as the attenuation response, deteriorates when this condition is deviated from. However, the fact that only three basic circuit elements are used, one of which is the terminating resistance, means that reasonable deviation, say by using 5 per cent values, will result in a filter that will easily stay within 3 deg. deviation from phase-linear.

Where the filter operates from a cathode follower into a resistance load many times the source resistance of the cathode follower these basic values can be used. Where the filter is interposed between two impedances, both of which must be regarded as finite for design purposes, these basic values need changing, in accordance with design data we have given elsewhere.

**Low-Pass Filter, M-Derived**

Some may criticize this designation of the next type of filter. The term "m-derived" has been applied to a good many ways of deriving a filter, which do not conform to the classic method, so we trust one more will be permitted. Our
reason for using the term is that the configuration is identical with the classic m-derived form (Fig. 6), but the values are very different.

The first step may be regarded as somewhat similar to m-derivation in concept. We use a value of series $L$ identical with that for the constant resistance type filter and with the same cutoff frequency, in this case 67,000 cps, we select values for $L$, and $C$ that will (a) resonate at the rejection frequency, in this case 67,000 cps, while (b) providing the correct capacitive reactance at cutoff frequency.

Plotting out the phase response of these values (Fig. 7), we find it to be reasonably phase linear up to about 45,000 cps, which is not quite good enough. Obviously what is needed is a narrowing down of the margin between the basic cutoff frequency and the maximum rejection frequency.

To change our approach slightly, since the definitive point of this configuration is really the maximum rejection frequency, we use it as the reference frequency for design. On this basis, 53,000 cps is 0.79 times the maximum rejection frequency. Using this technique, we have only two variables to explore:

1. the relationship between each rejection reactance and the terminating resistance at rejection frequency;
2. the value of the additional series inductance.

Exploring various possibilities in this way, we find the combination shown in Fig. 8 gives a good approach to phase linearity, being well within 2 deg. up to the required cutoff frequency. The corresponding attenuation response is shown at Fig. 9. Notice that the values (Fig. 6) are such that exact adjustment is not necessary for at least acceptable performance. It is recommended that the rejection pair be carefully tuned to 67,000 cps, after which the series element can be within 5 or 10 per cent, without serious change in performance. What changes is phase slope, within this range, to a much greater extent than phase linearity. Phase slope can be compensated for by slight realignment of the subcarrier reinsertion phase.

As with the low-pass circuit, this design assumes zero source impedance with finite load impedance of known (design) value. If both values are finite, which approach may well save a stage in some circuit configurations, the filter design is a little more involved, but follows the general method outlined here.

Band-Pass Filters

Now all we have to do is apply this to band-pass filters. Unfortunately, it's not that easy. Remember that a high-pass filter always presents a phase advance, that is complementary to an equivalent low-pass filter, plotted to a logarithmic frequency scale, as at Fig. 2.

The combination of values that achieves such good phase linearity in a low-pass filter requires frequency to be plotted to an inverse scale for the phase response to look linear. To a linear scale, the rate of change is always greater nearer cutoff and falls away to zero at higher frequencies, approaching infinity.

A band-pass filter is essentially a combination of high-pass and low-pass action. In a narrow band-pass filter, the range of absolute frequency is such that presentation on logarithmic, linear, or inverse law scale makes relatively little difference. Slight asymmetry in design could make the phase more nearly linear, if the departure is great enough to make the effort worth while.

But when the "carrier" is 38,000 cps, with sidebands from 23,000 to 53,000 cps, we are no longer narrow band. Only a linear frequency scale can provide 23,000 and 53,000 cps at equal distances from the 38,000 cps carrier. Some fudging might conceivably get phase linearity

(Continued on page 32)

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The new A300 Award Amplifier makes stereo attractive and inexpensive

The A300, 30 watt stereo amplifier, is a sparkling new addition to the widely acclaimed Award Series. Its strikingly handsome styling, professional features, solid performance and moderate price ($99.95) make it clearly the best buy in a stereo amplifier.

It is designed with the same skill and precision reflected in the 50 watt A500—first of the great Award amplifiers. When the A500, shown below, was introduced it quickly established new performance standards for integrated stereo amplifiers. In its own power category, the A300 is certain to establish similar standards of excellence.

The A300 delivers 15 watts (Music Power) per channel with less than 1% distortion. Special grain-oriented cores in the output transformers provide wide-band response. At normal listening levels the frequency response is ±1 db at 15 to 70,000 cps.

Its many features, unique for an amplifier in this price class, include: A zero to infinity balance control which permits balancing of speakers for virtually any listening position in the room; a variable blend control to eliminate undesirable “hole-in-the-middle” effect; ganged treble and bass tone controls provide 12 db boost and cut at 50 cycles and 10 db boost and cut at 10,000 cycles; dynamic loudness contour control; silicon diode power supply for excellent B+ regulation; RIAA phono and NARTB tape equalization controls; two tape outputs (after tone and loudness controls) for recording; illuminated push-button on/off switch which permits unit to be turned on and off without upsetting carefully pre-set controls; stereo reverse/normal switch and rumble filter.

The A300 and A500 will perform superbly with either of the Award tuners shown on the opposite page. Both instruments are handsomely finished in brushed gold.

The A300 is $99.95; the A500—$159.95. Optional enclosures, which fit both, include the CX50 (metal)—$12.95 and the WW50 (walnut)—$29.95. Prices are slightly higher in the West.

For complete information on the Award Series and other fine Harman-Kardon products write to Dept. A-8, Harman-Kardon, Plainview, N. Y.
down to two “bites” of equal slope, but it could never achieve full linearity from 23,000 to 53,000 cps.

The band-pass filter has been “needed” to separate the subcarrier sidebands from the main or sum channel. If this matrixing method is used at the transmitter, no such filter is required. Maybe low-pass filters are used to ensure that the audio contains nothing above 15,000 cps, to cause interference between main channel and subcarrier sidebands. But the actual matrix needs no selective filters. So why should the second (reception) matrix need them? A little further thought reveals that it doesn’t.

If we consider the composite of frequencies fed to the subcarrier detector, after reinserting the subcarrier, we have: 50–15,000 cps, main channel information; 23,000–38,000 cps, subcarrier lower sidebands; 38,000 cps subcarrier, which should be the biggest single component at this point; and 38,000–53,000 cps, subcarrier upper sidebands. (Fig. 10). If this is demodulated after the manner of an ordinary AM carrier, only the lower and upper sidebands will come out in the audio range; the 50–15,000 cps will be equivalent to asymmetric sidebands for modulation frequencies of 23,000–38,000 cps (inverted).

It’s just as if an adjacent carrier of zero frequency carried this sideband. The separation of 38,000 cps between carriers ensures the sidebands of one are ultrasonic in the demodulation of the other.

There’s just one snag: using ground reference, the detector gets the full 50–15,000 cps audio, unless there’s a band-pass filter, without being able to tell it’s supposed to be related to a 38,000 cps carrier. In short, the presence of the 50–15,000 cps will act as variable bias on the detectors in handling the 38,000 cps and its sidebands.

But this is not difficult to overcome: the detector load needs unhooking from ground, so the proper bias can be inserted. In other words, the whole detector circuit “floats” at the main audio waveform (Fig. 11). There are undoubtedly other ways of doing this, but this illustrates the general method. Now we don’t need the conflicting phase slope that is inevitable with a wide-band band-pass filter.

Relative Phase on Second Matrix

If phase linearity is maintained, the relative phase, between sum and difference, is simple to correct. The carrier needs inserting at the correct phase, along the phase slope of the sidebands (Fig. 8), so that a flat output, free from distortion, is obtained. Now the bigger time delay will be in the sum channel, which is equivalent to 90 deg. at 15,000 cps, or 16½ microseconds (due to the 15,000 cps, phase-linear low-pass filter, Fig. 3).

If the m-derived filter is in the sidebands channel after the take-off point for the 15,000 cps low-pass, this will introduce a delay of almost exactly 45 deg. at 38,000 cps (Fig. 8) or 3.3 microseconds. So, depending on the location of the m-derived filter, the demodulator needs to introduce a delay of 16½ or 13.3 microseconds, which can easily be arranged by means of the “r.f.” (in this case 38,000 cps and harmonics) filtering and its time constant.

As there is a nice wide gap between the residual subcarrier components to be eliminated and the highest audio—15,000 cps—simple R-C combinations can care for this time delay and filtering (Fig. 12).

Subcarrier Phase

This part is more a practical item than a basic design item, but it’s related to the rest of this problem, so here it is. Each way of regenerating the subcarrier will have slightly different methods of adjusting the phase to meet the requirements of the rest of the circuit.

Where the pilot frequency is just isolated and frequency doubled, extremely good isolation (with a high-Q circuit) is essential, so the tuning of the pilot frequency circuit should not be changed appreciably. In this case, probably the best compromise is to offset part of the phase compensation at 19,000 cps and

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(Continued from page 23)

Fig. 10. Audio spectrum of demodulated stereo program; the main channel, as sideband of the subcarrier, is ultrasonic.

Fig. 11. A method of connecting the difference detector that avoids the need for a band-pass filter and makes matrixing more efficient.

Fig. 9. Attenuation response of the filter whose phase response is shown in Fig. 8. Shaded area represents the maximum excursion an SCA subcarrier may make.

32
Introducing! The new E-V THIN MAN — the non-directional, voice-range, “invisible” microphone for vocalists, panel shows, group discussions, public address.

Developed through close personal liaison with technical directors, audio engineers and performers, the E-V Thin Man features a 24-inch long, 1⁄4-inch thick semi-rigid tube with the microphone on the end... close to the sound source for full-range, pop-free response without distracting or obstructing the view of either the performer or the audience.

It’s the latest Electro-Voice design achievement — and another reason why E-V microphones are used at major news events more often than the next four brands combined... 87.3% more often than any other single brand!

With the Model 652, you enjoy typically smooth E-V frequency response. Two transparent baffles allow accentuation of the presence range — the smaller for a 3 db boost and the larger for a 6 db boost at 5,000 cps. Used without a baffle, the Model 652 provides smooth response from 80 to 8,000 cps. It’s the perfect answer for small stations, small studios with acoustic problems solved only by a close microphone!

For full information on the Model 652, write for our free, fact-filled specification sheet!

Also available in 15” lengths as Model 652A. Identical in all other respects. List Price, $120.00 (652 or 652A). Normal Trade discounts apply.

ELECTRO-VOICE, INC., Commercial Products Division
Dept. 811A, Buchanan, Michigan
part after doubling, at 38,000 cps, because serious detuning of the 38,000 cps subcarrier can result in either asymmetry or distortion of the regenerated subcarrier.

Where the circuit uses a pilot-frequency oscillator, locked to the incoming pilot, slight adjustment of the free-running pilot oscillator frequency gives good control of phase. The doubler is then left tuned to exactly 38,000 cps. Detuning it would only have slight effect on phase anyway.

Where the circuit uses a subcarrier oscillator, synchronized by the pilot frequency, appreciable shift of the 38,000 cps free-running frequency is not desirable, because it will result in inequality of alternate cycles of subcarrier, even if the pilot holds it. Slight detuning of the 19,000 cps pilot will do the best job, by changing the point at which the (true) 38,000 cps is locked.

Frequency Doubling
Some spurious components can be eliminated from the output by removing all of the 19,000 cps from the regenerated subcarrier. A simple tuned circuit will never do a perfect job. A relatively simple circuit that will is shown at Fig. 13. The 19,000 cps oscillator plate cur-
rent is drawn through the 38,000 cps tuned circuit in such phase as to neutralize the amplifier 19,000 cps component due to the doubler stage (pentode).

Careful adjustment of values (operating voltages and coupling values) can make this circuit produce almost pure second harmonic with no tuned circuits at all (Fig. 14). When a tuned circuit is used as common plate load, virtually complete rejection is possible with relatively uncritical setting.

Output Filtering
By now, many will have discovered that the output, even with deemphasis, contains appreciable signal at 38,000 cps and its sidebands, which can be troublesome, if you want to tape record, particularly. A broad resonant circuit does not produce particularly good rejection. A narrow one, or a conventional twin-T filter, only takes the 38,000 cps and leaves most of its sidebands.

A very neat solution is a special twin-T that incorporates the deemphasis as well, provides a wide, deep null over the 38,000 cps region and requires values that are not nearly as critical as the normal twin-T circuit (Fig. 15).

Correct deemphasis is achieved by adjusting the total series source resistance (including matrix or diode load elements in their series-parallel arrangement) to an impedance (resistive) of 25,000 ohms for the values shown in the twin-T. Other values can be used if different circuit values have to be matched. In the original twin-T network design, the ideal values would be \( a/c = 7.5 \), \( b/c = 1.15 \). Using values \( a/c = 6 \), \( b/c = 1.2 \) allows for some series source resistance.

The great advantage of this circuit is that all values are relatively non-critical. Changing any pair of values by 5 per cent retains a rejection of better than 40 db. In fact when this filter is used, it is found that there are second harmonics of 38,000 cps present, that were completely masked by the much larger 38,000 cps component previously.

If the 76,000 cps components should prove troublesome, these can be removed by additional \( R \) and \( C \), using modified values so this can be part of the deemphasis too, and thus obtain some 30 db rejection of 76,000 cps. If more or better rejection is wanted, a similar twin-T design can be used, centered on 76,000 cps, with even greater latitude in tolerances.

This article has given the basic design data or approach, rather than completing any individual circuit design. This can be applied to any of the adapter circuits where such filtering is needed, by using the normalized design factors we have given, in whatever arrangement appeals to the individual designer.
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Here, through your fingertips, you take complete control of sound, blending it to magnificent perfection.

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SONY SUPERSCOPE The tapeway to Stereo

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Four and two track, stereo and monophonic, recording and playback, the Sony Stereocorder 300 — with its hysteresis-synchronous motor, built-in stereo pre-amps and power amps, and a dozen more professional features — is truly the ultimate in tape recorder engineering. $399.50, complete with two dynamic microphones, two extended range stereo speakers all in one portable case. For custom mounting, $349.50.

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PRODUCT PREVIEW SECTION

Along about this time of year, the serious audiolan begins to think about improvements—converting to FM-stereo, adding a tape recorder, or whatever. So that he may have an advance glimpse of the new merchandise which will be available with the start of the traditional buying season, we present the Annual Product Preview Section.

WITH SOME TWO HUNDRED separate items, along with prices of many more items which are not described, the third Annual Product Preview is considerably larger than last year's, and is—we believe—more complete. In most instances, a single product is described in each category from each manufacturer. In some cases, this may be the only product of that manufacturer. When the manufacturer offers a wide variety of items—as do, for example, those who make loudspeakers—it is obviously impossible to list everything. However, for more complete data, it is suggested that the reader write the manufacturer directly—or to us—for specific information. Because of the large number of manufacturers represented in this section, they are not coded in the usual fashion on the Readers' Service Card. If the manufacturers of interest happens to advertise in this issue, you may use the card and encircle the corresponding number. If there is room, you may write the name of any non-advertisers on the card and mail it. We will forward that your requests for further information.

Any compilation of this type is subject to omissions and errors. Any manufacturer not herein represented may be considered to have: (1), not been asked for information (our mistake); (2), the information was mislaid (ours again); or (3), he didn't send it (his). If we find enough such omissions, we shall try to fill in later. Since this is a catalog-type presentation, it must be pointed out that the statements made about the various products are the specifications as furnished by the manufacturer and are not the results of our own measurements or tests. Also prices may vary slightly between East and West (and vice versa).

We are sincerely grateful for the co-operation given us by all the manufacturers represented and by their advertising agencies. Without their concerted help we could not have prepared this material. We trust you will find it interesting and informative throughout the year.

AMPLIFIERS AND PREAMPLIFIERS

ACRO

- **180-Watt Amplifier Kit.** Adding to its already well-known line of amplifier kits, Acro introduces the Stereo 120, which provides an output of 120 watts (60 watts per channel). Incorporating printed circuits, the Stereo 120 is exceptionally easy to construct and provides performance equal to the laboratory model. Claimed to be the first commercially available amplifier which combines ultra-linear operation with hybrid feedback for unusually low distortion and high stability. Intermodulation distortion in less than 1 per cent at 60 watts and less than 0.5 per cent at 50 watts output. Variable damping is provided on each channel for optimum speaker performance. Illuminated meter is provided for bias adjustment and circuit check. Price for the kit, including protective cover, is $159.50. Acro Products Company, 369 Shure Lane, Cleveland 28, Ohio.

Ultra-Linear 11 60-watt preamp kit $79.50
Stereo preamp kit 69.50

A.E.S.

- **50-Watt Stereo Amplifier.** Featuring jewel-cased lights to clearly indicate the stereophonic or monophonic setting of the mode switch, the A.E.S. Model 225 amplifier has a solid heavy-brass front panel which may be mounted in its own cabinet, or separately mounted for custom installations. Frequency response is stated as 29-30,000 c.p.s. plus or minus 0.5 db, with harmonic distortion less than 0.1 per cent at maximum output per channel. Intermodulation distortion is less than 0.5 per cent at normal listening levels. Channel separation is over 50 db. A.E.S., Inc., 3338 Payne Ave., Cleveland 14, Ohio. User price $319.50 (f.o.b. factory).

ALTEC

- **Stereo Amplifier-Preamplifier.** The Altec-Lansing Model 353-A, is a complete amplifying system, embodying two 25-watt stereo channels which may be combined for 50-watt monophonic operation when desired. Among its features is a matrixing network for "three-channel" stereo. Circuitry includes feedback-type equalization plus feedback around all tubes for minimum distortion. All low-level tubes have d.c. heaters. Fourteen circuits include two each for magnetic cartridge, ceramic cartridge, tape head, tape recorder, tuner, microphone, and multiplex. Frequency response is 20 to 20,000 c.p.m. ±1.0 db at 25-watts output; 10 to 30,000 c.p.m. ±0.5 db at 10 watts. Harmonic distortion is less than 1.0 per cent. Tone controls are ganged and provide 14 db of boost or cut at 50 and 10,000,000 c.p.s. Rumble filter attenuates at the rate of 12 db/octave below 30 c.p.s. Sillmonic rectifiers are used in power supply. Engineered to the professional standards of the Altec-Lansing equipment, the 353-A meets every criterion of the most discriminating music lover. Altec Lansing Corporation, 1515 S. Manchester Ave., Anaheim, Calif. User net price $325.00.

Bell (Bell & Howell)

- **Stereo Amplifier.** Developed for stereo from input to output, the Bell "Carlton" Model 6060 is conservatively rated at 30 watts output for each channel, with 60 watts of monophonic power available when needed. Frequency response is stated to be 15 to 30,000 c.p.m. ±1.0 db. Hum level is 71 db below rated output. All operating controls of the 6060 are conveniently located.

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For more information or prices on the products listed, please contact the manufacturer directly or visit their website.
across the front panel. Bass controls permit 15 db rise and 18 db drop at 50 cps; treble controls afford 9 db rise and 18 db drop at 16,000 cps. Also located on the front panel are four lever-type switches which provide high and low-frequency filter cutoff to eliminate hiss and rumble, stereo function control, and speaker selection for stereo in more than one room. A separate balance control adjusts the volume level between two stereo speakers. Continuously-variable loudness control compensates for bass and treble at low listening levels. Dial frame is extruded aluminum, while the panel has all the lettering etched for clarity. Vinyl-tape cover is set off by the perforated thermal duct which provides ventilation. Bell Sound Division, Thompson Ramo Wooldridge Inc., 555 Marion Rd., Columbus 7, Ohio. User net price, $219.05.

2418 30-w ster ampl $109.95
2420 34-w ster ampl $129.95
2440 44-w ster ampl $179.95

BOGEN

• 220-Watt Stereo Amplifier. Designed to control all stereo sources, FM, AM, FM-stereo, tape recorder, phono or auxiliary, the Bogen AP-200 is a 44-watt stereo amplifier (22 watts per channel) which is one of the new "fun couple" series inspired by the novel "The Fun Couple." by John Hasb. This series of components is matched in appearance and in performance to provide maximum efficiency from each unit in the series. Frequency response of the AP-200 is within 1 db from 20 cps to 20,000 cps. Distortion is less than 0.5% at 1 watt output, and noise level is 60 db down at magnetic input, and 70 db down at the auxiliary and tuner inputs. Output impedance is 4, 8, 16, and 32 ohms. The front panel contains a coaxial volume control, treble and bass controls, and mode and input selectors : five switches, rumble filter, scratch filter, loudness contour, tape monitor and power. Bogen-Treem, B. O. of the Siegler Corporation, P. O. Box 500, Piscataway, N. J. User net price $154.05, walnut cabinet $24.75, metal enclosure $11.95.

AP-60 66-w ster ampl $249.95

DYNAKIT

• Stereo Preamplifier. Available in both wired and kit form, the new Dynakit Model PAN-2 is a deluxe stereo control unit which features unusual versatility and flexibility, along with exceptionally low distortion and noise. Although as many as 7 stereo or 14 monophonic inputs can be utilized, the PAN-2 is simple in operation and uncomplicated in appearance. Construction of the instrument from the kit is greatly simplified by the use of two factory assembled, printed circuit boards that include about three-quarters of the components. Average construction time is approximately eight hours. The built-in power supplies provide operation with any power amplifier. Frequency response of the PAN-2 is 10 cps to 30,000 cps, plus or minus 0.5 db at 500 cps. The noise level is below 0.05 per cent at sufficient output to drive an amplifier. Equilibration characteristics are closely controlled through the use of components of one-per-cent tolerance in the critical network of tape monitor controls. 3910 Powelton Ave., Philadelphia 4, Pa. User net price for the kit $50.95, factory wired $90.05.

EICO

• Integrated Stereo Amplifiers. Two new integrated stereo amplifiers, the 76-watt STTO and the 40-watt ST40 (shown), have been introduced by Eico, Inc., 1816 Northern Blvd., L. I. C., 1 N.Y., and are designed to handle any stereo program source: FM and/or AM radio, FM-stereo, mechanical cartridge, ceramic or crystal cartridge, tape head, or preamplified tape. Controls include selector switch, equalization, tape monitor, control, balance controls, bass and treble, scratch and rumble filters, loudness-level switch, and individual feedback-type bass and treble tone controls for each channel. The ST70 has a built-in tape monitoring system and a speaker phase-reversal switch. Frequency response of the ST10 is stated as plus or minus 1/2 db from 20 to 20,000 cps and harmonic distortion is less than 1 per cent from 20 to 20,000 cps. The dual power amplifiers of the ST40 are Williamson-type circuits employing voltage amplifiers and split-balun phase inverters driving the output stage. Frequency response of the ST40 is stated to be plus or minus 1/4 db from 12 to 25,000 cps; harmonic distortion is less than 1 per cent from 40 to 20,000 cps. The ST40 sells for $149.95 in kit form, $149.95 wired. The ST40 sells for $79.95 in kit form, $124.95 wired. All prices include metal cover. Electro-Electronic Instrument Co., 3500 W. Ogden Ave., Chicago 24, I. L. C., 1 N.Y. HFS5 ster preamp kit $39.95
HFS6 28-w ster ampl kit $43.95
HFS9 100-w ster ampl kit $99.50

ERIC

• 11-Watt Stereo Amp and Control Center. Intended to serve as a complete audio control center and 20-watt stereo amplifier, the Eric Model 3106-T uses two pairs of EL-34/HQ-6's in the output stages. It features a transistorized preamplifier for magnetic cartridges, thus reducing hum. Each channel has its own separate, calibrated (in db) bass and treble tone, and intermodulation distortion at maximum power output is 1 per cent per channel. Intermodulation distortion is 0.4 per cent at 17-watts output. Frequency response is 20,000 cps plus or minus 1 db at "normal" listening level. Hum level is 76 db below 2 watts. Panel dimensions are 12-1/2 x 4-3/4 x 5 inches, excluding knobs. The panel comes in an attractive satin-gold finish. Eric Electronics Corp., 1828 Colorado Ave., Santa Monica, Calif. User net price $106.20 (prices in East slightly higher). 3450P 10-w ster ampl $80.00 3500T 20-w ster ampl $149.95

FISHER

• Hifi-Watt Stereo Master Control Amplifier. The Fisher X-1000 is a 110-watt stereo-polygon control amplifier designed for use in home stereo installations incorporating the very finest equipment. Designed to the very highest technical standards, tape output restriction increases as power is built up, to the X-1000 incorporates a number of valuable new controls and control functions in addition to the full range of con-
Kardon Model A-309, a 26-watt amplifier. Although moderately priced, its styling and features clearly show its family resemblance to the more elaborate members of the award-winning Audio-Technica series. Among the features which make this unit so versatile are: a zero-to-infinity balance control which permits either speaker to be completely cut off so that the system may be balanced for virtually any position in the room; continuously variable blend control; genuine treble and bass control which provides 12-db boost and cut at 50 cps.

16-db boost and cut at 10,000 cps, illuminated pushbutton on/off switch, other features include: stereo reverse/normal switch; rumble filter; dynamic control center controls; phone-RIAA and tape-XATECH equalization; two tape outputs for recording. Special grain-oriented high-permeability materials in the output transformers provide wide-band response. At equal input, average the frequency response is plus or minus 0.5 db to 15,000 cps. The A-300 delivers 15-watts into 8-ohm load at less than 0.1 db per cent distortion. The price of the A-300 is $109.50. Harman-Kardon, Palmuch, N. Y. A-500 50-watt amp $159.95

CIT IV-CIT IV-oriend high-permeability phonoplates provide a blend of music and drama. Two minutes pushbutton selection permits time control of the program. It is available in a variety of finishes, from antique brass to white or black lacquer.

LEAK

- **Point-One** Stereo Preamp. Impressive new styling enhances the appearance of the recent version of the well-known Leak "Point-One" stereo preamplifier. Designed to the new front panel offers changeable color panels for both faceplate and knobs, enabling the user to match the decor of any room. The new switchplate is interchangeably with the present one, permitting present owners the option of inexpensive conversion to the new styling. The Phase One speaker preamplifier is priced at $150.

KNIGHT

- **All Transistor 52-Watt Stereo Amplifier.** The Knight KN-4000 is a 36-watt stereo amplifier which takes advantage of the rapid growth of transistor technology. It can be run continuously for extremely long periods of time without getting hot and it consumes an extremely small amount of power—only 25 ma when operating at normal levels. Yet it has a factory-wired version, LA-250, at $131.50. Lafayette Radio Corp., 165 Broadway, N. Y. KT-500A Stereopreamplifier kit $34.50 LA-250A 50-watt amp $99.95 LA-240 40-watt amp $79.95

LAFAYETTE

- **105-Watt Basic Stereo Amplifier Kit.** In keeping with the current trend towards quality, the Lafayette KT-550 stereo amplifier kit achieves sound reproducing capabilities far in excess of the audiophiles—plus 0.5 db, 1 db from 20 to 20,000 cps. Utilizing multiple feedback loops, the KT-550 achieves extremely low distortion without evidence of ringing or instability. Total harmonic distortion is less than 0.3 per cent at 50 watts from 20 to 20,000 cps. Hum and noise are better than 50 db below 50 watts. Although rated at 25 watts the KT-550 amplifier kit is provided with four 50 watts tubes are required to deliver only 50 watts thus ensuring long tube life. Other features include phone grade electrolytics; very high quality capacitors; gold-plated connectors; gold-plated input and output tubes; dual inputs for virtually any type of stereo or monaural input; no drive for an extremely low cost; a new and unique power supply; a new and unique power supply;

Slate, glass-core resistors; two printed-circuit boards; and a step-by-step instruction manual with large pictorial illustrations. The KT-550 sells for $131.50 and is available in a variety of finishes, from antique brass to white or black lacquer.

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LEAK

- **Point-One** Stereo Preamp. Impressive new styling enhances the appearance of the recent version of the well-known Leak "Point-One" stereo preamplifier. Designed to the new front panel offers changeable color panels for both faceplate and knobs, enabling the user to match the decor of any room. The new switchplate is interchangeably with the present one, permitting present owners the option of inexpensive conversion to the new styling. The Phase One speaker preamplifier is priced at $150.
NO TOOLS... NO CONTROLS... NO SWITCHES... NO PROBLEMS...

FM MULTIPLEX RECEPTION AUTOMATICALLY WITH AMAZING PILOT 200

THE AUTOMATIC ANSWER TO FM MULTIPLEX RECEPTION—THE PILOT 200 MULTIPLEXER

The great beauty of stereophonic music till now has been confined to records or tape. NOW, with the Federal Communications Commission ruling on April 19th, 1961, all this great music can be broadcast over the air-waves. The Pilot 200 automatic Multiplexer is the easiest way to enjoy the new stereo Multiplex broadcasts. All connections are external, made with jack cords that simply plug in place. No controls. All switching is done automatically—when the tuned-to station is broadcasting stereo, the Indicator Light goes on and the Multiplexer automatically switches to stereo reception. And, it will not affect reception of monaural FM. Completely self powered. Measures 5" high x 3” wide x 14" long. Contains three tubes plus one rectifier. Housed in an attractive black and brass enclosure designed to match Pilot components. Complete with enclosure $7950

PILOT 100 SEMI-AUTOMATIC FM MULTIPLEXER!
Completely self powered with only one operational control—a simple slide switch to put the Multiplexer into or out of the circuit. All connections can be made externally. Contains two tubes and one rectifier. Dimensions 5” high x 3” wide x 9” long in handsome black and brass styling. Complete with enclosure $4950

FOR COMPLETE TECHNICAL INFORMATION ON THE PILOT 200 AUTOMATIC FM MULTIPLEXER OR THE PILOT 100 SEMI-AUTOMATIC FM MULTIPLEXER, PLEASE FILL OUT AND MAIL COUPON.
Jensen's New 3-P Speaker
Make Sound

1. 3-P woofer has flat plane radiator. All the surface is 100% effective for efficient sound radiation.

2. Two layer molded POLYTEC* piston, with center-plus-edge drive, suppresses vibrational modes.


5. Five all-new speakers (all with POLYTEC radiators) precisely complement each other for a new smoothly blended coverage of the complete frequency range. Includes the new 3-P* 10 1/4" Woofer, a special 8" midrange, two 3 9/16" tweeters, the sensational Sono-Dome* Ultra Tweeter, and crossover network. Available in kit form at $97.50.

6. Improved transient response is an important contributor to better sound quality. You'll marvel at the new clarity and transparency of 3-P speaker system sound.

7. Flat piston and shallow SYNTOX*6 ceramic magnet make possible unusually slim cabinetry combined with big speaker sound. This feature is fully utilized in the 3-P/2 Super Slim Panel System which is only 3 9/16" deep overall!

*T.M.
Systems Better 7 Ways!

When you buy a new high fidelity speaker system, you can be sure you are in the forefront of new developments with Jensen 3-P, the all new speaker development that makes sound better 7 ways!

Not only do you get new smoothly-blended transparent sound, coverage of the complete frequency range . . . with full bass capability . . . from the 5-speaker 4-way system with all-new components . . . but there's an exciting choice of decorator styled cabinetry in standard shelf size . . . or space-saving contemporary slim shelf and the super-slim panel version, a mere 3¾" from front to back! Your 3-P system can match existing decor or be a revelation in inspired modern flexibility, adapting itself to your space and visual design for living.

SPECIFICATIONS
Components: 3-P/W1 woofer; M-80 midrange; two TW-40 tweeters; E-10 Ultra-Tweeter. Frequency Range: from as low as 20 cycles to beyond audibility. Crossovers: 600; 4,000; 10,000 cps. Power Rating: Speaker 25 watts. Higher rated amplifiers may be used when adjusted to reasonable room levels. Adequate living room level with 12-15 watt amplifier. Impedance: 8 ohms. Control: H-F balance.

WRITE FOR NEW CATALOG 165-G
to 70 db switchable, self-noise level is less than 0.5 mv, total distortion is less than 0.4 per cent rms. Channel separation is greater than 40 db, and output level is 1.5 volts. 

PACO

NORTRONICS

- Recording Amplifier. The Nortronics Model RA-100 is a high-quality recording amplifier which will supply any magnetic recording head with audio power and the required bias voltage. It also provides high- and low-impedance sense power for erase heads. It has a VU-meter recording-level indicator which allows constant and accurate monitoring during recording. Mains are provided for synchronizing the oscillators to prevent beating. Two RA-100 amplifiers are used for stereo recording. The RA-100 can also be synchronized with the most popular tape recorders. The Nortronics Co., Inc., 1015 S. 6th St., Minneapolis 4, Minn. *User net price* $57.50.

Width control for WV-2 $125.00
PFB-150WD, 150-watt amp $81.00

Pilot

- Sixty-Watt Stereo Control-Center Amplifier. The Pilot Model 214B is a fine stereo amplifer (harmonic distortion 0.5% from 20 to 20,000 cps at rated power) combined with a versatile control center that includes 14 inputs for monophonic use or 7 pairs for stereo. Fifteen controls include bass, treble, tone, rumble filter, and a tape monitor switch. The 214B has Pilot's Stereo PWR-2 tone control, an adjustable speaker connection which can be used for center kit-in for stereo or monophonic listening in another room. Input is 20 watts per channel or 40 watts total; sensitivity is 1 volt for full output. Intermodulation distortion is less than 0.5% and frequency range is 20-20,000 cps. Model: 214B SH-6 is shipped with a certificate showing final test values for that particular instrument. In distinctive brass and black styling. Pilot Radio Corporation, 32-46 36th St., Long Island City, N. Y. *User net price* $249.311.

216A, stereo preamp $199.50
240, 30-watt amplifier $143.50
256, 60-watt preamp $179.50
246, 60-watt amplifier $199.50

Quad

- Stereo Preamplifier. The Quad Model 22 is a stereo control unit that is a comprehensive phonostage, monophonic preamplifier utilizing a pushooter arrangement to select any one of four possible combinations. The Quad 22 is designed to operate with the Quad power amplifier, either singly or in pairs. Frequency response is 20 cps to 20,000 cps, plus or minus 0.5 db. Distortion at 14 volts rms output is 0.02 per cent at the most favorable arrangement of the controls. With the worst possible arrangement of the controls the distortion is less than 0.1 per cent. Total hum and noise is less than 0.05 db per channel. Channel separation is better than 40 db from 20 cps to 20,000 cps. The front panel is a die-cast and finished in a silvery color. Electron Tubes of City Line Center, 764 City Line Avenue, Philadelphia 21, Pa. *User net price* $150.00. Quad II pwr ampl $125.00.

Ravenswood

- 28-Watt Stereo Amplifier. Designed such a short time ago that photographs are not yet available for this particular model, the Ravenswood Model 10800-D stereo amplifier features 14 watts (music power) per channel at a distortion of less than 0.2% at normal listening levels. Frequency response is plus or minus 1 db from 20 cps to 20,000 cps. Hum level is 8 db below rated output. A standard complement of controls is provided. Ravenswood Division of Minneapolis, Electronic Corporation, 214 West St., Annapolis, Md. *User net price* $99.55.
PA-2000 60-watt preamp $99.55
PA-3000 130-watt preamp $199.55

Sheel

- 71-Watt Stereo Control Amplifier. A complete monophonic stereo control center, the Shell 2920 "Monasst" features visual power output is 4 w at the magnetic phone input, 3 w at the tape head input, and 300 w at the high-level input. For the 2920B employs 6 power transistors, 12 medium gain transistors, 2 driver transformers, and 1 rectifier transformer. Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass. *User net price* $153.50. SP-212 stereo preamp $99.50.
TA-18 36-w trans. ster amp $99.50
SA-24 24-w trans. ster amp $99.50
BA-210 140-w sterling preamp $179.50.

H. H. Scott

- 24-Watt Amplifier Kit. Taking its place beside the unusually well-designed H. H. Scott FM tuner kit in this 72-watt amplifier kit, the Scott LS-72 is an outstanding piece of equipment that seems to have all the virtues of the tuner kit. This kit is again a perfect match for the tuner kit so that the builder may have a system which is matched in appearance as well as performance by the time he is finished. Specifications for the LS-72 are similar to those for any factory-assembled unit: full power (30 watts per channel); HFIM power band extends down to 20 cps; harmonic distortion is less than 0.4 per cent at full power; hum level is better than 70 db below full power output. Among the many additional features of the LS-72 are a "center-channel" level control, switch filter, tape recorder monitor, and separate bass and treble control for each channel. The H. H. Scott LS-72 is available through H. H. Scott, Inc., Dist. P., 111 Powdermill Road, Maynard, Mass. LC-21 72-watt preamp kit $99.55.
LK-150 150-watt amplifier kit $169.55.
122 24-watt preamp kit $28.50.
222C 44-watt preamp kit $149.55.
announcing

the new **MIRACORD**
**STUDIO SERIES AUTOMATIC TURNTABLE AND RECORD CHANGER**

...the first and only automatic turntable and record changer designed to meet the uncompromising requirements of stereophonic record reproduction. The heart of the finest record reproduction equipment is the constant speed hysteresis synchronous motor. This is the heart of the new MIRACORD STUDIO H. Equally outstanding is the one-piece, dynamically-balanced, seven-pound, cast and machined 12" turntable...another assurance of uniform speed. The scientifically designed, professional type tone arm with plug-in head is non-resonant and free in all planes. It tracks faultlessly at recommended tracking weights. The arm is mass balanced and no springs are used. The 4-speed MIRACORD plays all size records as a conventional turntable, an automatic turntable or as an automatic record changer. **STUDIO H** with hysteresis synchronous motor $99.50.* Where line voltage variation is not a problem the **STUDIO** with heavy-duty, shaded, 4-pole motor will provide uncompromising stereo performance $79.95.*

*Complete with arm, less cartridge and base.

**BENJAMIN**
ELECTRONIC SOUND CORP., 97-03 43rd Ave., CORONA 68, N.Y.

AUDIO • AUGUST, 1961
balance of the stereo channels by an electronic "eye" tube. Located on the front panel, with individual meter controls and balance controls, the "eye" permits precise dynamic balancing of the input signals. In addition a built-in signal generator provides a reference voltage for balancing. The "eye" is also useful as a monitor for recording. Controls are also provided for selecting mode, loudness control, mono channel 1, channel 2, or combined, and rumble filter. Bass and treble controls are separate within each channel. Power output is 40 watts or 29 watts for each channel with harmonic distortion less than 1% between 30 and 10,000 cps. Frequency response is 20 to 20,000 cps ± 3 db at rated output. IN db of feedback is used with a stability margin of 15 db. Hum and noise are down 80 db at the tuner and auxiliary inputs, 65 db at the tape input, and 70 db at the phono magnetic input. Sherwood Electronics Mfg. Corp., 112 State St., Westbury, N. Y. User net price: $196.75.

Ptuners, or auxiliary equipment. Treble, bass, and balance-loudness controls are ganged or, by turning each friction-locked knob separately, can be operated to adjust the channels individually. The X-15 includes low and high filters, and output jacks for tape recording.

SHERWOOD

- 60-Watt Stereo Amplifier. Featuring fifteen front-panel controls and switches and twelve input and output jacks, the Sherwood Model S-2900 Amplifier provides 25 watts (music power) per channel, included in the front-panel controls are 12 db/octave rumble and scratch filters (effective at all inputs), friction-locked bass and treble controls (each channel separately or both channels simultaneously), function switch, selector, stereo balance and individual gain, loudness, tape monitor switch, loudness-in-out switch, phase-reverse switch, and stereo-reverse switch. To facilitate home or professional type stereo tape recording, two microphone follow-up outputs and front panel tape monitoring switch combine to give complete recording flexibility. Hum and noise is 80 db below 24 watts (radio input) and 60 db below 24 watts (phone input). Frequency response is plus or minus 1 db, 20-40,000 cps. IM distortion is 1.5 per cent, and harmonic distortion is 0.5 per cent at 24 watts continuous. Distortion factor of 5 assures optimum performance with today's low-efficiency speaker systems. Dimensions are 4 x 11 x 14 inches; price is $196.50 (less case). Sherwood Electronic Laboratories, Inc., 4300 Thalasso Ave., Chicago 12, Ill. 50001 80-watt amp $199.50 10001 36-watt amp $199.50

TEECO

- 55-Watt Stereo Amplifier. An integrated amplifier containing provisions for controlling all audio playback functions, the Teeco Model 1230 provides 15 watts in each channel or 30 watts in monophonic operation. It incorporates provision for a center channel speaker which may be used in the same room as the stereo speakers, or it may be used in a remote location for monophonic reproduction of the program. The Model 1230 is designed for use with a magnetic cartridge, tape head, ceramic or crystal cartridge, AM/FM mounting and placement loss critical since ventilation is not a factor. The Tecco 55-Watt Amplifier does not use an output transformer, and is thus free of the distortion developed in this type of unit. Separate bass and treble controls are provided for each channel. There are also five pairs of inputs and two switched a.e. outputs. Power output is 40 watts (20 watts per channel) measured according to IIPM musical power standards with 4-ohm load. Frequency response is 20-20,000 cps. Frequency response is also +0.5 dB at 20 cps to 3000 cps and 1.0 dB at 10,000 cps. Intermodulation distortion is less than 0.1 per cent at rated output, and harmonic distortion is less than 0.5 per cent at rated output. The circuit includes fourteen low-level transistors, four power transistors, two germanium rectifiers, two germanium diodes, and three silicon diodes. Transi-Tronics, 1601 Olympic Blvd., Santa Monces, Calif. User net price $129.50.

TUNERS

ALTEC

- Home Music Center, Advanced design and performance with an accent on style is featured in the new ALTEC 707 stereo AM/FM tuner-amplifier. Operating as a complete home music center the 707 can accommodate either mono or stereo systems with equal facility. Featured also is a connection for a center speaker which makes the unit suitable for extended stereo applications. Power output of the amplifier section is 48 watts (24 watts per channel) by IIPM ratings. The 707 is part of line of matched monophonic and stereophonic components of 29 db, and its frequency range is 20 cps to 50,000 cps (includes 10,000 cps whistle filters). Individual tuning meters are provided for AM and FM. The amplifier section provides 22 watts per channel (IIPM) and its frequency response is 2.1 db from 20 cps to 20,000 cps. Total harmonic distortion is less than 1 per cent at 1000 cps at 40 watts rms. A complete complement of controls is provided. ALTEC TUNER CORPORATION, 1515 S. Manchester Ave., Anaheim, Calif. User net price: $399.95.

BOGEN

- "Fonie Couple" A.M-F.M. Stereo Receiver. Inspected by a book of the same name, the new Bogen "Fonie Couple" Series includes an FM-stereo tuner and the AM-FM-stereo receiver shown (Model RP-200). The RP-200 features a 20-watt per channel stereo amplifier and built-in FM-stereo circuitry. Except for speakers, this unit contains everything necessary for a complete stereo system. FM sensitivity is 3 µv by IIPM standards. The RP-200 incorporates sufficient controls to make the most ardent knob twirler happy.

BOGEN RADIOMATIC, INC., 1999 S. Anaheim, Calif. User net price: $261.00

BELL

- A.M.-F.M. Receiver. An AM-FM tuner with a 44-watt stereo amplifier on the same chassis, the Bell Model 2145 will receive simultaneous broadcasts and contains provisions for the installation of an FM-stereo adapter. The FM tuner sensitivity is 1.8 µv for 30 db of quieting and frequency response is ± 0.5 db from 20 cps to 20,000 cps. The AM section sensitivity is 4 µv for a signal-to-noise ratio of 15

AUGUST, 1961
the year’s most wanted components...

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in all

**RECEIVERS and TUNERS**

Top quality, handsome styling... and the Industry’s first complete line of receivers and tuners with built-in Multiplex...all from BOGEN, the only major high fidelity manufacturer with five years experience in the production of commercial Multiplex receivers.

For example, take just one unit from the all-new Stereo Line... the superb RP200 Fun Couple receiver. Inspired by the novel “the fun couple,” and dedicated to fun couples everywhere... the RP200 offers compact, contemporary design, unexcelled performance, sensitivity, balance, and many features found only in receivers costing far more.

The all-new Bogen Stereo Line is the result of 30 years leadership in the precise art of sound engineering. Write for the BOGEN Stereo Hi-Fi Catalog.

*Prices slightly higher in the West

**BOGEN-PRESTO**

Desk A-B - Paramus, N. J. • A DIVISION OF THE SIEGLER CORPORATION

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RP200 Fun Couple FM/AM, 40 watt, Stereo Receiver $299.95*

Top quality, handsome styling... and the Industry’s first complete line of receivers and tuners with built-in Multiplex...all from BOGEN, the only major high fidelity manufacturer with five years experience in the production of commercial Multiplex receivers.

For example, take just one unit from the all-new Stereo Line... the superb RP200 Fun Couple receiver. Inspired by the novel “the fun couple,” and dedicated to fun couples everywhere... the RP200 offers compact, contemporary design, unexcelled performance, sensitivity, balance, and many features found only in receivers costing far more.

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*Prices slightly higher in the West

**BOGEN-PRESTO**

Desk A-B - Paramus, N. J. • A DIVISION OF THE SIEGLER CORPORATION

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RP200 Fun Couple FM/AM, 40 watt, Stereo Receiver $299.95*
addition of an adapter. The FM section has a.f.c., a.f.c.-defeat, a.f.c.-on, and a broadband ratio detector for improved capture ratio and easier tuning. FM frequency range is 20,000,000 cps. The AM section features switched "narrow" (14,000 cps) and "normal" (10,000 cps) bandpass. AM frequency range is 20,000,000 cps (narrow). Panel controls include: separate AM, FM tuning, automatic AM, FM level controls; selector switch for choosing AM only, FM only, AM-FM stereo, or FM-STEREO. The $79.95 sets for $79.95 in kit form; wired, the price is $129.95. Both prices include a metal cabinet, Electronic Instrument Co., Inc., 3200 North- ern Blvd., L. I. C. N. V.

FISHER

- FM-Tuner Kit. Fisher FM-2000 is an example of excellent engineering. Incorporation of such features as interchannel muting by cutting off the last i.f. stage and automatic a.f.c. defeat whenever the tuning knob is touched makes this switch on the front panel. Antenna input is 50-ohm balanced. The front panel is matted-gold finished, Fisher Electronics Corp., 1823 Colorado Ave., Santa Monica, Calif. List price, $84.95. (Slightly higher in East.)

- FM-Stereo Tuner. An unusually fine FM tuner with many advanced features, the Fisher FM-2000 is an example of excellent engineering. Incorporation of such features as inter-channel muting by cutting off the last i.f. stage and automatic a.f.c. defeat whenever the tuning knob is touched makes this switch on the front panel. Antenna input is 50-ohm balanced. The front panel is matted-gold finished, Fisher Electronics Corp., 1823 Colorado Ave., Santa Monica, Calif. List price, $84.95. (Slightly higher in East.) 3357 FM tuner $56.75 3157 stereo tuner $99.95

HARMAN-KARDON

- Integrated AM/FM-Stereo Tuner. The Har- man-Kardon Model TM100X is a new AM/FM tuner with a multiplex adapter built in. The circuit consists of a tuned grounded-grid r.f. amplifier followed by a triode mixer, 3 high-gain, wideband, pentode i.f. stages and a switched-beam limiter. The circuit employs a wideband solid-state Foster-Seeley detector, a colpitts oscillator, and reference type a.f.c. circuit. Sensitivity of the 7000X is 1.2 v by HIP standards. Harman-Kardon Inc., Plazaview, L. I. N. V.

KARG

- FM Tuner. Intended to round out the Karg line of FM tuners, the "Primana" CT-3 is a really stable tuner with a handshaped encloser, featuring printed r.f. coils, flywheel-action with inline tuning, "magic eye" tuning indicator, dual function switched-beam limiter, wideband Foster-Seeley discriminator, and two audio outputs plus multiplex jack. Sensitivity is stated as 0.8 stv at 20 db of quelling with 10% less than 0.7 per cent at 100 per cent modulation. Frequency response is plus or minus 1 db from 20 to 20,000 cps. Price of the CT-3 is $99.95 without a case. A brown metal case and various wood cabinets are available as accessories. Karg Laboratories, North Norwalk, Conn.

- Complete FM Receiving System. The Karg Model 8 is a complete FM receiving system in two walnut cabinets, each of which mea-
COMMANDBING NEW SYSTEMS

We are proud to present the new W40 Achromatic—Wharfedale's remarkable ultra-compact two-speaker system built around a newly developed 8½ inch low frequency drive with an extremely high flux density magnet; and Wharfedale's outstanding 5 inch tweeter. In size (24" x 12" x 10"), the W40, with its unobtrusive, clean modern lines, is an instrument of remarkable range. It is ideally adaptable for the greatest enjoyment of music in today's modern apartments, the den of a country home or in larger rooms. True Wood $79.50, Unfinished $69.50.

NEW W40

Wharfedale has combined the excellence of W60 and W70 reproduction with handsomely crafted pieces of period furniture. We are sure you will welcome the addition of these authentic Provincial designs in genuine Fruitwood to the Achromatic Series.

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The W60 and the W70 continue to provide the distinguished performance which has won phenomenal acclaim for all the speakers in the Wharfedale Achromatic Series. The decorator designed cabinets will complement modern decor... look "at home," anywhere. True Wood $116.50, Unfinished $101.50.

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NEW W70PR

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Wharfedale, a division of British Industries Corp., Port Washington, N.Y.
Knight

- **FM Stereo Tuner (with SSR).** Featuring dynamic signal regulation (DSR). The Knight KN-150M FM stereo tuner is designed to provide optimum reception of all FM stations. The circuitry is designed to virtually eliminate distortion of虚弱 signals as well as the distortion caused by overmodulation of the signal at the station. The multiplex adapter and a control for regulating stereo balance is included. A panel light will glow automatically whenever an FM stereo signal is received. FM distortion of the KN-150M is less than 25 per cent at signal levels over 10 microvolts. The audio output stage utilizes a cathode follower to permit cables up to 100 feet in length. APC and inter-station muting are also provided. An output level control is mounted on the front panel to facilitate tape recording of FM broadcasts. The KN-150 is provided with a beige finish metal case and the control panel is gold and charcoal brown. Allied Radio Corp., 30 Cross Ave., Chicago 80, Illinois. User net price, $149.50.

- **"Criterion" FM Tuner Kit.** The Lafayette Model KT-650 FM tuner kit is a member of the Lafayette "Criterion" series—apparently the top of their kit line. The KT-650 incorporates many features: multiplex jack; anode follower output allows tuner to be located up to 50 feet away from amplifier; flywheel weighted tuning; variable f.f.c.; electronic eye tuning indicator; tuner level control on front panel. Sensitivity is 6 µv by IFPM standards; frequency response is ±0.5 db from 15 cps to 35,000 cps. Distortion and noise are better than 0.5 percent at 1.5 volts at 100 per cent modulation. Lafayette Radio, 145-08 Liberty Ave., Jamaica 33, N. Y. User net price, $54.50. Factory wired and tested. $79.85.

- **AM-FM Stereo Tuner Kit.** McIntosh Model MR-66 AM-FM tuner kit is virtually clear for the purist. Some of its signal features are variable f.f.c. which automatically disengages with the slightest tuning action, and automatically re-engages at the start of a multiplex adapter. Ultrasonic muting injected in the i.f. stage so that it is operative during FM-stereo broadcasts. Bialam coil in the 300-ohm output circuit for a balanced line. Sensitivity of the FM section is 3 µv by IFPM standards. Frequency response is ±3 db from 20 cps to 20,000 cps. AM sensitivity is 1.5 µv and distortion is less than 2 per cent at 100 per cent modulation. Provision is included to feed a multiplex adapter. McIntosh Laboratories, Inc., 4 Chambers St., Binghamton, N. Y. User net price, $225.00.

**MONARCH**

- **Stereo AM-FM Receiver.** Monarch Model STA-2100 is a complete stereo unit mounted on a single chassis. Featuring dual amplifiers, separate AM and FM tuners, the STA-2100 is ideal for simultaneous receiving or, with an adapter, for F/M stereo. With its full complement of controls and its built-in 100-watt amplifier, the STA-2100 truly qualifies as a home music center. Amplifier circuit features are an oversize power transformer; fully potted, grain-oriented output transformers; and the control panel; balance-adjust meter on back panel; fixed bias on the output tubes. Sensitivity of the FM tuner is 1 µv for 20 db of quieting. Monarch Electronics International, Inc., North Hollywood, Calif. User net price, $324.56.

**PACO**

- **Stereo FM/AM Tuner Kit.** The Paco model ST-45PA stereo AM/FM tuner kit features separate prewired and prealigned AM and FM tuner circuitry on two printed circuit boards. Having separate AM and FM circuits, the Paco model ST-45PA can play simulcast stereo as well as separate AM or FM. A multiple socket is provided with space beside it for a multiplex adapter. The FM tuner has a sensitivity of 2 microvolts for 20 db quieting. Bandwidth is over 200 kc, with harmonic distortion less than 1% from 2% to 20,000 cps. The circuit includes dual limiters and a Foster-Seeley discriminator. The AM tuner has a tuned r.f. stage with a three-tube tuning capacitor. The built-in ferrite antenna is rotatable as well as removable. The circuit includes 10-sec whistle filter. Both AM and FM sections have separate flywheel tuning, cathode follower output and individual output level controls. Paco Electronics Co. Inc., 70-31 84th St., Glendale 27, L. I., N. Y. User net price, $99.50 for the kit; factory wired, $134.95.

**Ravenswood**

- **AM-FM Tuner.** Completely ready to be adapted for FM-stereo, the Ravenswood Model T-1000 provides FM sensitivity of 1.8 µv for 20 db of quieting and an AM sensitivity of 20 µv using the built-in ferrite loop-stick antenna. Frequency response is plus or minus 1 db from 20 cps to 20,000 cps. Distortion is less than 0.5 per cent at 100 per cent modulation. A f.c. and a.f.c. defeat provided. Ravenswood Division of Annapolis Electronics Corp., 241 West St., Annapolis, Md. User net price, $99.50.

**McIntosh**

- **AM-FM Tuner.** A deluxe tuner with many unusual features, the McIntosh Model MR-66 AM-FM tuner kit is clearly intended for the purist. Some of its signal features are variable f.f.c. which automatically disengages with the slightest tuning action, and automatically re-engages at the start of a multiplex adapter. Ultrasonic muting injected in the i.f. stage makes this unit uniquely easy to tune for minimum distortion. Separate tuning meters

**Quad**

- **AM-FM Tuner.** Featuring an indicator light which automatically glows when a stereo program is tuned in, the Quad Model 220 tuner also automatically switches to stereophonic FM reception. Some of the other features of the Model 220 are a precision tuning indicator; built-in power-line cord FM antenna; low-impedance cathode follower outputs; FM level control on rear panel. FM sensitivity is 3 µv by IFPM standards. The circuit includes a low-noise trio r.f. amplifier, low-noise triode converter, 3 i.f. stages, and a wideband detector. Pilot Radio Corp., 37-06 36th Street, Long Island City, N. Y. 200 FM-stereo adapter 79.50 480 AM-FM tuner 159.50 602 AM-FM rec 249.50

**Realistic**

- **AM-FM References.** Built-in FM-stereo adapter and separate AM and FM tuners make the Realistic Model T-8 an optimum minute tuner. In addition, color-scale tuning

**Audio**

- **August, 1961**

AmericanRadioHistory.Com
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CUSTOM ALTEC TWO-WAY SPEAKER COMPONENT SYSTEMS NOW FROM $34.50 TO $301.00 COMPLETE...

Make up your own distinctive two-way speaker system with world-famous ALTEC Speaker Components. It's a personally satisfying project that adds up to uncompromised quality at remarkable savings!

Wide range ALTEC Speaker Components smoothly cover the entire audible spectrum—from lowest low to highest high—in a professional two-way manner. Result? Virtually distortion-free realism that is impossible to achieve with limited range speakers used in phase-distorting multi-crossover systems.

HOW TO GET STARTED? THREE EASY STEPS:

1) On chart at right, 12 ALTEC two-way Speaker Systems are shown. With ALTEC, you have a wide choice from good small systems to the finest full-size systems available today.

2) Clip out chart as a reminder and visit your nearest ALTEC Distributor where you may order the ALTEC System of your choice. Ask for your free copy of the informative 16-page ALTEC brochure, "Loudspeaker Enclosures—Their Design and Use."

3) Use the design plans and ideas in this brochure to build your own Audio Enclosure. Or, if you prefer, your ALTEC Distributor can have one built for you. For additional savings, consider a "built-in" installation in wall, closet, etc.

So why compromise sound to pamper a budget? You needn't, ever again! Instead, do-it-yourself... with ALTEC.

YOUR GUIDE TO 12 CUSTOM ALTEC TWO-WAY SPEAKER COMPONENT SYSTEMS

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*Exclusive of Enclosure

ALTEC LANING CORPORATION
Dept. A-8, 3151 So. Manchester Ave., Anaheim, Calif.
New York • Los Angeles
A Subsidiary of Ling-Temco Electronics, Inc.
are provided for AM and FM. Sensitivity of
the FM section is 1.5 µv for 30 db of quieting
and 75,000 cps deviation and 1000 per cent mo-
datum. AM sensitivity is 2 µv for 20 db
signal-to-noise ratio at 50 per cent modula-
tion. Frequency range of the FM section is
20 cps to 20,000 cps; frequency range of the
AM section is 20 cps to 3000 cps, Radio
Shack Corp., 720 Commonwealth Ave., Bos-
ton 17, Mass., tel. H*1115.

STA-7 FM-stereo rec. .......... $124.95
TM-220 transis FM-stereo tuner ...... $194.95
MPX-215 FM-stereo adapter .......... 39.95

H. H. SCOTT

• FM-Stereo Tuner. The new H. H. Scott
FM-stereo tuner, Model 350, is an FM-
stereo version of the well-known Model 314
tuner. Incorporating the wideband circuitry
which characterize all the H. H. Scott tuners,
the Model 350 will provide optimum stereo-
phonic reception. Visible sensitivity, by HHFM
maximum stereo separation, FM sensitivity is
1.5 µv by HHFM standards, Sherwood Elec-
tronic Laboratories, Inc., 4300 N. California
Ave., Chicago 18, Illinois. User net price...... $110.00.
S-3000 III FM tuner .......... $101.00
S-8000 FM-stereo 64-w ....... $299.50
S3MX self-own FM-stereo adapter 69.50

TEECO

• AM-FM Receiver. A complete unit con-
stituting of an AM-FM tuner plus a 20-watt stereo
amplifier, the TEECO Model 1060 provides
pushbutton selection of either monaural or
separate AM and FM operation. Separate
selecting controls and tuning indicators are
provided for AM and FM. The amplifier may
be used as a 20-watt monophonic amplifier
or as a 15-watt per channel stereophonic
unit. Sensitivity of the FM section is 2 µv
for 40 db of quieting: AM sensitivity is 1.5 µv.
Frequency range of the FM section is 20
cps to 20,000 cps; frequency range of the
AM section is 20 cps to 3000 cps, The Model 1060
has a full complement of controls plus pushbut-
ton mode selection. TEECO Electronics, Inc.,
8642 Santa Monica Blvd., Hollywood 38,
California. User net price, $272.90.

TRANSISTRONICS

• Transistorized FM-Stereo Tuner. Occupying
a space of only 3" x 10¼" x 8¼", the TEO-
FM-15MIX provides FM stereo (or mono FM)
with a power consumption of only 4 watts.
Utilizing 27 transistors and 9 diodes, the

SHERWOOD

• FM-Stereo Tuner. The new Sherwood Model
S-3000 IV combines the sensitive Sherwood
S-3000 III tuner with their new wideband
multiplex circuitry to receive either FM-
mono or monophonic FM. The multiplex cir-
cuit includes a phase-locked synchronous oscil-
lator, an extremely sharp filter circuit to
remove the 19,000 cps pilot and the 67,000
cps commercial channel transmission. This
 tuner has controlled frequency and phase re-
 sponse of the 17 µv, amplifier, limiter, and
discriminator for minimum distortion and

LOUDSPEAKERS AND SYSTEMS

ACOUSTIC RESEARCH

• Low-Cost "Acoustic-Suspension" Speaker
System with Super Tweeter. Selling for little

and ready for finishing. Frequency response of
the Gigolo II is 25 cps to 10,000 cps plus
or minus 8 db. Harmonic distortion is less
than two per cent from 50 cps to 15,000 cps.
A.E.S., Inc., 3333 Payne Ave., Cleveland
14, Ohio. User net price $49.50.
Gigolo 1 biwafh speaker ........ $15.00
800A 8-in spkr ........ 19.95
1200A 12-in spkr ........ 50.50
1500A 15-in spkr ........ 59.95

A.E.S.

• Bookshelf Speaker System, The A.E.S.
Gigolo II is a wide-range speaker sys-
tem enclosed in a natural birch cabinet, which
is only 24" x 30½" x 12". All of the wood used
for the enclosure is at least ¾ in. thick;

AmericanRadioHistory.Com
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A STEREO TONE ARM FOR THE PROFESSIONAL

The most versatile ever developed—
The ultimate in simplicity, ruggedness and reliability. Virtually maintenance free.
Unexcelled audio performance. Sets a new low in tracking distortion. Response ≈ 1 DB from 5 cycles to cartridge limit.—This is the finest tone arm Gray has ever made and it is already setting new industry standards.—Here's why:

Plug in all cartridges including the G.E. Broadcast turn-around.
Dual balanced line output.
New modular weight system allows mounting almost any cartridge with hardware supplied.
Individual slide "memory" of the physical and electrical arm adjustments for each cartridge.
Built-in calibration to allow instantaneous exchange of cartridges between arms.
Set up in seconds for monophonic or stereophonic operation as your Broadcast schedule dictates.
Eliminate forever special equipment or "lash ups".
Available from stock now for immediate delivery.

Write today on your company letterhead for complete technical information, specifications, and application data.

GRAY SPECIAL PRODUCTS DIVISION 15 ARBOR ST., HARTFORD 1, CONN.
ALTEC

- Two-way Speaker System. The Altec 838-A "Carmel" speaker system provides unusually fine sound in a handsome cabinet of modern design. Available in walnut or mahogany finish, this Altec system is compact enough to be practical for stereo in many living rooms yet large enough to provide "large" loudspeaker sound. The Carmel is a professional-type two-way reflex system with a "guaranteed" frequency range from 30 cps to 22,000 cps. Two new high-compliance 411-A bass speakers provide low-frequency reproduction. An Altec 802-B driver mounted on an 811-H horn covers the highs to 22,000 cps. An 800-B crossover network provides crossover at 900 cycles. Altec Lamine Corp., 1015 S. Manchester Ave., Anaheim, Calif. User net price $297.00.

- 52-301 "Avant" spkr sys .................................. $246.00
- 53-1 "Capistrano" spkr sys .............................. 399.00
- 50-A7 "Voice of the Theatre" spkr sys ............... 299.30
- 505-A 15-in Duplex spkr .................................. 177.00
- 514-A 12-in, bass spkr .................................. 54.00
- 502-D high-freq. driver ................................ 53.00
- 811-B Sectoral horn .................................. 30.00

ARGOS

- Speaker Enclosure. Compact enough for a table-top yet large enough to accommodate a 12-in. woofer and a tweeter, the Argos "Eldorado" is only 27½" x 14¼" x 10". Especially important for smoothness of the bass is the tuning tube which is easily installed to match the Eldorado to any speaker you may use. The top, bottom, and two sides are covered with a "wood-grained" Pyrolysin, a new covering which looks exactly like wood from four feet away. Available in either blond or walnut. Argos Products Company, 301 Main St., Geneva, Ill. User net price $22.50.

AUDAX

- This Loudspeaker System. The new "Sonoteer" speaker system introduced recently by Audax employs five speakers but measures only four inches thick. Featuring a return to the open baffle principle, the "Sonoteer" produces the figure-eight sound pattern usually associated with this type of speaker mounting. Thus greater coverage can be achieved if this speaker is appropriately placed. Housed in an oil rubbed walnut frame with a filament pattern of matching wood over the speaker cloth, the "Sonoteer" weighs only 18-lb. and costs $79.95. The "Sonoteer Companion," Model 70, is the first in the Sonoteer's series which will include cabinets of traditional, classic, and provincial designs. Hick-Hut Company, Inc., Coruna, N. Y.

- CA-60 spkr sys ........................................ $59.95
- CA-1008 spkr sys ..................................... 124.95

BOZAK

- Three-way Speaker System. Although small in size, the Bozak H-362A possesses the same musical sensitivity featured by all Bozak speaker systems. It is ideal for small listening rooms or in pairs for stereo. The H-362A contains one Bozak 207A two-way speaker, one H-206A midrange speaker and one 10102 crossover network to provide crossover at 875 cps. Frequency range is 40 cps to 16,000 cps. Impedance of the system is 8 ohms, and system utilizes the servo-amplifier principle to provide improved fidelity. Servo, through a special coil wound on speaker elements, constantly monitors the action of the cone. The slightest unwanted variation from input signal is corrected within the fully transistorized, transformerless amplifiers. These are the same techniques employed in military missile guidance. The three channels of the system consist of one 12-in. woofer, three midrange elements, and three horn-loaded tweeters, respectively. Speaker elements feed their information back to their own transistorized amplifier sections. Each amplifier is conservatively rated at 12 watts per channel, at one per cent maximum harmonic distortion within its pass-band. Thus a total of 36 watts is available. Crossover networks are provided at the input of each amplifier: woofer up to 800 cps; midrange 800 to 3000 cps; tweeter 3000 to 20,000 cps. All crossover networks have 12 db per octave attenuation outside of their respective transmission bands. Frequency response is plus or minus 3 db from 35 cps to 15,000 cps. Input requirements are 0.75 volts and input resistance is 250,000 ohms. It is available in walnut fruitwood finishes, and also in a utility model less outer wood housing. Crosby Electronics, Inc., 135 Eleon Way, Synquest, L. I., N. Y. User net price, contemporary walnut $255.00; provincial fruitwood $225.00; utility model $200.00. Troubadour compact spkr sys ..................... $29.95

DUKANE

- "Jubilant" Speaker System. Utilizing ionized air instead of the conventional speaker diaphragm for converting electrical pulsations into audible sound, the Jubilant loudspeaker is being marketed by Dukane. The system, which utilizes electronic amplifiers and a unique transducer, is said to have a power-handling capacity of 20 watts at 8 ohms. The Jubilant system is being marketed at a suggested retail price of $99.95.

DURABOND

- High Fidelity Speaker. The Durabond D-700 is a high fidelity speaker system designed for use in the home. It consists of a mid-range driver and a tweeter, both of which are mounted in a single cabinet. The system is powered by a 35-watt amplifier and is capable of reproducing frequencies from 30 to 15,000 cps. The Durabond D-700 is available at a suggested retail price of $179.95.

CROSBY

- Servo-Amplifier Speaker System. Representing a new concept in sound reproduction, the Crosby/Intergrand servo-amplifier speaker system utilizes the servo-amplifier principle to provide improved fidelity. Servo, through a special coil wound on speaker elements, constantly monitors the action of the cone. The slightest unwanted variation from input signal is corrected within the fully transistorized, transformerless amplifiers. These are the same techniques employed in military missile guidance. The three channels of the system consist of one 12-in. woofer, three midrange elements, and three horn-loaded tweeters, respectively. Speaker elements feed their information back to their own transistorized amplifier sections. Each amplifier is conservatively rated at 12 watts per channel, at one per cent maximum harmonic distortion within its pass-band. Thus a total of 36 watts is available. Crossover networks are provided at the input of each amplifier: woofer up to 800 cps; midrange 800 to 3000 cps; tweeter 3000 to 20,000 cps. All crossover networks have 12 db per octave attenuation outside of their respective transmission bands. Frequency response is plus or minus 3 db from 35 cps to 15,000 cps. Input requirements are 0.75 volts and input resistance is 250,000 ohms. It is available in walnut fruitwood finishes, and also in a utility model less outer wood housing. Crosby Electronics, Inc., 135 Eleon Way, Synquest, L. I., N. Y. User net price, contemporary walnut $255.00; provincial fruitwood $225.00; utility model $200.00. Troubadour compact spkr sys ..................... $29.95

AUDIO • AUGUST, 1961
—not only the best, but the most complete line of
long-excursion, infinite baffle, precision speaker systems...

LINEAR-EFFICIENCY SYSTEMS

THE OLYMPUS
infinite baffle system without peer
Sensational sight, sensational sound, remarkable bass, indetectable
crossover, incredible transient response, transparent highs,
smootherst wide-angle projection...Every superlative ever used to
describe a precision transduction system has been applied to
the new JBL Olympus. The system includes a new 15" Linear-
Efficiency low frequency unit, the LE15; new high frequency driver,
the LE85; new slant plate acoustical lens, exponentially-tapered horn,
and new dividing network. All unite to reproduce sound
so clean, so smooth, so intact that the Olympus is destined to
establish a new standard for this type of system. The free-standing,
trim, beautifully-proportioned enclosure is available in all JBL
wood finishes and with choice of carved wood or fabric grille.

THE JBL MINIGON
Aristocrat of bookshelf-size speaker systems, the JBL Ranger-
Minigon provides integrated stereo through radial refraction,
the same patented method used in the fabulous JBL Ranger-
Paragon. Minigons accommodate either LE8 full-range units
or JBL Model S5 two-way systems. Grille may be either the unique
louver assembly shown here or fabric.

THE JBL MADISON
An exquisitely-styled minimum volume enclosure, the Madison
reflects the Danish design influence and is especially popular in
oiled teak or walnut finish. Finished four sides and front for vertical
or horizontal placement. Takes the LE8 speaker or S5 system.

THE JBL DALE
A timeless, elegant, modern design with removable legs and
hangers on back (also on Madison) for wall mounting. Finished four
sides and front. All finishes and grille cloths available.

HIGH QUALITY, LOW COST COMPACT LINEAR-EFFICIENCY SYSTEMS

THE LANCER 33
It is possible to offer typical JBL precision response, fine cabinet
craftsmanship, and lasting-listening satisfaction at a lower price
than ever before by making a simplified enclosure, longer
production runs, limiting choice of finishes, using one grille, and
providing somewhat less flexibility. The Lancer 33 is a ducted
acoustical enclosure with an LE8 eight-inch, full range speaker.
Lancer finishes are those most frequently asked for—tawny
walnut, oiled walnut, dark mahogany, ebony, and pumice.
Grille cloth is beige linen-weave.

THE LANCER 66
Similar in appearance to the 33, the Lancer 66 is a "buttoned-up"
enclosure with a two-way, dividing network system with an LE10
and new high frequency unit. Performance is remarkably smooth
and transparent. Lancer speakers are factory installed.

and for building in...
THE JBL WILTON
Unfinished, the Wilton is furnished with either the LE8 or
S5 system factory installed. Offered with either a flush grille or
overlapping grille for use when built into a wall or partition.
Whatever your choice...exponentially-tapered horn, bass
reflex or infinite baffle system...you'll find your ideal speaker in
the extensive JBL line. Write for complete catalogue.

JBL products are manufactured by James B. Lansing Sound, Inc. and marketed by
JBL INTERNATIONAL Los Angeles 39, Calif
into sound, the “Ionovae” high-frequency speakers are available either separately or as part of a complete speaker system such as the DuKane full-range system shown. Based on the work of French physicist Sigfried Klein some years ago, the DuKane Corporation developed the principle to a practical reality. Heart of the speaker is a small open-end quartz cell, no larger than the eraser on a pencil, in which air is confined in a chamber which narrows down to a tiny aperture. Within this small space air molecules are bombarded by a high-frequency, high-voltage current which knocks sufficient electrons free to ionize the air. The ion cloud is modulated by signals from the amplifier and is then fed into a small horn which delivers them essentially to the room as sound waves. The “Ionovae” has a frequency range from 3000 to 5,000,000 cps. The DuKane-20 includes two midrange speakers and a 12-in. high-compliance woofer in addition to the “Ionovae.” DuKane Corporation, St. Charles, Ill. User net price $87.50.

Rubber Bookshelf $59.50 DuK 10 tweeter $79.50 DuK 30 wide-range sys $199.50 DuK 40 wide-range sys $149.50 DuK 50 bookshelf sys $139.50

EICO

- 3-Way Speaker System Semi-Kits. The Eico HFS-3 and HFS-4 provide extraordinarily pure reproduction of bass frequencies with good efficiency. In an enclosure of only 21 cubic feet. Both are 3-way systems consisting of a 12-in. bass-suspension woofer and an 8-in. closed-back midrange speaker with a high-frequency horn tweeter which achieves its highest efficiency in the 40 cps region, and continues to respond down to 29 cps and lower. Midrange is handled by an XP12 full-range speaker in a separate compartment. The sensitive T250 treble-driver using an SH1 deflection horn, provides reproduction of frequencies above 500 cps. A T250 tweeter extends the response to an upper limit of 30,000 cps. The enclosure is styled in a handsome contemporary design, and is made of selected one-inch-thick woods which are finished in hand-rubbed mahogany, blond, limed oak, or walnut. It occupies only 5.3 square feet of floor space. Size 191/2 " x 281/2", Eico. Inc. Buchannan, Mich. User net price $750.00.

Stereon 200 3-way spkr sys $375.00 Royal 400 3-way spkr sys $249.50 Regal 300 3-way spkr sys $179.00 Lytton 100 bookshelf spkr sys $84.50 Coastal spkr (4-1/16 in.) 29.50-89.00 3-way spkr (3-1/2 in.) 66.00-125.00 30W 30-in. woofer $185.00

EMI

- Professional Studio Monitor Speaker System with Built-in Amplifier. Hand made and identical with the systems used in the recording studios of EMI in England. DLS 1 is a superb speaker system which will appeal to the connoisseur with unlimited budget and limited space. Built high rather than wide, the DLS 1 stands 20 inches high but is only 12½ inches wide and 17½ inches deep. Although those dimensions were chosen for the system’s design function as a studio monitor, it works out very well in a home. Three speakers are used in the column: a large elliptical cone woofer and two smaller units to cover mid- and high frequencies. The axes of all speakers are vertical so that optimum horizontal dispersion is achieved over a wide frequency range. Frequency range of the system is 30 to 15,000 cps. An EMI 25 watt, extremely low distortion amplifier is built into the base of the column. The amplifier uses four adjustable, factory-set, frequency correcting networks to attain flat response over the required frequency range. The column is mounted on four large, concealed casters. Exclusive United States distributor, Scope Electronics Corp., 10 Columbus Circle, New York 19, N. Y. User net price $704.00.

DLS 529 bookshelf spkr sys $159.00

ERCONA

- Compact Speaker System. A precision piece of Swedish design incorporating a new, integrated, multi-layer free-speaker cone, the Nordic I is an exceptionally efficient speaker which performs well with amplifiers of moderate power. The compact enclosure contains a 2-way speaker system which consists of an 8-in woofer and a 5-in cone-type tweeter. The woofer has a multi-layer, free cone, each layer of which is made of a different fibre and material. The combination of hard and soft materials, plus special edge treatment, reduces distortion to one per cent in the range from 100 cps to 10,000 cps. Distortion from 10,000 cps and 15,000 cps does not exceed 1.5 per cent. crossover for the tweeter is 2500 cps, although it actually cuts in at about 5000 cps. System frequency range is 45 cps to 18,000 cps, Impedance is 8 or 16 ohms. Power handling capability is 20 watts music power. Dimensions of the handsomely finished enclosure are 7 1/16" x 19 1/16" x 22 3/8". It is finished on four sides in walnut or teak. Ercona Corp., 16 W. 46 St., New York, N. Y. User net price $95.00.

FISHER

- 4-Way Speaker System. The Fisher XP-4 represents a new approach in loudspeaker design. The conventional metal frame (bass) and woofers are replaced by fibreglass, a material that is more flexible than metal. Thirty watts of power is available from the unit. Fisher XP-4. $375.00.

olf. AUDIO • AUGUST, 1961
Is this man an audiophile or an audio engineer?

In view of the many 'good music' FM stations now using Empire turntables, starr and cartridges, he may very well be an engineer. On the other hand, he may be an audiophile. We're not sure. The appreciation of fine equipment is not limited to professionals. Neither are we sure whether he is using a stereo or monophonic system. The Empire Troubadour is known to be fully compatible with both.

However, we are sure of the quality of his other components. They are undoubtedly the finest obtainable. For, it is hard to imagine this man having exercised such meticulous care in the selection of his playback equipment being any less discriminating in the choice of his amplifier and speaker components for his music system.

Audio engineers know the importance of component quality to playback performance. People in other walks of life are beginning to recognize this too. They are discovering a quality of performance in the Empire Troubadour, they believe to be unattainable in high fidelity music systems in the home.

The Empire Troubadour comprises the finest components ever designed for the playback function: the Empire 208, 35-speed hysteresis belt-driven turntable; the Empire 96, dynamically balanced arm; and the Empire 108, truly compatible mono/stereo cartridge.

See and hear the Empire Troubadour at your high fidelity dealer. Price of $180 includes cartridge, arm, turntable and walnut base. Price, less cartridge, $145.50. For full details, write to:

empire

1075 Stewart Ave
Garden City, N.Y.
supporting the outer edge of the bass speaker cone has been completely eliminated. This structure is often the source of undesirable acoustic feedback, causing uneven frequency response. In place of the metal speaker frame, the Fisher XP-4 utilizes the heavy walls of the cabinet itself. Reflections are eliminated by parking the space behind the bass speaker cone with AcoustiGlass. The XP-4 contains a total of four speakers, a 12-in. woofer with 2-in. voice coil, two 5-in. midrange units (packed with AcoustiGlass to eliminate cone breakup), one 2-in. hemispherical, high-frequency unit which covers an angle of 120 deg. for non-directional treble. Infinitely variable balance controls are provided for mid and high frequencies. Professional type, three-way crossover network uses heavy air coils, and oil-filled capacitors for elimination of distortion of crossover frequencies. Impedance is 8 ohms. Dimensions are 12 1/2" × 24 1/2" × 14 1/4". It is available in oiled walnut, cherry, mahogany, and unstained birch. Fisher Radio Corp., 2121 44th Drive, Long Island City 1, N. Y. User net price, mahogany, walnut and cherry, $189.50; unstained birch $189.50.

XP-1 3-way spkr sys mah $129.50
XP-2 2-way spkr sys mah $84.50

FRAZIER

• PF-3 Speaker System Series. The Frazier PF-3 series loudspeakers consists of models having approximately 3 cu. ft. enclosures. The Delmar (PF-31), the Lexington (PF-32), and the Black Box I (PF-3X) are all electronic loudspeakers. These consist of a special 8-in. full-range speaker, a 3 1/2-in. cone-type tweeter, and a high-pass filter. Since these assemblies have identical tuning tubes and components, their sound is identical except for the slight loss of high frequencies due to the grille cloth on the finished models. The price differential on these units is dependent entirely on the cabinet cost. Frazier Loudspeakers, 2649 Brenner Drive, Dallas, Texas. User net price, Del Mar, $89.50; Lexington I, $99.50; Coro- nado I, $89.50 and Black Box I, $37.50.

GOODMANS

• Super-quality 8-in. Speaker. The Axion 80 (shown) is capable of the highest accuracy of sound reproduction in the medium power level. It has an audio range of 20 to 20,000 cps and a power handling capacity of 12 watts. Freq. response is 17 000 cps. The low-frequency diaphragm of the Axion 80 is a true "free-edge" suspension, being suspended by three pairs of double-acting cantilevers to produce an extremely low and linear axial stiffness and a powerful radial centering action. Reso- nance is 20 cps. Ideal for monitoring and applications. Norman Triangle series consists of dual- cone low-frequency units with aluminum-diaphragm high-frequency pressure drivers. Three 12" models range from 25 to 45 watts: three 15" models from 30 to 50 watts. Axion II is an all-molded 8-in. unit covering range from 40 to 15,000 cps and capable of handling 12 watts. Rockhall Corporation, 650 Holset Ave., Mamaroneck, N. Y. User net price, $68.50.

10AX series 3-way spkr $56.50-17.50 Alpha 2-way spkr sys $49.95

HARTLEY

• Compact Full-Range Speaker System. The Hartley "Capri" comprises a full-range 10" speaker mounted in a handsome natural wood cabinet which measures 24" × 13 1/2" × 12 1/4". The grill is made of bamboo, adding a note of distinction to the appearance. The driver is the new model 320 which is a super polymerized adaptation of the model 220.

I (PF-31B), the Coronado I (PF-31G), and the Black Box I utility model (PF-3X) are all electronic loudspeakers. These consist of a special 8-in. full-range speaker, a 3 1/2-in. cone-type tweeter, and a high-pass filter. Since these assemblies have identical tuning tubes and components, their sound is identical except for the slight loss of high frequencies due to the grille cloth on the finished models. The price differential on these units is dependent entirely on the cabinet cost. Frazier Loudspeakers, 2649 Brenner Drive, Dallas, Texas. User net price, Del Mar, $89.50; Lexington I, $99.50; Coro- nado I, $89.50 and Black Box I, $37.50.

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10AX series 3-way spkr $56.50-17.50 Alpha 2-way spkr sys $49.95

HARTLEY

• Compact Full-Range Speaker System. The Hartley "Capri" comprises a full-range 10" speaker mounted in a handsome natural wood cabinet which measures 24" × 13 1/2" × 12 1/4". The grill is made of bamboo, adding a note of distinction to the appearance. The driver is the new model 320 which is a super polymerized adaptation of the model 220.

J. B. L.

• Elegant Speaker Enclosure. The James B. Lansing C-50 "The Olympus" loudspeaker enclosure exemplifies fine furniture craftsmanship and advanced acoustical engineering. The Olympus is designed to bring out the capabilities of the JBL 81 linear efficiency system. The C-50 will also accept the JBL 86 and 88 systems. The C-50 is available in mahogany, walnut, oiled walnut, Danish teak, and ebony. The system consists of an LE-15A 15-in. woofer, and an LP-85 high-frequency driver which is used with an HL-91 exponentially tapered, cast-aluminum horn coupled to an acoustic lens.

The crossover network, LX-5, crosses over at 500 cps. James B. Lansing Sound Co., Inc. 3249 Casitas Ave., Los Angeles 39, Calif. Price of the Olympus with hand-carved wooden fretwork grille, is $258.00; with fabric grille. $189.00. LE-15A 15-in. woofer $124.50 LE-85 high-frequency driver $139.00 HL-91 horn-lens assembly $33.50 LX-5 crossover network $72.00

JENSSEN

• Eleven Loudspeaker System. The Jensen SP/2 is a super-slim panel speaker which is only 3/4-in. deep, and can stand on a floor or hang on a wall, and in general fits in with most decors unobtrusively. Dimensions are 2 1/2" × 21 1/4" × 3/4"." The case is selected walnut veneer in an oil finish with raftan grille and oak trim strips. The SP/2 contains five speakers, a 10-in. woofer with a solid-foamed plastic cone, an 8-in. M-50 midrange plastic-cone speaker; two TW-40 tweeters; and an E-10 "Son-O-Dome" super tweeter. All...
"ASSEMBLING A GOOD STEREO SET"

by Ken Winters, music and recordings editor of the Winnipeg Free Press:

"I chose the AR-2a speakers over other extremely good systems because of their self-effacing dispositions. They seemed to intrude less in the music than did other speakers with more markedly individualistic sound-producing natures."

A number of articles have appeared recently in which the author (or magazine staff, or consumer organization) selects components for a complete high fidelity system. Most of these systems have included Acoustic Research speakers for the same reason given by Mr. Winters: the ability of AR's to reproduce music naturally, with minimum coloration.

We will be glad to send you a reprint of Ken Winters' article, discussing his choice of components for a stereo system in the medium-price range. Other lists of preferred high fidelity equipment are also available on request: a reprint of Down Beat magazine's "Picks of the Year" in stereo components,* and a description of four stereo systems,** each selected for Gentlemen's Quarterly by a different audio expert as the ultimate in quality.

AR speakers are priced from $89 to $225.

*AR-2a's chosen for medium-price system, AR-3's for luxury system
**AR-3's included in three of the four lists

ACOUSTIC RESEARCH, INC. 24 Thorndike Street Cambridge 41, Massachusetts
of the speakers have "Polyure" radiators. Jensen Manufacturing Co., 6001 S. Lorraine Av., Chicago 28, Ill. User net price $139.50.

TR-10 3-way spkr sys mah $19.50

Galaxy III spkr sys mah $29.50

**KLH**

- **Full-Range Two-Way Speaker System.** Housed in a cabinet measuring 21½" h x 21½" w x 11½" d and supported 15½" above the floor by runners, the volume of the Model 7 is 236 cu. ft. The speaker component is a 12" acoustic suspension woofer and two small cone-type direct radiators operating as rigid panels over the range from 1360 to 20,000 cps. The use of two such bookspeakers gives a surprisingly large apparent sound source. Low and high-frequency sections are coupled by an L/C crossover network at a frequency of 1360 cps. The relative levels of low- and high-frequency sections may be varied 2½ db to provide some degree of control over different room acoustics. Cabinet shape chosen to fit decors where the longer rectangular shape of the Model Six might not fit. Efficiency is identical with that of Model Six. KLH Research and Development Corp., 30 Cross St., Cambridge, Mass. User net price: mah $196.00; wal-oiled wal. $203.00; unf wal. $198.00; unf birch $199.00.

4 2-way spkr sys mah $224.00

6 2-way spkr sys mah $250.00

9 wide-range electrostatic mah (pr) $1,030.00

10 2-way spkr sys mah $98.00

**KLIPSCH**

- **5-Way All-Horn Speaker System.** The Klipsch horn employs a folded corner horn base unit with straight-axis midrange and tweeter horns. The bass system delivers one acoustic watt output at 22.7 cps, with a maximum diaphragm motion of 1/16", assuring very little frequency- and amplitude-modulation distortion. The straight-axis midrange unit affords less than 0.0002 dyne per centimeter, and the over range of greatest auditory sensitivity. Natural "twid" for stereo provides a minimum shift of the virtual sound source for different listening positions over a wide listening area. Amplifier power requirement is of the order of less than five watts for 120 db intensity (referred to 0.0002 dyne per centimeter), but the speaker is capable of 25 acoustic watts output at 120 electrical watt input of normal program material. Klipsch and Associates, Inc., Hope, Arkansas.

KLIPSCH and Associates, Inc., Hope, Arkansas. Prices range from $314.00 for the decorator model to $527.00 for the most expensively finished, exotic hardwoods.

Cornwall wide-range spkr sys $311.00-408.00

Model H 3-way spkr sys $188.00-221.00

**KNIGHT**

- **Two-Way Speaker System.** The new Knight KN-264 is a beautifully styled, very shallow enclosure that fits anywhere, offering almost unlimited placement possibilities in your home. The good reproduction of sound is made possible by the use of specially designed components: a 10-in. high-compliance woofer with ¾-in. cone excursion; two 3½-in. direct-radiator tweeters for midrange and a wide-angle precision diaphragm. The enclosure with its components and duct are critically tuned for lowest distortion and uniform response. The matching natural beech grill cloth is acoustically transparent to permit free passage of high frequencies. Frequency range of the KN-264 is 40 cps to 16,000 cps. Built-in crossover network with level control for adjusting high-frequency response. The crossover point is 2000 cps. Power handling capability up to 50 watts of program material. Impedance is 8 ohms, and the over-all size is 13½" x 23½" x 6½". The enclosure is finished in an attractive, oiled walnut veneer. Allied Radio Corporation, 160 N. Western Ave., Chicago 30, Ill. User net price $94.95. Also available in an unfinished, smooth-finished Korina veneer at only $44.95.

**LAFAYETTE**

- 10-in. 3-way speaker. Designed expressly for use with bookshelf enclosures the Lafayette "Trihelix" Model SK-160, incorporates three completely independent speakers with three separate voice coils in a single compact unit. Although they are individual units, the 2-in. tweeter and 5-in. midrange speakers have been especially designed to complement the 10-in. woofer. In addition, the midrange tweeter are completely enclosed by a specially designed baffle. A built-in electrical crossover network with crossover points at 1200 cps and 5000 cps allows each speaker to reproduce its portion of the audio range smoothly and efficiently. Frequency response is 30 cps to 18,000 cps, plus or minus 3 db. Free-air resonance is 35 to 55 cps; impedance is 8 ohms. Power handling capability is 20 watts average program material. Lafayette Radio, 160-68 Liberty Ave., Jamaica 33, N. Y. User net price $92.50. Lafayette also has available a complete line of speakers and enclosures at all price levels.

**MERCURY**

- **Compact Speaker System.** Featuring an acoustically sealed enclosure plus an additional midrange section which permits the speaker to undergo greater excursions, the Mercury Model CM-6 contains a 3-way speaker system specifically designed for its small size. The special compartment (called "Doubleit") accepts the back pressure from the speakers and radiates it in two directions which are 180 deg. out of phase. Speakers are a 1½-in. baffle woofer-midrange and a 4-in. tweeter. Enclosure is executed in genuine walnut veneer. Mercury Electronics Corp., 111 Roosevelt Ave., Mineola, N. Y. User net price, $79.95.

MA-1 "Maestro" 2-way sys $59.50

**AUDIO ● AUGUST, 1961**
20-CYCLE SOUND IS PERFECTLY AUDIBLE

PAT-30X
12-inch Triaxial Speaker With Horn Speakers Arranged For The Medium And Treble Ranges

The PIONEER is proud to offer its latest 12-inch speaker, which it claims to be the world's highest in performance. PAT-30X is a full 3-way speaker with a 12-inch woofer arranged with speakers for medium and treble ranges. For each speakers, a powerful magnetic circuit is provided. The woofer is provided with a minimum resonance frequency entirely out of comparison with existing 12-inch speakers through the adoption of a special design for the edge. Distortion in the bass range, moreover, has been so reduced as to be entirely negligible. One of the outstanding features of this 12-inch speaker is its capacity to reproduce sound as low as that reproduced by a 15-inch speaker. The second feature is the adoption of horn type speakers for reproducing medium and treble ranges. The medium range, in particular, is far more excellent in quality than any of the existing cone speakers, reproducing natural and beautiful sound. The tweeter is capable of reproducing up to 20,000 cps, which is the highest achieved by a horn type speaker. The quality of sound is very clear and sonorous. PAT-30X is provided with a crossover network capable of sharp attenuation, and an attenuator for the medium and treble ranges. These have completely eliminated disturbances near the crossover frequency, and the reproduction over the wide frequency range between 20 cps and 20,000 cps is entirely flat. Sound reproduced with PAT-30X is guaranteed to satisfy you completely.

SPECIFICATIONS
Voice Coil Impedance 16 ohms
Resonance Frequency 20–32 cps
Frequency Range 20–20,000 cps
Power Input 30 watts
Sensitivity 102 db/watt
Total Flux Woofer 233,000 maxwell
Mid-Range Sp. 70,000 maxwell
Tweeter 20,000 maxwell
Flux Density Woofer 10.450 gauss
Mid-Range Sp. 13.200 gauss
Tweeter 12.800 gauss
Weight 24.25 lbs
Crossover Network Parallel Type 3-way
Type
Attenuation 12 db/oct., 18 db/oct.
Crossover Frequency 800 cps, 6,000 cps
Impedance 16 ohms

Well-known for its Pioneer Brand, the Fukuin Electric, Ltd. has now changed its name to the Pioneer Electronic Corporation.

PIONEER ELECTRONIC CORPORATION
5 Otowa cho 6-chome, Bunkyo ku, Tokyo, Japan
MONARCH

- **Bookshelf Speaker System.** The Monarch Model XTS-108 Bookshelf Speaker System employs a foam-suspended woofer which permits exceptionally large voice-coil excursions while maintaining linear response. Frequency range is 25 cps to 18,000 cps. A pair of specially designed cone-type tweeters are also incorporated in a tuned cabinet damped with plastic tubing, thus reducing unwanted resonance. A level control is provided for the tweeters, the cone-handling capacity is 20 watts. Unit is finished on the four sides with Swedish walnut. The cabinet is 23 1/2" x 14" x 11 1/2". Monarch Electronics International, Inc., 7035 Laurel Canyon Blvd., North Hollywood, Calif. User net price is $40.50.

NORELCO

- **Speaker Series.** Illustrated is Model AD-5217M, the most powerful in the new T-7 series of twin-cone speakers manufactured by Philips of The Netherlands, and featuring Ticonal 7, a high-coercivity alloy which provides the highest possible concentration of flux densities in the voice-coil air gap. Weight for weight, Ticonal 7 is said to be about 30 percent more powerful than any of the conventional magnet materials used in speaker construction. Voice-coil impedance of the new T-7 speakers is held constant throughout the entire frequency range by means of a copper ring fitted into the air gap. The ring acts as a shunted turn which induces a current opposite in polarity to that flowing through the voice coil, which reduces that current, thereby lowering the impedance to its proper level. The resonant frequency of the T-7 speakers is very low, resulting in an extremely straight response curve in that region. In addition to the cone for low and middle notes, the speakers are equipped with a high-note cone which extends the upper frequency range. Model AD-5217M is a 12-in. speaker with a frequency range of 35 to 18,000 cps and 20-watt continuous power-handling capacity when properly housed. Cone resonance is 45 cps. High Fidelity Products Division, North American Philips Company, Inc., Hicksville, N. Y. User net price, $59.50.

PACO

- **2-Way Semi-Kit Speaker System.** A compact 2-way speaker system, the Model L-2 kit features a factory-built and finished cabinet crafted of furniture-grade plywood. The integrated system incorporates a special design 11-inch Jensen long-exursion woofer and a horn-loaded compression tweeter. Low-frequency response is extended by a pre-tuned, tube-loaded port. Frequency range is stated at 45 to 14,000 cps. Impedance is 8 ohms. The compact cabinet, 23" x 13" x 12", is available, unfinished or walnut finish. Four Electronics Company, 70-31 84th St., Glendale 27, Long Island, N. Y. User net price, $35.50. Unfinished, $39.50 walnut finish. Li bookshelf spkr sys $24.95

PERMOFLUX

- **"Royal" Speaker Line.** The Permoflux "Royal" speaker line includes 8 and 12-in. speakers in deluxe and standard configurations. The speaker cone in this series is flexible, slotted, and thin at the edge, and coated with a permanently soft and resilient formula which, together with an extra-large, low-resistance suspension at the cone apex gives very high compliance. The stiffened cone apex and special voice coil provides a smooth distribution of high frequencies. The Royal Deluxe 12 (shown) has a frequency range from 50 cps to 12,000 cps, and has a power handling capability of 20 watts. The Royal Standard 12 has a frequency range from 40 cps to 12,000 cps, and has a power rating of 15 watts. The Royal Deluxe 8 has a frequency range from 45 cps to 10,000 cps, with a power handling of 15 watts. The Royal Standard 8 has a frequency range from 50 cps to 12,000 cps with a power handling capability of 15 watts. The Royal Deluxe 6 has a frequency range from 60 cps to 10,000 cps with a power handling capability of 6 watts. All the Royal speakers have an impedance of 8 ohms. Price for the speaker line varies from $10.00 for the Royal Standard 6 up to $32.50 for the Royal Deluxe 12. Permoflux Products Company, 1161 San Fernando Rd., Glendale, Calif.

PILOT

- **2-Way Bookshelf Speaker System.** Completely finished on all four sides the Pilot PSV-4 3-way bookshelf speaker system is a handsome addition to any room. The bass is produced by a 12-in. "Air Flex" heavy-duty woofer which is front mounted in an orlon filled enclosure. Two 3¾-in. cone-type speakers produce the midrange frequencies. The high frequencies are produced by a specially designed super tweeter. This Pilot Bookshelf Speaker System is priced at the pilot PSV-4 3-way bookshelf speaker system is priced at $64.50.

QUAD

- **Full-Range Electrostatic Speaker.** Perhaps the first full-range electrostatic speaker in the world, this speaker may herald the future for the industry. Completely free standing and non-critical as to placement, it radiates

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Audio • August, 1961
The selected Diamond Stylus pickup of the 4-speed Electro-Acoustic 7000 Series stereophonic record player, with its high compliance and extremely low stylus pressure combine to extend record life and maintain the original fidelity of your fine recordings.

The dynamically-balanced 4-pole, 4-coil motor and turntable, micro-honed motor spindle, precisely machined bearings, and the custom-fitted turntable drive ... limit rumble to -40db, wow to less than 0.15% RMS and flutter to 0.06% RMS (better than NARTB standards). Turntable speed is certified to be within ± 1% of absolute.

The Electro-Acoustic 7000 series handles your records more carefully than human hands. It is designed to capture the full beauty of every recording for hundreds of playings. $69.50 Audiophile Net.

Write today for free illustrated literature and the name of your nearest dealer.

ELECTRO-ACOUSTIC PRODUCTS COMPANY
2135 South Bueter Road, Fort Wayne, Indiana
from both sides in a figure-eight pattern which minimizes reflections from the walls and ceiling. Frequency range of the speaker is 45 to 18,000 cps and its impedance is 16 ohms. Dimensions are 31” high, 34” wide, 10” deep at bottom. Manufactured in England, exclusive United States distributor is Leser & Co., 380 City Line Ave., Philadelphia 31, Pa. User net price, $26.95.

RAVENSWOOD

- **Reflection Coupler** Stereo Speaker Sys., den. Utilizing a patented "Reflection coupler" system for achieving stereo spread, the Ravenswood Model M/20 is a complete stereo speaker system in an enclosure measuring only 5" wide x 10" high x 6" deep. Power handling capacity of the system is 15 watts of program material and dispersion is 80 deg. The system contains 3 speakers and the impedance is 16 ohms. Ravenswood Division of Amalgams Electrasonic Corp., 241 West St., Amalgams, Md. User net prices: in oiled walnut enclosure, $199.95; in genuine mahogany or imported teak, $159.95.

**R & A**

- **Conical Speaker Series.** Manufactured by a well-known British speaker manufacturer, the 70-series Mark IV models are a group of high-quality woofer/midrange speakers. Although they vary in fundamental resonance, they all provide smooth frequency response up to 18,000 cps. All feature Alconix III Anisotropic magnet systems with a flux density of 12,000 gauss (10,000 gauss in 5-in. unit). The moment assembly is easily remova- ble without demagnetization and has zero external field. Power handling capacity is 10.

**RICH**

- **Three-way Speaker System.** A completely new type of unit which embodies three different and unique transducers; the newly Rich speaker system to the particular acoustic environment and room setting. The speakers have been designed to be used with amplifiers of modest power. H. H. Scott, Inc., Dept. P, 3H, Poston Mill Road, Wayward, Mass. User net price in standard finish: Model N-2 $159.95; Model N-3 $199.95.

**STENTORIAN**

- **10-inch Extended-Range Speaker.** Excellent performance is the key feature in this high-fidelity speaker manufactured by Whitley Electrical Radio Company in England. The model HF1214 has a frequency range of 25 to 14,000 cps with a cone resonance of 30 cps. The 11-inch diameter voice coil is driven by a 54° round Alconix magnet structure with a flux density of 14,000 gauss. Power handling capacity is 15 watts and voice-coil impedance is 16 ohms. The patented Stentorian camber cone is used, and the speaker is mounted on an unusually sturdy die-cast, non-resonant base.

20, 25, and 30 watts respectively for Model 750 (4”), Model 880 (8”), Model T1400 (10”), and Model T120 (12”) speakers. Voice-coil Impedance is 8 ohms for all models. Distributed in the United States by Frenum Corporation, 19 W, 48th St., New York 2, N. Y. User net price. Model 750 $99.50, Model 880 $129.50, Model T1400 $169.50, Model T120 $189.55.

**REALISTIC**

- **Electrostat-2 Full-Range Speaker System.** Featuring a 4-ohm electrostatic tweeter, the new Electrostat-2 introduced by Radio Shack of Boston is intended to provide good sound quality at a reasonable price. The highs in this full-range system, as previously indicated, are handled by a 4-element electrostatic tweeter which is placed so that a 120-degree dispersion is achieved. The lows are handled by an 8-inch woofer. Crossover frequency is 7500 cps and level attenuator is included to permit sensitive balance of the highs. An ON/OFF switch is provided to control the electrostatic element. Frequency range is stated as 30 to 25,000 cps for the system. Power handling capacity is 50 watts.

**H. H. SCOTT**

- **New Loudspeaker Systems.** Utilizing a fresh approach to crossover network design, the new H. H. Scott loudspeaker systems, the S-2 and S-3, are the culmination of years of experience. The S-2 consists of a low-frequency woofer, a midrange unit, and a super tweeter. The slightly larger S-3 contains a high-compliance woofer of low resonance, two dual-cone midrange speakers, and a special spherical tweeter. Continuous midrange and tweeter controls permit fine adjustment of frequency.

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**AUDIO • AUGUST, 1961**
WE CHALLENGE COMPARISON REGARDLESS OF PRICE OR SIZE

Here, at A. E. S. we have made comparison tests with every bookshelf speaker system available to us, and found the Gigolo II to be by far the most outstanding performer. In the words of our Engineering Department, quote: "This system cannot be improved upon."

These are the facts:

To explain these technical specifications to the average layman, in language that can be easily understood, all these figures and curves show that the Gigolo II is more properly suited for use in some type of professional application, where large surges of power and extreme frequency reproduction would be needed, rather than for use in the home.

But, for those people who feel they must impress their audiophile friends by having the most outstanding performing system in their group, or the type of person who wants to have that certain feeling of psychological satisfaction which comes with owning that special piece of audio equipment, we offer the Gigolo II, so you may compare and prove this to yourself, or it may be returned on our purchase price money back guarantee.

DESCRIPTION:
The A. E. S. GIGOLO II incorporates a newly developed 10" free edge woofer, a 3" hard cone tweeter, and an electronic cross-over. The enclosure is made of the finest 3/4" select natural birch. The baffle is of the pneumatic loaded design. The outside dimensions are: 24" long, 13½" high, 12" deep. Our grille cloth is supplied by one of the country's largest manufacturers of acoustic grille material. Your Gigolo II, comes to you completely assembled, sanded, ready for finishing in either blond, walnut, mahogany, cherry or ebony. All units sold on 100% MONEY BACK GUARANTEE.

Price $49.50 Unfinished, F.O.B. Factory

SPECIFICATIONS:
Frequency response 29-16000 cps ± 8 db
Harmonic distortion less than 2% 50-15000 cos
Impedance curve within -0% +100% of 8 OHMS
Intermodulation distortion Negligible
Free air resonance 35 cos
Recommended power 15-60 watts

Following test equipment was used to determine the above specifications:
Hewlit Packard distortion analyser
General Radio response curve recorder
Tektronix Oscilloscope
Response curve run at continuous 25 Watt input.

A. E. S. Inc.
3338 Payne Ave., Cleveland 14, Ohio

Gentlemen please ship Gigolo II $49.50 Each I understand these units are guaranteed and if I am not satisfied I may return for a full purchase price refund.

Name
Address
City and State
Enclosed find check money order

AmericanRadioHistory.Com
STEPHENS

**Free-Cone Full-Range Speaker.** Although only 8-in. in diameter, the Stephens 80FII achieves big speaker response. An exclusive internal air damping system provides control cushioning to eliminate breakup at extremely high levels. Impedance is 16 ohms (8 ohms optional). Frequency range is 40 cps to 15,000 cps. Free air resonance is 50 cps. Power handling capabilities are 25 watts of program material, and the voice coil is 2-in. edge-wound aluminum ribbon. Stephens Trumatic, Inc., 8438 Warner Irene, Culver City, Calif. User net price $33.50.

120F 12-in. wide range speaker $60.00
150F 15-in. wide range speaker $87.00
150 CX 15-in. coaxial $92.50
ST102 "Stereo Dot" w tweeters 249.50
RT-1 tweeter 26.50

TANNONY

**Compact Speaker System.** In keeping with the modern trend towards decreased size, the new Tannoy "Cabinet" is a mere 11 x 13½ x 2½ inches in size. Of course the small size is not an indication of performance: within its 1½-cubic-foot volume is contained a 10-in. Tannoy dual-cone coaxial loudspeaker which was designed specifically for an enclosure of this volume. In common with the other Tannoy dual-cones, this speaker incorporates two completely separate loudspeakers: a horn-loaded high-frequency unit and direct-radiator low-frequency unit. The low-frequency unit has an encircling cone, plastic-terminated surround, and the whole unit is suspended by means of an acoustically transparent center-dome and rear suspension. Although not claimed to have all the "bravv" of its 15-in. big brothers, this speaker will provide the extended range coupled with low harmonic distortion for which its elders are already well known. Power handling capability is 20 watts and impedance is 16 ohms. The Cabinet is available in oiled walnut at $145.00, Tannoy (America) Limited, P. O. Box 177, East Norwich, L. I., N. Y.

Daltor w. 12-in. dual conc $213.00
Belvedere w. 12-in. dual conc $203.00
"GRF" w. 15-in. dual conc $725.00
15-in. dual conc. w. x-over $179.00
12-in. dual conc. w. x-over $138.00
10-in. dual conc. w. x-over 112.75

UNIVERSITY

**3-Way Speaker System.** Intended as a bridge between the large speaker systems of the past and the compact of the present, the University Classic II is a 3-way speaker system capable of "big" sound. The system includes a high-compliance 15-in. woofer featuring rigid diaphragm and extremely compliant, soft surround and a massive die-cast frame. Midrange is handled by an 8-in. direct radiator which features a completely enclosed basket, thus protecting it from the effects of woofer-generated pressures inside the cabinet. The tweeter is the well-known University "Sphericon" super tweeter. Frequency range is from 20 cps to 40,000 cps. The Classic II may be used with any high-quality amplifier rated from 10 watts to 60 watts. University Loudspeakers, Inc., 80 E. Kenisco Ave., White Plains, N. Y. User net price $295.00.

Medallion XII 3-way sys. mah $139.95
RRL-12 12-in. 3-speaker sys mah 119.95
TMS-2 stereo sys. mah 258.00
Series 200 high-comp. spkr (8-15 in.) 28.00-156.00
Series 100 wide-range spkr (8-15 in.) 16.95-83.00

UTAH

**Bookshelf Speaker System.** The Utah bookshelf speaker system, SLI-1, is only 10" x 10" x 2½" and 5½ in. plywood is used throughout. The system is fiberglass lined if necessary. Bass is reinforced by tuned, ducted reflex ports which have been adjusted to complement the response curve of the 8-in. woofer. The 3½-in. woofer-midrange speaker handles frequencies from 38 cps to 4,000 cps. The 2½" x ¾" tweeter handles frequencies up to 17,500 cps. The power handling capabilities are 18 watts. Impedance of the system is 8 ohms. Available in walnut, mahogany or blond finishes. Utah Electronics Corp., 651 E 1700 S, Salt Lake City, Utah. User net price $95.00.

VITAVOX

**Conical Speaker.** The Vitavox DU120 coaxial loudspeaker provides full-range reproduction, and incorporates mechanically and electrically independent low- and high-frequency units. Both units are of the direct-radiator, moving-coil type, permitting a broad crossover and are chosen because of their reliability. The magnets used in the DU120 utilize high-efficiency magnet materials, and are designed to give optimum performance with price as a secondary consideration. The magnet in the low-frequency unit is of the ring type, and provides a constant field throughout the maximum excursion of the voice coil; thus eliminating nonlinear distortion. The high-frequency unit uses a center pole magnet because the cone movement is extremely small. Frequency range is from 30 cps to 15,000 cps. Crossover frequency is 2000 cps. Vitavox Corp., Randolph St., Norwalk, Conn. User net price $45.00.

WEATHERS

**Triphonic Stereo System.** An unusual approach to stereo speaker design, the Weather Triphonic stereo speaker system consists of the non-directional Hideaway bass and a pair of Harmony stereo speakers. No bigger than an unhandbook dictionary (11 x 15½ x 5½ inches) the Harmony speakers are a stated frequency range from 70 to 15,000 cps and have a power-handling capacity of 3 watts. The speaker is a full-range moving-coil type with an impedance of 4 ohms. The Hideaway (continued on page 32)
Which cable has the Beldfoil*?

Both shielded cables have the same number of twisted pairs with identical AWG. But... the cable with exclusive Belden BELDFOIL is smaller in diameter.

What does this mean to you? It means that when you specify BELDFOIL, you are really buying extra space—extra conduit space, extra raceway space, extra console and rack space.

A new development by Belden—BELDFOIL shielding is 100% effective. It is a major development in quiet cables. BELDFOIL eliminates crosstalk and is superior for stationary or limited flexing at both audio and radio frequencies.

BELDFOIL shielding is a lamination of aluminum foil with Mylar which provides a high dielectric strength insulation that is lighter in weight, requires less space, and is usually lower in cost. For multiple-paired cables, with each pair separately shielded, the Mylar is applied outside with an inward folded edge.** This gives 100% isolation between shields and adjacent pairs.

For complete specifications, ask your Belden electronics jobber.

**Patent applied for

Belden
WIREDMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

Power supply cords • cord sets and portable cordage • electrical household cords • magnet wire • lead wire • automotive wire and cable • aircraft wires • welding cable

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AUDIO • AUGUST, 1961
Folk
Carolyn Hester.

 Tradition TLP 1043
We have a Texas gal, here, who has entertained the world in the most individual manner, out of the city via records and night clubs. She's far removed from what folk song once was in the good old times, but these gals (and boys) carry a big wallop and much appeal to the hearts of young adults today.

I'd say Carolyn is lucky to have a fine musical ear and an interesting voice, strangely thin and bright in its upper register, ranging down into an unexpected Odessa-like throatiness at the bottom. She's a good scheduler. With such a voice and ear her singing can't go far wrong. But she still hasn't made up her mind where to settle down in folk-song styling. She hasn't heard enough.

The voice is always musical but the guitar accompaniments tend towards the amateurish, with awkwardly placed chords and a poor choice of them. She doesn't know what to do with the modal tunes—tunes which have found superb harmonizations plenty often enough. Hers are uncomfortably gauche.

She needs to hear what others have done and to learn from them. If she can.

Remember that these new folk singers are "third generation"; they learn their music mostly from people who in turn learned theirs from the actual "original" folk singers—people who picked up their music just naturally, from their daddies and uncles, and cousins in some smallish community. Work songs were sung to work, to coal-mining days, and grew in coal mines and railroad songs were heard on the railroad.

Pete Seeger, Alan Lomax, Frank Warner, even Jean Ritchie, are "second generation," folk-song collectors who have got their stuff direct from these. The young people mostly learn indirectly, from them in turn, via records and an occasional "live" session; or they dig out tunes from printed collections like the Cecil Sharp material published in the early part of this Century.

Yes, each generation, each of the individuals, adds his own touch and feeling. But today's young people must decide arbitrarily where to choose, at a complete distance, out of the huge wealth and variety of folk material now audible. Will it be the prison yards of the U.S. south, or t'other Irish sea? Not easy to know, especially when your livelihood is going to come from the very un-folkly night club circuit. This is Carolyn Hester's problem and she's done' fine, so far, with a long way to go.

The Clancy Bros. & Tommy Makem.

 Tradition TLP 1042
I Am the Wee Falerie Man. David Hammond.

 Tradition TLP 1028
Songs of Tommy Makem.

 Tradition TLP 1044
The folkish label of Tradition Records was inspired by an American gal, Dian Hamilton, *780 Greenwich St., New York 14, N. Y.

Duophonic—Spread-out Mono


Capitol Duophonic DGC 7127 (3)
Following upon RCA's painstakingly careful reconstruction of a group of Toscanini records into simulated stereo, Capitol launches here a similar but evidently simpler operation, applied to a wide range of cuts from Hugo Goodmann to these Haydn Symphonies. The "Duophonic" disc play only on stereo machines, not on mono.

Again—It works. Indeed, I have nothing but praise for the wise limitations in the "treatment" of both classical and pops selections. Not studied effects, no fake sounds, indeed nothing that is consciously strange at all. Just a real stereo-like hall liveness, a wide spread and only a moderate amount of directionality, helpful by its very unobtrusiveness.

The big point here is that instead of looking for stereo superfluities—sensational "on-the-right" and "on-the-left" trickery—Capitol has gone straight to the heart of the mono inadequacy as heard via stereo reproducing systems, the forced busheling of the mono sound into a blob in the middle, between the speakers. (Actually, the sound is heard from a sharp point, as with a speaking voice; but the imagination can't take this and is able to widen it into a "bloch"—though not nearly wide enough.)

The fact is that mono records sound better on single-channel systems, where a natural mono spread is achieved by reflection and spatial illusion of the sound. The stereo speakers force the mono sound into the middle, pinch it together, and the better the stereo setup, the worse is the mono pinch.

Therefore Capitol has concentrated simply on spread—on enough unphased, differentiated sound-pairings to provide a difference signal of sufficient impact, especially in the reverberation, to pull the music out sidewise into the equivalent of the stereo spread. I don't know the method (though I suspect a good deal of trickery—added reverber) but I do know that the thing works like a charm. Sir Thomas Beecham did the first set of these Symphonies in mono only, then the second in stereo; he died before he could do over the first, and now have no hesitation in applauding this Duophonic Vol. 1 to the point of acclaiming Vol. 2.

And try the other Duophonic tales—I really enjoyed the vintage Benny Goodman, spread out and modernized to whistle-cleanliness of sound.

and is managed by the Clancy family of actors and singers; the company has naturally specialized in popular Irish fare sung by the Clancy clan and their friends imported from the old country, mostly of a youthful sort. The material is largely forthright and popular, not the fancy folk music the collectors dig up in obscure rural retreats but simply the songs that are popular here and there, done up with zest and a proper brogue, accompanied by the now-invisible guitars (not so special here), occasionally by fiddles and drums and such (much more lively)

The Clancy tribe plus friend Makem have lately broken into big stuff but (match) remain on their own "home" label too. Roheterous and good bouncer, they have the punch and fineness to hit TV and stable spots without essentially compromising their own way of doing things. Good, loud, lusty stuff for the most part, but unfailingly musical (and in tune).

On his own, Tommy Makem shows himself as a young promotor of masculine strength in singing. He's solid and matter of fact in rhythm, tough in diction—should learn his "doodling" of nonsense Irish syllables and his baritone voice has the edge of a sharp-cutting axe. He belts it out, to solid guitar background, and no hi-falutin' nonsense about voice production and vocal culture; he is OK just as it is. You wouldn't believe he was primarily an actor, are the Clancy brothers too. Acting needs strong music and a mind for realism if you're Irish.

An almost unnoticed oddity may strike you in passing; in some of his songs, Tommy Makem accompanies himself on a penny whistle. Just try that some morning when you are feeling in the shower, being careful not to choose to death. Quite a trucx and I had this thrill of personal discovery.

A newer addition to the tribe, here in the U.S., is David Hammond. He sings by himself in an arresting manner, by his white-shirt, his sincere; he goes in for frequent hesitations and some of the surrealistic sentimentalism. He's a Belfast lad, out of Northern Ireland, and a few of his items have a Scots touch to them. Compared to Makem, Hammond is a bit weak-tea-ish, for my taste.


Period SPL 751
So the countertenor hits the folk music trail! Not that he hasn't before, what with Alfred Deller singing assorted folk songs for Vanguard. But the name itself, for a very high alto-range male voice, properly goes with "classical" music of the Anglican church and in much secular music of the British Seventeenth century—Henry Purcell was himself a countertenor.

The countertenor is now a find of considerable proportions in "Baroque" music circles. Good idea, for the voice will survive all faddisms. That it should go over to other areas of production is inevitable. But, as I say, if this man were really a folk singer, he probably wouldn't have ever heard the term. He isn't, of course. He's primarily classical, in fact Purcell, Carl Orff and even much modern music for high tenor. This is a side-line.

These are thus "classical" arrangements of many old familiar ballads—Waly, Waly, The Spanish Gail, Greenmanes, Barbara Allen, Poor Wayfarving Stranger. The guitar is more
SOUND EFFECTS, Vol. 2
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DFM 3010/DFS 7010

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a lute in style, the flute plays pretty counter-melodies against the tune. Aside from the odd neighboring quality inherent in most counter-tenor singing, you'll find it all pleasingly straightforward and pleasantly old fashioned in a classical sort of way.

Exotic and Circular

Classical Indian Music.Introduced by Yehudi Menuhin. London CS 6213 stereo

No one giving the names of the three distinguished Indian musicians who play the Veena (2) and the Mrdangam through most of the tracks, I do indeed look at an exotic music. You wouldn't know them. The well-known Western same ardent doesn't play a note: he talks, and at length, on a full orchestral side, not to mention shorter introductions to three different works on side 2. Yehudi Menuhin has talked before about Indian music in a recording of this same type, but not if I remember, at such length as this.

Frankly, though I am for the noble sentiments he expresses concerning the music of other peoples, I found his speech rather full of flowery generalities and, paradoxically, technical matters not adequately explained. There is, for instance, much talk of the improvisatory nature of this ancient musical tradition, of how the musical “variations” are made up within a very rigidly stylized framework—then without an eye batted, the first piece is introduced as a well-known Nineteenth century composer and not a word as to whether he “improvised” it, say on January 23, 1847, or is it being improvised now, according to the composer’s never-written-down ideas. Menuhin doesn’t tell us.

Indian scales or modes are played and described (which is good) but the relationship of the scales to the music might as well be made clear while the moment is propitious: and such obvious obviously notegs of the mode as the sliding-pitch notes, starting on-place and zooming up or down to another, or the assorted trills and other ornamentation, could at least be mentioned in passing. I emphasize this because Menuhin is here writing quite sincerely the role of a musician. Like many performers, his imagination does not go out well into words, he is at a loss to offer rational explanations for listening people, he takes things for granted which a more imaginative outlook he would surely attempt to explain, as well as he could. Like many big musicians, he takes refuge in a sort of doctrinaire, academic sort of discussion—and of all places, the doctrinaire approach is most at a loss in getting at the meaning of this exotic and exciting oriental mode!

It seems to me that more music and a lot less Menuhin would be preferable on the record itself. He does not in any case speak “to” the home listener, but reads his manuscript as though making a formal platform speech, while a more direct style in recorded effecitenua.

The music? Well, don’t expect me to have much to say about it either, I enjoy it. I begin to have a vague sense of its shape and progress, but I do not “understand” it any more than you will, until you have heard many hours more than I have present.

It is enough to say that this Eastern music has no real beginning or ending but does definitely build up in both complexity and intensity, very gradually over minutes and even hours. It is a psychosocial buildup, only in the increasing speeds and greater complexity but in the persistent monotony. Without reference to the key tones that keep recurring with a head-drilling force.

Tinny stringed instruments and assorted percussion are featured here by the three performers. They sound like a dozen.


Capitol SG 7244 stereo*

I’m supposed to act naeek after hearing this new stereo sensation. I’m not. I didn’t feel a thing. Though I enjoyed the music.

The brilliant idea of someone with a very limited imagination was to reproduce in stereo the circular whir of a merry-go-round.

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AUGUST, 1961
"Third Concerto," Bartok's last work. And from that you can travel with zest into the extraordinary sounds of the "Second," which dates from the early 1900's and rates with such incredibly potent pieces as the "Music for Two Pianos and Percussion" (1937), or "Music for Strings, Percussion and Celesta" (1935).

It just isn't possible to convey an impression in so many words of the "Second Concerto," but it is an overwhelming experience if you are ready for it. That peculiarly great quality of humanity in Bartok, shining through the wildest dissonance, the "sound of genius" in every bit of the marvelous construction, the ineffable spirit of Bach and Beethoven that shapes the modernity of the sound, these things hit you more and more as you delve into this man's mature middle-period and late-period work.

This Hungarian team (with a German orchestra) does a most interesting job with the music. Interpretation of works like these is still fluid; no binding traditions have as yet been solidly established. New ways of expression appear at each recording—Anda does particularly successful things in the difficult and atmospheric slow movement of the "Second Concerto," with its strange, subterranean trills, half-suppressed glints of high voltage thought. He is excellent, too, in the gentler and less dissonant "Third Concerto," and his orchestral backing is superb throughout.


Columbia MS 6216 stereo (mono: ML 5616)

When he conducts other types of music

Robert Craft is a pretty chilly intellectual, but in the music of the original Viennese "twelve-tone" school and in many another more recent product in related fields, suddenly he has a way with the material. "Course, it could just be that these musicians play well and convincingly by the way they deliver the dynamic leadership of a very learned conductor here. He's good.

In a considerable sense this series (there are others previous) is a historical survey of the quality music within the serial (twelve-tone) movement, as well as a recording of the masterpieces in that area. It's astonishing how much these men are already around in works dating back to 1906; the rest of the musical world has had to catch up to them in that respect, not to mention us listeners. It won't do your ear any harm at all to give this disc a once-over and a twice-over, and the sounds, however meaningless you may at first think them, will be bound to interest you as other instrumental color and texture. Don't worry about those Twelve Tones; Just Listen.

Hindemith: Oboe Sonata (1938).

Columbia ML 5603 mono

When a big musician dies, these days, they rush to dig out all the old tapes he left lying around and publish them on discs before his memory begins to fade.

Mitropoulos was a fine pianist and an ever-eager searcher into odd but important corners of recent musical history. I once saw him positively glowing with pleasure as he conducted Stravinsky's "Histoire du Soldat" in a tiny chamber-style performance, chatting casually with the players between scenes as if in the nice tradition in that work. His name turns up in surprising places, on small labels, in obscure situations, all for the sheer love of music.

It's the piano here, in a middle-period oboe piece of typical Hindemith expertise and in two remarkable and unheard works of a dated period by one of our earliest real composers. Charles Martin Loeffler. Loeffler was born in Alaska but became a long-time Bostonian, for 54 years indeed. By today's taste, his music is thick and old-fashioned, a style that is now at bottom repie (pretty soon it'll) come back, like Edwardian clothes. Nevertheless, there's a lush, fresh sound about it that wears well. He was a good musician and composer, as Mitropoulos knew.


Columbia MS 6213 stereo (mono: ML 5613)

Columbia has put out some stunning photographic cover art recently. The jacket photo on this one tells as much about the performance as the playing itself—a pleasantly social get-together of five smiling wind players with Poulenec seated in the near foreground. Excellent. And it should sell the record.

Actually, I found that the Poulenec piece, with Poulenec playing the piano, was the least interesting item on the disc, which abounds largely because of the skillful and entertaining Milhaud piece. These three composers, of varying ages, all belong within the once-modern anti-German Post-War I school of French snazzy satire (or did, in the 1930's), music that is deliberately small-scaled, unbrolic, low-brow but, as French art, carefully tailored and happily written. The Poulenec is just plain too low-brow, self-consciously, at the expense of stylistic consistency, whereas the Milhaud is a far less selfconscious and much better integrated work, absolutely charming in its expertly French woodwind expression. The Inter Francais is a kind of afterthought (the straight younger man in the same style, now much more mellow and very nearly a French dead end. But it hums along pleasantly, so. Gorgously transparent, playing throughout, and even better recorded sound.

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**More Classics**

**Beethoven: Violin Sonata No. 9 ("Kreutzer"); No. 1, Francescatti, Casadesus.**

Columbia MS 6125 stereo

**Beethoven: Violin Sonata No. 9 ("Kreutzer"); No. 5 ("Spring"); Szeryng, Rubinstein.**

**RCA Victor LSC 2377 stereo**

These two rival discs came out a while back and I have just got around to a detailed comparison of the common element, the "Kreutzer" Sonata, Opus 47.

For my ear: Rubinstein and Szeryng win hands down, though Columbia's French team is far from second rate nor yet again incompetent. There is, admittedly, a French approach to Beethoven that predicates a certain anti-Teutonic love for the composer, altering those Beethovenian aspects that are most Germanic in favor of a more French aesthetic. The breadth and grandness of German architecture are conferred—as far as is possible—into a more precise and delicate tracery. And when Beethoven obstinately gets out of hand, into powerful contrasts or complex development, the French become frastic, hard, as if to hasten the music's submission to the French ideal. Still, the best French Beethoven is generally lovely, picking up as much as it loses, for an over-all excellence.

Francescatti and Casadesus are an eager team by all accounts but in this demanding sonata Francescatti is tired and out of tune, lacking breadth and emotional control, while Casadesus pounds the daylight out of the loud parts without achieving either grandness of line or convincing musical shape. Columbia concurs with a dry, rather dead pickup and a low recorded level.

Rubinstein and Szeryng, both Polish born, are top Central European pianists and close to the German tradition. Rubinstein is a master of the very architecture that Casadesus dislikes. Szeryng is a somewhat old-fashioned and Romantic fiddler whose style complements Rubinstein's most eloquently. And RCA has given this pair a bigger, more resonant recording, at a higher level, to fit the musical drama.

**Debussy and Fauré Sonatas. (Debussy: Sonata No. 3 in G Minor; Fauré: Sonata No. 1 in A.) Berl Senofsky, violin, Gary Graffman, piano.**

**RCA Victor LSC 2488 stereo**

This is just plain a lovely record, if not exactly a sensational one. Listening to it, I somehow kept imagining the whole enormous, haughty RCA Victor colossus here brought to a benign halt, waiting quietly for these unassumingly excellent young musicians to finish their music-making—like some fabled emperor who stops to chat with the citizens while his minstrel stands by! Silly idea, perhaps, but in a way that is what RCA does here. Even the program notes by Joseph Wechsberg are casually informal.

"I asked the artists why they were recording there. Because we like the sound of this hall," said Senofsky.

He stood beside the piano in his stocking feet, having taken off his creaking shoes.


"So maybe Debussy would have liked Webster Hall after all."

"Let's do it once more," said Graffman."

And so they did, unto the sixth and the seventh take, while RCA stood around paying for tape and technical assistance by the hour, with not even a murmur of official protest. This is the way recording should always be done. It's a shame that smaller companies aren't more often subsidized in order to offer exactly this sort of leisure to all recording artists worth hearing.

The big Fauré sonata is in high French Romanticism, at length and out of César Franck, a type of music that too quickly becomes dated and dull under today's usual high-pressure treatment. Not here. Graffman is a wonderfully energetic sort of relaxed pianist, an old fashioned poet of the instrument; Senofsky...
sky plays a sweet, gentle fiddle, never florid, modestly unassuming when the piano is in the forefront (ah! for more of that among big fiddlers!), rather nervously tense in expression at just the right moments of climax. I don’t think I’ve ever enjoyed Fauré as easily on records.

The short Debussy sonata is almost an afterthought, a part of side 2. A quietly excellent performance, relatively less outstanding than the Fauré—but, after all, the Debussy sonata gets some pretty fancy performances elsewhere.

Give credit to RCA, also, for a perfectly balanced recording, exactly right for the musical sense, with an optimum piano sound and an ideal fiddle pickup, light and wholly natural.


Columbia MS 6236 stereo (mono ML 5636)

These Marlboro Music Festival records, taken down at the Vermont summer “school” directed by Rudolph Serkin, offer a strange and interesting sort of music-making. As Serkin says, “we are a republic of equals”; and in these recordings you will hear top professional artists mingling with top student performers, most democratically. A wonderful experience for the students.

But, I’d suggest, not always so wonderful for us. True, the student performers are inspired and the general “tone” is impeccably good; these are not bungling beginners. But for all the republic of equals, the plain fact is that Serkin is one thing (and Fleischer, Singer, Harold Wright), the rest are something not quite the same.

They try earnestly and do well, but they are still in that formative, imitative stage that shows up with relentless persistence in the repetitions of a recorded performance—though perhaps not in the generally inspired enthusiasm of a festival.

Thus in the Brahms “Liebeslieder” the two pianists Serkin and Fleisher (one piano four hands) are so astonishingly wonderful that it is a pity the mixed quartet of singers is in comparison merely more than adequate. In spite of Martial Singer (of the French tradition and not exactly a Brahms man), the leadership and the urgency is all in the piano. The piano part has never been played with such easy, authoritative, unbuttoned precision!

The soprano, Benita Valente, has a lovely young voice of unusual accuracy. Her sense of style isn’t really well enough developed yet to cope with the Brahms (in company with other three voices, as that) but in the long solo Schubert work, an extended song with clarinet obbligato, she does quite an extraordinary job, rolling off the high-speed yodel-style trills and runs as few singers can now do. She is again outclassed, however, by that veteran of piano music-making, Rudolph Serkin, and by one of the most lovely clarinet performances I hope ever to hear, from Harold Wright.

Altogether, a pretty fine record, students or no.


RCA Victor LSC 6094 (2) stereo

The usual orchestral suite “Iberia” is an arrangement of five out of 12 pieces originally for piano, done by Albeniz’s friend Arbós many years ago. 5:12 is a good average proportion for dozens and dozens of such “suites” that have been made up for concert use out of longer works during the last seventy years or so; now the trend is strongly in reverse and back we go, again and again, to the full-length works. Now it’s the whole of “Fire Bird”, the complete “Daphnis”, all twenty four movements of the Handel “Water Music”. And so it is that the contemporary Spaniard Carlos Surinach was commissioned to fill...
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out of the whole of "Iberia", seven more movements. This is the resulting complete version—and it is pretty darned good if you ask me. The stuff is too thick, too lush, too ripe for such heavy-orchestral treatment. It fails after three or four movements in a row, and twelve of these—more than three LP sides—is really too much at a time.

In spite of a worthy desire to emulate the earlier Arbois orchestrations, Surinach has turned out a quite different sound in the movements that are his. Much more modern in tone (even though based on the same Albeniz), oddly Latin-American in sound—more precisely, Mexican; I kept thinking of Chaves.

Surinach puts a contemporary emphasis on brass and winds, where Arbois stuck to the lush string-based sound of Albeniz’ own day, 1909. In the Surinach movements you hear the chatty trumpets, the great horns, the arsetic rhythms, of middle Strainski. And some of the harmonies sound mighty like Surinach’s own, though it could be a modern emphasis on inner dissonance technically already present in the 1909 originals. All of which is highly anachronistic, but generally good to listen to even so. After all, it’s 1901 and Surinach isn’t living in 1909.

The French Conservatory Orchestra is most uneven in its playing, some of which is well below RCA standards. French orchestras are notoriously temperamental; either this one is insufficiently rehearsed in the Albeniz (they play the Ravel practically by heart) or else it is just plain acting sloppy, especially in the strings. Messy timing, hurried outbursts, stilted pitch. RCA had better tighten up its remote-control discipline.

Bach

London CS 6197 stereo

This man is so fantastically good that I devoted three successive radio programs to his recording. And this even though in some respects his earlier 10-inch mono record for London (around 1955) was even better musically.

For the initiated, let’s say that in a very masculine way he conveys the Landowska tradition. He is a romantic-minded "big" harpsichordist, a master of dramatic registration and phrasing. He makes the instrument "talk" as though it were a piano, or better an orchestra. We’d best not yet say he is Landowska’s successor; but he surely is one of the great harpsichordists of our time and unique in his skilful romantic-dramatic approach.

The uninitiated will find this harpsichord music fully as exciting as anything by a Bach orchestra; for the kind of legerdemain that Malcolm plays with his pedals, his registrations, his tone colors, his rhythms and phrasings, is the sort that hits you direct in the musical emotions.

Remember only that the harpsichord gets its big sound by tone coloring and doublings of octaves, not through sheer volume; keep your volume control turned well down from maximum and let the instrument’s proper lightness speak for itself.

David Oistrakh Plays Bach Sonatas (Vi- olin and Keyboard Sonatas in F Minor, G Major). With Hans Pischner, harpsichord.

Deutsche Gramm. 138677 stereo

Even the great Russian, the "Oyster", has come around to the harpsichord for these big Bach sonatas (instead of the piano), thereby joining the "authentic" camp straight out of a career of typically Russian old-fashioned Romanticism. He still sounds old-fashioned Romantic himself, but this is a big russian and a careful one; the purists of purists will have to admit he does a pretty fine job; and his German colleague at the keyboard is an excellent instrumentalist. Moreover, though this was presumably a special-occasion recording taken while the Russian was on concert tour, there is every evidence that the two players worked over the music together to achieve a reasonable balance of forces and a common interpretation.

Oistrakh even takes the trouble to play the

This pleasant recording by an earnest and well-rehearsed team offers one of those commonly-made "compromise" ensembles that pop up today, between musical friends and within record-company contracts-areas-part authentic, part old-fashioned non-authentic. Authenticity, I might point out, has very little to do with musicianship and so it often happens that two excellent musicians team up for an interesting performance and, as the phrase goes, do the stylistic torpedos.

Well, these two Pros give a very interesting performance, if not one of top inspiration. Mr. Greenhouse is no great gamba player-he doesn't even bother to try, but plays the sonatas on the similar instrument, the cello. (Sibylar but not at all the same, and Bach was exactly specific when he called for one or the other or, as with the cross-bowed flute versus the end-blown recorder, the oboe versus the lighter-toned oboe or the heavier-toned English horn.)

This is gamba mode played on a cello and by analogy we might expect the harpsichord part to be played on a piano, also a "similar" instrument - but Sylvia Marlowe just happens to be a harpsichordist, so that is that. So great matter, I guess. Maybe there wasn't a good gamba player available, or maybe Miss Marlowe just likes to play with Mr. Greenhouse, good enough reason.

(Rhat it would be nice to hear the mode on its original instrument - well played.)

Bach: Cantatas No. 198, Trauer Ode; No. 131, Aus der Tiefe. Soloists, American Concert Choir, Columbia Symphony, Robert Craft. Columbia MS 6177 stereo

The ubiquitous Robert Craft moves into big Bach in these two splendid cantatas. Much in the performance is lovely. But there is also that dogmatism rigidity which Mr. Craft brings to contemporary music - a great deal more successfully than to that of earlier periods. There is also the hallmark of up-to-date old-music playing, an increasing emphasis on authenticity—lutes, gambois, violins, double-dotted rhythms ("French dotted"), exactly correct ornaments.

The "Trauer ode" is a major work, much more than a minor, but it has been heard. Even in this frequently rigid and inpatient performance the gorgeous expression, the glowing vocal and instrumental colors, come through - crazy to have neglected such a work, indeed. "Aus der Tiefe" (out of the depths I try to Think) is a very early work - which means merely that it is free in form, youthful in intensity, broken up into

(Continued on page 96)
Popular disk jockeys often protest against being restricted to playing hits in the top forty, but few do anything more about it than become program directors or station managers. One of the exceptions is Alan Grant, a former Jazz musician who insists on making his own music and believes the methods used to establish his jazz show on WLIR-FM will work in other parts of the country. Stereo already plays an important part in attracting new listeners to his programs, and plans are underway to begin FM-Stereo broadcasts.

Rather than just sit playing records in the station's Garden City studios, Grant goes out to perform at nearby clubs. When he returns to WLIR-FM, his audience increases to several thousand. Stereo brings in more new listeners to his programs, and plans are underway to begin FM-Stereo broadcasts.

During intermissions at both places, Grant introduces the live audiences to the latest jazz releases, in stereo, which give listeners a first-hand introduction to the newest components. Stereo adds a long-term basis for a generous sponsor. Queries about the equipment from any interested parties are answered, and Grant issues frequent invitations over the air, in a rich baritone voice, urging home audiences to come down and hear a demonstration.

"If more disk jockeys did this sort of thing," claims Grant, "they would put more live music on the air and find their work more enjoyable. Their shows would attract a more mature audience, including those young adults who are now the top forty tunes as the disk jockeys. Better shows will attract a better class of sponsor, but first they must be heard by the audience, which can be reached. Some of my clients never used radio before.

Grant is quick to credit Eloise Smith of "Copa City," along with John Avinzo of "San Su San," for having the foresight to see the show's possibilities. "The musician's union is also happy about the response," he adds, "and it would like to see similar activity in other clubs. It has no objection to the playing of stereo recordings during intermissions, and both clubs use the equipment when I'm not there. Perhaps the union prefers stereo because it sounds more like actual musicians than a coin machine. And customers who hear something they want to buy can always inquire as to the album title, which is not the case with anonymous piped in sound. The people who play records in my absence are all informed enough about stereo to answer most questions."

The advantage of Grant's program as a showcase for stereo components was noted by Newmark and Lewis, Sy Teltier, manager of their Hempstead store, received the cooperation of manufacturers in assembling the equipment to be installed in the clubs. Reko-O-Kut takes credit for the turntable and matching tone arm as well as the Audax speaker, and JBL assembled the Citation and Harwood stereo system. The Citation and Harwood systems were used in the Citations and II used at "San Su San," while the amplifier at "Copa City" is a Harwood 5000 H. Grant hopes to complete arrangements to broadcast Friday nights from the "Cork 'n' Jingy Wishing are hard to mistake. And they can understand Orbs Spann without a lecture on jazz roots. I wait until the hour after midnight to schedule audience-pleasing works. Even in the stereo music, one must be able to identify the artist even if one is not a jazz LP fan of his choice at all. Regular recording only makes sense if one with his sponsor in the studio and let's watch the switchboard light up."

Grant ran a series of jazz programs for teenagers at Syosset High School, featuring the Bob Craton Octet, which he sponsored to schedule Sunday concerts at "Copa City." Another of his projects is planning a Jazz Summit for teenagers at the Mineola Raceway next fall. "Other stations made offers for the show began drawing attention," claims Grant, "but refused to guaran-
tee that I could continue to play jazz. I like to stay in jazz and such shows will be more successful. John Reilger, station manager at WLIR, gives me cooperation and complete freedom to plan the station program as soon as possible, and I have a large stereo library ready."

**STEREO**

Roy Harte & Milt Holland: Perfect Percussion

World Pacific ST1405

The supply of adjectives existing enough to accomplish the word percussion in album titles must be nearly exhausted by now, but I hope that Harte & Holland can add to that list with "The Attic," their new LP's, including several successful treatments of full scores from Broadway musicals, Kingstonettes, Kingstonettes, Bing Crosby, Rosemary Clooney and Al Jolson. Their joint efforts are over-dubbed anyway, they could fire a complete stereo LP, but this technique is invariably used to ensure an air of unqualified accuracy.

Selected works of the Mastersounds, a youthful quartet first introduced on this label three years ago, serve as a base of operations for the percussionist's forum. Before deciding to go no further than half a season this year, the Mastersounds put together seven LP's, including several successful treatments of full scores from Broadway musicals, Kingstonettes, Kingstonettes, Bing Crosby, Rosemary Clooney and Al Jolson. Their joint efforts are over-dubbed anyway, they could fire a complete stereo LP, but this technique is invariably used to ensure an air of unqualified accuracy.

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AUDIO • AUGUST, 1961
The First Book of its Kind—No Other Like It!

SOUND in the THEATRE

by Harold Burris-Meyer and Vincent Mallory

Nothing like SOUND in the THEATRE has ever been published. It is the first book to set forth in authoritative detail what you can do with sound by electronic control, and how to do it whenever the source (singer, musician, speaker, etc.) and the audience are present together. The book develops the requirements for electronic sound control from the necessities of the performance, the characteristics of the audience (hearing and psychoacoustics), and the way sound is modified by environment, hall, and scenery. Sound sources are considered for their susceptibility of control and need for it, and the many techniques for applying electronic sound control are described and illustrated in thirty-two specific problems. From these problems are derived systems and equipment specifications. Complete procedures are given for Planning, assembling, and testing sound control installations—Articulating sound control with other elements of production—Rehearsals and performances—Operation and maintenance—Sound control equipment.

THE AUTHORS

During the past thirty years, the authors have developed the techniques of sound control in opera, open-air amphitheatres, theatres on Broadway, theatres on-the-road and off-Broadway, in concert halls and night clubs, in Hollywood and in the laboratory. Some of their techniques are used in broadcast and recording as well as in performances where an audience is present. From their laboratory have come notably successful applications of sound control to psychological warfare and psychological screening.

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and Holland are unimpeded in their most fanciful flights.

Before discounting over-dubbing along with channel-switching and other tricks of the trade, stereo purists might investigate some of the virtues and practical advantages of the method. As purists want an exact reproduction of what takes place in a studio or auditorium, they entertain little sympathy for practical considerations that dictate anything different. However, they could hardly doubt about the advisability of the characteristic size and acoustics of the recording hall remaining constant throughout, no matter how much the nature changes during the course of an entire album. The original master sound recordings were given the intimate qualities suitable to a jazz quartet. With a bit of Bock's legendarium aiding at the controls, the purists cannot cause the stereo diodes to expand or contract at will, fully justifying a Liver claim that "the final effect is startling and unlike anything previously presented on record."

A wind machine and a few surround sounds are employed to create a fog-bound scenic set on Erroll Garner's "Misty", but the effect must be heard to be believed. Yet the individual quartet voicings remain unaltered on such jazz originals as Richie Crabtree's "The Kick", and the spatial gain here is mostly in the nature of increased depth, plus repeated excursions into both extremes of the frequency range. In this last respect, Harte and Holland demand nothing less than perfection from reproducing systems in either the stereo or monophonic versions.

Don Ewell: Man Here Plays Fine Piano! Good Time Jazz #10043

As anyone who has heard Jack Teagarden in the last four years knows, the man playing fine piano in the group is Don Ewell. This session, which features Ewell in a solo role and as part of a quartet, was recorded just before he accepted the post and went with Teagarden on a State Department tour of eight countries in Asia. Perhaps some day it will look so long to see the light of day, because a record warehouse of San Francisco served as a studio. Evidently working on the assumption that excellent acoustics might result from the construction of a large storage space and stacked rows of corrugated boxes, Roy Innis cleared space for the musicians and set up microphones. On the basis of the evidence just issued, both theory and circumstances prove correct, and the late arrival dates neither the sound nor the spacious studio. Now that this recording has escaped from the warehouse, tradition lists should never let it go back.

The bass playing of品方, who celebrated his sixteenth birthday next year, is another aspect of the date not superannuated. The New Orleans sextet has yet to lose his ability to propel a small group or get a big solid sound. No wonder Max Roach says he would like to find a bassist with similar qualities and the strength to stay on the job sixty years. Veterans of only slightly less experience are Minor Hall, drums, and warmed Howard, whose melodic and impassioned clarinet is the nearest thing to Sidney Bechet's now extant. Howard assumes a fluent lead on his own Green Street, My Home Is In A South Town, and Is it Blue?

Ewell is one youngster who always learned from older statesman, and his first job after Army service was with Bunk Johnson. Far from being adverse to later developments, the pianist works in a style best described as timeless and rather accurately as "from it," Prewitt Manor, I Want A Little Girl, and his own Fourteen. S. I. Hayakawa contributes discerning liner notes.

Jimmy Rushing: The Smith Girls
Columbia CS6465

In paying tribute to girls named Smith, the incomparable Jimmy Rushing is introduced physically for once. Mrice, Mamie, Trixie and Clara are all lady watche size, with lungs fully developed from quivering tenorshere audiences, and they knew the blues from the inside out. Even Rushing's free-by-five dimensions are no match for the scales for all four, but he is...
equally versed in the blues and can shout with the best of them. On the feminine side of the dossier, only Benjines can be said to have possessed greater vocal stature. Rather than try to displace her recorded versions, Rushing wisely offers his own distinctive styling of such tunes as Down Hearted Blues, Squeeze Me, and Gulf Coast Blues. By the time he reaches Muddy Waters, a full head of steam is building against the escape valve, causing the boat to rock in a true Kansas City fashion. Clara is remembered only once, but Rushing makes a real masterpiece of Dishwasher Blues.

Rushing handpicked the supporting cast, and both Coleman Hawkins' tenor sax and Buster Bailey's clarinet are on records as having been in the studio with more than one of the Smith girls. Bessie's Clayton's glorious trumpet obligato reminds us of the late Joe Smith, who Benjines called her favorite accompanist. It is also one of his earliest influences. Dickie Wells, Claude Hopkins and Everett Barksdale are also present, and stereo brings out the full majesty of Rushing's vocal powers.

Tommy Gwaltney: Goin' To Kansas City
Riverside RLP9353

Not everything printed about Kansas City is ready to go, but this livery outfit has all the qualifications and then some. Tom Gwaltney spent a decade in the bands of Bobby Hackett and Billy Butterfield before settling in Norfolk, Virginia, where he is the guiding force behind the Virginia Beach Jazz Festival. He produced and arranged this album, with the help of fellow-Virgilians Tommy Newson, and together they take care of the sax section. The band's seven other members include veterans Bessie, Clayton, Dickie Wells and Buddy Schutz, along with such relative newcomers as Charlie Byrd, Bobby Zotzolfs, John Dunch and Walter Mitchell.

Where most trips to Kansas City usually start short after a rehash of familiar Bennie tunes, this excursion covers a lot more territory. Besides side trips to the bandsstands of Benny Moten, Andy Kirk and Jay McShann, the Itinerary lists representative new material. Newson provides Clayton with a prodigious trumpet showcase on Kansas City Brought, and Gwaltney switches to xylophone on his own touch to the tribute to Walter Page. Bunch strides through the piano chorous on Moten's New Tuba Blues, and Wells reclaims his trombone part on Hello, Babe. The arrangements swing mightily, with solo space for all, and the relaxed riff in the background is an incentive for dancing. Phil Ramone of A & R Studios is responsible for the effective stereo.

Cannonball Adderley and The Poll-Winners
Riverside RLP9355

Nearly every label has its poll-winners by now, and albums featuring another victory of one sort or another are apt to sprout at any time of the year. As anything unexpected happens so rarely on these parade-of-stars releases, the surprise of an unbilled artist walking away with top honors is something of an event. Cannonball Adderley, Ray Brown and Wes Montgomery, the featured dignitaries at this gathering, all go polite through the required paces. Being British-born and uniformed in the rules of behavior, Victor Feldman charges in where the wordless fear to trend. Aided and abetted by drummer Louis Hayes, he stirs up so much excitement on piano and vibes that the rest of the quintet forgets propriety for awhile, especially on two Feldman originals. Montgomery unleashes his guitar for a headlong solo on Arise Serape, and everyone answers the tribal call on The Chant. Boss alto-assist Adderley toys in friendly fashion with Yours Is My Heart Alone, and Never Will I Marry. The meeting took place on the west coast, and Wally Helder is credited with the engineering.

Peggy Lee: Basin Street East
Capitol ST1520

A four-week return engagement brought Peggy Lee to Basin Street East last January, and the management threw away the key. Patrons braved three of the worst snow storms

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H. H. Scott FM-Stereo Adapter Schematic

Here is the schematic diagram of the H. H. Scott FM-stereo adapter, Model 335, which was omitted from Mr. von Recklinghausen's article in the June issue. Note that all of the circuit constants are given except for a few of the filter coils. In reality these omissions are not significant and would not stop an experienced experimenter. On the other hand only the most experienced builder should even think about building this complex circuit—and if he is really experienced he would hurry to his local audio store and buy one.

JAZZ
(from page 77)

in fourteen years to keep every seat filled at all performances. Record purchasers are a more cautious breed, however, and may well ponder the reasons for acquiring this in-person album, especially since the singer has recorded most of the songs before in a studio. There is a difference, almost like the one between night and day, and all devoted admirers will want to hear how Miss Lee reacts to a live audience. Any doubt about the reactions from the pacing customers would never enter their minds, but elevens are to be heard in plenty for such choice items as "Fire!", "But Beautiful", "Mona Lisa" and "Blue Skies". Miss Lee responds with an electrifying performance and builds to a smashing climax in paying her respects to Ray Charles on "Just for A Thrill", and "Yes, Indeed!" Capitol engineers do a marvelous job of retaining the singer's intimate qualities, spotlighting drummers Chino Pozo and Russ Levy, and allowing a full stereo spread for Joe Harrell's lively band.

MONO

Red Mitchell: Rejoice
Pacific Jazz P122

Esteemed bassist Red Mitchell turns to the cello at this session, which was recorded live at The Renaissance in Hollywood, and the instrument is made to sound for the first time as illegitimate as the lively washboard. Jazz bassists have flirted with pizzicato cellos before, but they seem slightly awkward by the ladylike qualities and always treated it with too much respect. Mitchell gives it the same sort of workout Armstrong or Gillespie would use to test a new trumpet, extending it to the utmost and discovering hitherto undisclosed resources. He frequently gets a tone as gutty and unprincipled as any Jim Hall, the other invited guest, can manage on guitar. Hosts are members of the Frank Butler trio, which holds the fort all week and withstands the onslaughts of featured weekend visitors.

Butler receives ample opportunity to demonstrate why he is the Jazz drummer to hear right now. Taking off from an ordinary rhythmic figuration on "You'd Be So Nice To Come Home To", he develops a solo filled with logic and imagination. Definitely not to be overlooked is a stunning display of finger drumming on "Night In Tunisia". Mitchell contributes the subtle tone, while Hall is responsible for Jim's Blues, and together they whip up fierce and gutsy interplay between guitar and cello. Jimmy Bond, bass, and pianist Frank Strazzeri complete the quintet. This is one of the best informal sessions ever, and is highly recommended. The recording quality is fully adequate and conveys vocal participation of both audience and players.

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AUDIO • AUGUST, 1961

79
ABOUT MUSIC

HAROLD LAWRENCE

Anyone For Quodlibet?

A 103-year-old Englishwoman was interviewed recently by a BBC announcer who asked for her opinion of the world today. "Wonderful, isn't it?" she replied, in a light, musical, slightly quavering voice. She went on to speak enthusiastically of man's great strides in the fields of science and technology, of the jet aircraft, atomic power, and flights into outer space. Probably the "wireless" and the "tele" had more to do with bringing the world closer to her than any other factor. Paradoxically, mass entertainment in the home may help us to better understand the universe, but it also makes us feel less at home than ever before. Fewer people now create their own home entertainment, and, instead, rely increasingly on passive forms of recreation.

Olin Downes devote one of his last Sunday columns in The New York Times to a musical victim of our scientific age, the "grand old practice of duet playing," During the 19th century and the early decades of the present century, when four-hand piano playing was one of the most popular musical diversions, arrangements were made of everything from operas to symphonies, and there was hardly any work in the standard repertoire that had not been transcribed for piano duet. In the days before the phonograph, this was the only way one could hear one's favorite symphonic compositions short of attending a concert. But, even today, the phonograph or radio, wrote Olin Downes, "can never replace the joy and the profit of four hands and a new score on the music rack, and the creative participation of all concerned on the piano." There is a special insight and pleasure to be derived from producing the actual notes of an orchestral work with your own fingers.

Fortunately, tandem piano-playing has not vanished altogether; four-hand music is still available, and even performed in public from time to time.

Musical home entertainment was probably at its height during the 17th and 18th centuries, when the public and private lives of entire households were often given over to music. The Bach family is a case in point. The numerous members of this celebrated clan practiced their trade as cantors, organists, and court composers all over Germany and taught their offspring the rudiments of the clavichord and string instruments along with their ABC's. As so not to lose track of each other, it was decided that the Bachs should meet annually on a pre-arranged "family day" in Erfurt, Eisenach, or Arnstadt, depending on the geographical deployment of the family at the time. Naturally, music-making took precedence over all other functions, with the possible exception of eating. The Bachs particularly enjoyed playing musical games during these "journées," and the quodlibet was a favorite pastime.

Taken from the Latin, "what you please," the quodlibet is an old musical joke, dating back to the 13th century. The game is based on the juxtaposition of pre-composed melodies, usually of entirely incongruous mood or textual inspiration. There are two kinds of quodlibets: successive and simultaneous. The first, a simple quodlibet, consists of stringing together unrelated tunes or snatches of melodies, for which only the skills of modulation and rhythmic flexibility are required. The simple quodlibet is cousin to the medley, pot-pourri, fantasia, and "musical switch." In its more humorous aspect, it appeared in the Hoffnung Music Festival Concert at the Royal Festival Hall in London (November, 1956). The work was Franz Reizenstein's Concerto Popolare, a self-styled "piano concerto to end all piano concertos."

To play from a parade of concertos was out of the question, but, since horses were announced in an outrageously ingenious manner, coming upon one almost without warning. In Strauss's music for "La Bourgeois Gentilhomme," a large part of The Dinner constitutes a witty quodlibet. To illustrate the menu, the composer helped himself to generous portions of Wagner, Verdi, and his own compositions. For the serving of the Rhine wine, what could be more appropriate than Das Rheingold? For the mutton course, Strauss's own sheep music from "Don Quixote" was in order. And some sort of Italian dish is suggested by La donna è mobile.

The more sophisticated simultaneous (or polyphonic) quodlibet is encountered less frequently than its simpler counterpart. Here, two or more melodies are made to run in multiple harness. The composer is permitted to alter time-values so as to dovetail each part. He may also introduce parts of different points of entry, since it is obviously impossible to begin and end all contrasting and pre-composed melodies at the same time. Finally, he may fragmentize his tunes, using a phrase here and there, in jigsaw-puzzle fashion. A classic example of a meticulously devised polyphonic quodlibet was written (embroided?) by Johann Gödel, a 16th century composer, on no less than five chorale tunes.

It is not surprising that the Bachs, who were all proficient contrapuntists, should practice the simultaneous quodlibet at their family gatherings. They particularly delighted in combining sacred and profane melodies. In the last variation from the Goldberg Variations, Johann Sebastian composed a quodlibet based on two popular songs, one of which is still extant, accord-
ing to some reports. Here are the texts of the original tunes:

1.
I long have been away from thee,
I'm here, I'm here, I'm here
With such a dull and dowdy pride
Out there, out there, out there.

2.
Cabbage and turnips
Don't suit my digestion;
If my mother cooked some meat
I'd stay here without question.

Over the years, the polyphonic quodlibet of the 17th and 18th centuries has lost most of its intended humor. Only when one knows the texts behind the quoted melodies can one appreciate Bach's musical joke. On their own stems, the notes don't indicate the point. As a device, however, the quodlibet continued to attract composers. Mozart made effective use of a three-part quodlibet in the Act I Finale of "Don Giovanni." when three orchestras play three different dances simultaneously: a minuet, a country dance, and a waltz. In the concluding measures of the "Meistersinger" Prelude, Wagner combines three motifs in grand fashion: the theme and fanfare of the Mastersingers, and the Frize Song. Although the latter is regarded as a true quodlibet, it lacks the thrown-together feeling characteristic of the finest examples of the species. This charge can never be leveled against Charles Ives, master of the modern quodlibet, both successive and simultaneous. His "Second Symphony" is a vivid illustration of his use of this device: through the fabric of this score are woven such tunes as "Bringing in the Sheaves, America the Beautiful, Old Black Joe, Columbia the Gem of the Ocean," and fragments of Brahms' "First Symphony" and the Beethoven's "Fifth." The second movement, Putnam's Camp, from Ives' "Three Places in New England" is a rich example of simultaneous quodlibet, in which is depicted the sonic collision of two passing bands during a Fourth of July celebration. With all due respect to Ives, it should be pointed out that his quodlibets were freer in execution and therefore easier to assemble than the purer variety. He may have created an unforgettable music image in Putnam's Camp, but could he have thought of mating Bizet and Wagner in the following quodlibet masterpiece?

Now this is one of the great quodlibets of all time. Examine it carefully. Note how the two melodies intertwine elegantly, with one voice pausing while the other carries

(Continued on page 102)
PRODUCT PREVIEW

(from page 6)

Bass may be hidden out of sight under a table, chair, sofa, or behind drapes because of its small size (16 1/2 x 12 x 5 1/2 inches) and its non-directional characteristic. Frequency range of the speaker is 30 to 80 cpm and power handling capacity is 10 watts. Impedance is 8 ohms. Harmony speakers available in ebony or cordova. Hideaway Bass available in ebony. Included in system (S-700A) is 12 watt amplifier to drive bass speaker. Weather Industries, 66 E. Gloucester Pike, Haddonfield, N. J. User net price (complete system), $160.00. Separate, Hideaway Bass, including amplifier, $119.50.

WHARFEDALE

- Compact Speaker System. The most compact speaker system ever produced by Wharfedale, the W-40 features the famous "Achromatic" principle with the sand-filled panels for rigidity and non-resonance. The size of the system is 24" x 12" x 10", and the speaker complement is the newly developed 8 1/2-in. low-frequency driver with an extremely high-flux-density magnet and which features a design and differ only in the type of turntable platter used. Thus the Model 1100 turntable uses a 3/4-lb. formed steel platter whereas the B61 has a platter made of a 71/4-lb. machined zinc alloy casting. Both models use the modified P.A.1 transcription tone arm. A convenient lever on the turntable deck automatically lowers or raises the tone arm at any point on the record, thus assuring gentle contact between the stylus tip and the record. Speed may be varied from 29 to 86 rpm continuously by sliding a lever on the deck. There are click-stop positions for the four standard speeds, Bozen, A 16" vibration of the Welger Corp., P. O. Box 500, Paramus, N. J. User net prices: B60, $49.95; B61, $39.95.

COLLARO

- Four-Speed Transcription Turntable. Manufactured in England, the new Collaro 4-speed turntable, Model 4TR-200, features a dynamically balanced, 8 1/4-lb. non-magnetic turntable platter. The weight is distributed carefully to take advantage of flywheel effect to achieve smooth rotation. The motor is a heavy duty shaded 4-pole induction type motor, 3/3-lb. machined, individually balanced aluminum alloy platter. Manufacturer states that a condition of sale is that these turntables meet NARTB specifications for broadcast equipment on wow, flutter, rumble, and speed accuracy. Acoustic Research, Inc., 24 Thorne St., Cambridge 41, Mass. User net price, $58.90.

BOGEN

- Series II Turntables. Equipped with tone arms and featuring continuously variable speed and automatic cueing, the Bogen Series II turntables, 160 and 161, are similar in

DUAL

- Four-Speed Changer-Turntable. The new Dual 101G-1 "Custom" is a combination record changer and turntable offering four-speed operation. The "roll-over-feeler" record indexing action permits inter-exchanging of any size records for completely automatic operation. AShaded four-pole induction motor is used which goes from rest to correct speed in one quarter of a revolution. The platter is laminated and concentrically damped for increased rigidity. The one-piece tone arm tracks and trips at 1.5 grams and is adjustable for a wide range of tracking forces. The arm has a built-in tracking-force gauge. A lock-in cartridge holder is provided for use with all standard cartridges. With built-in stereo-mono switch. United Audio Products, 202 E. 39th St., New York 3, N. Y. User net price, $79.95. Wood base, walnut or mahogany, $6.95.

ELECTRO-ACOUSTIC

- Four-Speed Turntable-Changer. Featuring low stylus force (2.5-3 grams) for a record changer, the new Electro-Acoustic 7060 Series provides performance exceeding NARTH...
Now an FM tuner with multiplex built-in!

New H. H. Scott FM Stereo Multiplex Tuner uses Wide-Band design for top performance

Here it is! No adaptor needed! The world's first Wide-Band tuner designed specifically for multiplex! H. H. Scott's new Model 350 FM Multiplex Stereo Tuner heralds a new era in FM reception.

The FCC, in its recent acceptance of FM stereo multiplex, said that the approved system "... like any multiplex transmission system, will increase energy transmission at the edges of the channel involved. Accordingly, for optimum stereophonic reception, the (tuner's) bandwidth ... must be considerably greater than that of monophonic (tuners)."

From our very first design ... the revolutionary 310A ... H. H. Scott incorporated substantially wider IF bandwidth than conventional tuners. This gave better selectivity and usable sensitivity. The new 350 FM Multiples Stereo Tuner incorporates this same exceptional circuitry allowing reception of even weak multiplex stations with amazing clarity. You get other benefits, too — the 2 MC Wide-Band detector provides superior rejection of interference and complete freedom from drift. The Wide-Band design of the IF's and detector give the new 350 a remarkable usable sensitivity of 2.5 µV measured by stringent IFM standards ... one of the best measurements of a tuner's ability to effectively receive weak multiplex signals. If you are considering a new tuner, or addition of an adaptor to a conventional narrow-band tuner, you owe it to yourself to first listen to the new H. H. Scott Model 350 Wide-Band FM Multiplex Stereo Tuner. Its superiority in sound quality ... its ability to receive weak multiplex signals ... its complete freedom from drift ... are so dramatically different that you will not want to settle for less.

Important Technical Information

*See paragraphs 36, FCC Report and Order, Docket no. 13506, 4/19/61. Emphasis ours.

Wide-Band Multiplex Adaptor

Important News for H. H. Scott Tuner Owners
H. H. Scott has once again protected your investment against obsolescence. Your tuner, regardless of age or model, can be quickly converted to multiplex with the new Model 355 Wide-Band Multiplex Adaptor. Because of H. H. Scott's unique no-compromise Wide-Band design, we can guarantee superior multiplex reception only when the 355 and an H. H. Scott tuner are used together. 5 tubes, 8 diodes. $99.95, case extra.
TABLE.

The TA-210 transistor record changer, produced by R. C. August, has low distortion and noise, and is designed to be used with any type of transistor amplifier. It features a high-fidelity, high-performance system, with a wide dynamic range and excellent frequency response. The TA-210 is suitable for use in stereo or monaural systems, and is designed for use with 45-rpm or 33 1/3-rpm records.

Audiophile turntables are designed for high-fidelity reproduction. They are characterized by their low noise and distortion, and their ability to accurately reproduce the high-frequency content of records. Some audiophile turntables feature a variety of features, such as adjustable counterweights, automatic tone arm return, and anti-skate mechanisms.

The FAIRCHILD Model 440 is a three-speed (33 1/3, 45, and 78 rpm) belt-driven turntable. The pre-assembled, heavy aluminum baseplate and

GARRARD

- Automatic Turntable, Combining a dynamically balanced (counterweight) tone arm with a fully professional turntable, the new GARRARD Type A Automatic Turntable provides all the convenience of a changer plus the quality of a fine turntable and arm. The Type A turntable platter is cast, weighted, and polished—over-all weight being 6 pounds. The table is cast of non-ferrous

GLASER-STEERS

- Stereo Record Changer, The GS Seventy-Seven is precision-enclosed, completely automatic in operation, and offers new features and refinements which enhance the enjoyment of stereo records, at the same time allowing enjoyment of monophonic records to the utmost. Stylus force is variable over a wide range with newly developed vernier adjustment. Variation of stylus force between first and last record on a stack is less than 0.0 gms. The damped, acoustically isolated tone arm is not repositioned within the audio range, and moves both internally and vertically on linear bearing. Humble, wow, and flutter have been reduced by improved motor design. As in earlier Seventy-Seven models, the turntable features a heavy duty 4-pole induction motor, free-floating and shock mounted to eliminate vibration. The 3-pound, rim-weighted, 12-inch aluminum table is constructed with a permanently lubricated olive bronze bearing while the spindle turns on a single ball bearing. Speeds are selected by means of a click-in shift lever and the idler

ANCHOR

- Vintage Analog Tapes, Anchor is a leading manufacturer of analog tapes for a wide range of applications. Their Vintage Analog Tapes are ideal for use in professional and consumer audio equipment, and feature high-quality construction and a wide dynamic range. The tapes are available in a variety of formats, including quarter-inch and half-inch, and are suitable for use in a wide range of applications, from recording and playback to dubbing and editing.

The FAIRCHILD Model 440 is a three-speed (33 1/3, 45, and 78 rpm) belt-driven turntable. The pre-assembled, heavy aluminum baseplate and

The GRAY ST-33 turntable provides a high level of performance for playing 33 1/3 rpm stereo and monophonic records. Humble is minimized by four five-rubber shock absorbers and a polyurethane belt drive which isolates the motor both vertically and horizontally.

The turntable features a heavy duty 4-pole induction motor, free-floating and shock mounted to eliminate vibration. The 3-pound, rim-weighted, 12-inch aluminum table is constructed with a permanently lubricated olive bronze bearing while the spindle turns on a single ball bearing. Speeds are selected by means of a click-in shift lever and the idler
is disengaged in the off position. A fine-speed control permits adjusting the speed up to plus or minus 7 per cent. Noise and rumble are 50 db below average recorded level with wow and flutter less than 0.2 per cent. The 12-inch tone arm is easily adjusted for different stylus forces by means of a knob at the rear of the arm. Additional features include a plug-in head and an ON/OFF switch located in the arm rest; simply lift the tone arm to start the motor and replace in the arm rest to stop it. Supplied with a strobe disc, 45-rpm adapter, shielded hook-up cables.

LAFAYETTE, 165-08 Liberty Ave., Jamaica 33, N. Y. User net price, $49.50.

LESALA

Four-Speed Record Changer. Fully automatic, the new Lesa Model CD2/21 record changer has only two controls for all operating cycles, speed selection, start, stop, reject. Up to eight records of any size may be played with automatic load. A lever actuated, the record balance is simply moved to its side position. When operated manually, the tone arm is returned to rest automatically, after each record. A built-in click suppressor eliminates switching noises by means of an R-C network. A 4-pole, carefully balanced, heavy-duty motor drives the CD2/21's turntable which has an exceptionally high moment of inertia. The tonearm mechanism is jam-proof, the arm capable of being raised or handled at any time without damage to the mechanism. The record-changing cycle time of 6 seconds is the same for all record sizes and speeds. Pre-wired for both monophonic and stereo operation, the Lesa changer is equipped with a universal plug-in shell which accommodates all standard cartridges. Electrophono & Parts Corporation, 530 Canal St., New York 13, N. Y. User net price, $44.50.

SM5/11 4-sp. man. rec. player $29.95
4-V3/11 man. rec. player 23.95
665AL port. stereo phono 229.95

MIRACORD

Hysteresis Motor Turntable-Changer. Featuring a hysteresis motor for accurate speed control, the new Miracord "Studio II" is intended to combine the convenience of a record changer with the accuracy of a turntable. In addition, the tone arm is of the quality normally found on turntables. The one-piece turntable platter weighs 7 lbs. It is dynamically balanced and is made of a non-ferrous metal, and is 11¾-in. in diameter. Automatic changing is accomplished by means of the "Magic Wand" arm which was a well-known fea-

Now, For The Newest and FINEST Phono Cartridge Modern SCIENCE Can Devise

ASTATIC

TAKES YOU INTO THE WONDER WORLD OF NUCLEAR AGE MATERIALS AND PROCESSES

THE Cantata

MODEL 45D STEREO CLASSIC WITH MINIATURE ALPHA RAY NUCLEAR SOURCE

If you are a real, uncompromising, hard-nosed perfectionist, this is now the ONLY phono cartridge for your system. Astatic engineers have significantly extended the application of today's new processes and wonder materials to bring you a new standard of excellence. Example is the inclusion of patented* miniature alpha ray nuclear source which keeps grooves free from foreign particles by dissipating static charge from the record surface. Record and needle abuse are reduced, extra clarity and cleanliness of reproduction are achieved. By any measurement, actual or theoretical, the Cantata is superior. The specifications are excellent, and an actual listening test provides final proof of superiority. So much so that you must try it. Then, we'll wager, you must own it!

TECHNICAL DATA

Frequency response: 20-20,000 cycles; Output voltage: ten millivolts at magnetic input, 1000 cps at 5 cm/sec; Separation between channels: 30-35 db; Channel balance: within 2 db; Tracking force: one gram in professional tone arm; Hum rejection (to external fields): better than 60 db below 5 cm/sec. recorded level after RIAA equalization; Mounting: standard mounting and dimensions to fit all audiophile tone arms and record changers; Needle: single, super-polished replaceable diamond; Entire finish: polished gold.

WRITE FOR MORE COMPLETE DETAILS

ASTATIC CORPORATION, CONNEAUT, OHIO

IN CANADA: Canadian Astatic Limited, Toronto, Ontario
EXPORT SALES: Roburn Agencies, Inc. 431 Greenwich St., N. Y. 13, N. Y., U.S.A.

*U.S. Patent No. 2,991,331

LIST PRICE $44.50

Complete with pair of matched input networks to quickly plug into magnetic inputs without changing amplifier or pre-amplifier.
tecture of previous Miracord changers. The Studio II also comes with a manual pitch-change Record-selector selection and actuation of automatic operation is accomplished by means of pushbuttons. For manual operation, a dial need only be placed in the first groove of the record. The pitch selector lever built into the arm actuates the motor. The Studio II is also extremely handsome in appearance. Benjamin Electronics, Sound Corp., 97-03 43 Ave., Corona 68, N. Y. User net prices: Studio-II, $299.50; Studio (same as Studio II but with shaded 4-pole, induction motor), $79.95.

NEAT

- **Four-Speed Turntable.** The Neat Model P-60H is an attractive turntable with high-priced performance characteristics which belie its price tag. Driven by a hysteresis-asynchronous motor which is designed to reduce vibration and noise, the P-60H has wow and flutter of less than 0.25%. The heavy, die-cast turntable is 12 inches in diameter and is composed of a special aluminum alloy. Neat (Japan) Ltd. Co., Ltd., No. 4-1 Demachi Kanda Hattacho, Chiyoda-ku, Tokyo, Japan.

NEUMANN

- **Automatic Two-Speed Turntable.** Small in size (41/2"x12") deck but large in performance, the Neumann PABA automatic turntable turns itself off at the end of each track. The turntable is built on a solid cast plate. The hysteresis drive motor on the one hand, and the turntable and the other, are separately shock mounted on this plate. Rotation of the motor is transmitted by means of a rubber belt to two idlers, either of which—depending on the setting of the speed selector switch—is brought to bear against the inner rim of the turntable and thus driving it. When the speed selector switch is in its neutral position, both wheels are free. Next to the speed selector switch is the tone-arm lever, bringing this lever forward causes the pickup to lower slowly to the disc until it gently sinks into the groove. Moving the same lever gently

vertical rumble attenuation is 12 db/octave below resonance; noise is 0.35 db below reference level; speed accuracy is ±0.2 per cent total variation. Pickering & Company, Inc., Plainview, N. Y. User net price, chassis only, $60.00. Model 800CR, complete base, in mahogany, walnut, or blond, $15.00.

REK-O-KUT

- **Three-Speed Hysteresis-Motor Turntable.** Featuring a hermetically sealed hysteresis-asynchronous motor and a self-lubricating turntable shaft, the Rek-O-Kut Model R-121H is ideal for the most exacting turntable requirements. Noise level is 57 db below average recording level and wow and flutter are 0.12 per cent. Speed selection is by means of single selector knob. An "OFF" position is adjacent to each speed selection to permit the turntable to be shut off without passing through other speeds. The idler is disengaged in "OFF" position. A built-in pilot light indicates when the motor is operating. A 45-rpm hub is built in. Rek-O-Kut Co., Inc., 28-20 71st St., Corona 68, N. Y. User net price, $129.95. R-121H (standard instead of custom-built hysteresis motor), $99.95.

N-33H single-speed belt dr. $79.95
N-34H 2-speed belt dr. $99.95

PHONO ARMS

**DYNACO**

- **16-in. Professional Integrated Tone Arm.** A new 16-in. tone arm and cartridge combination manufactured by Hanf and Wohlers of Denmark is now being distributed by Dynaco, Inc. This arm, the TA-16, features the "Isodynamic" principle of inertial balance to attain dynamic equilibrium. This concept, on which patents are pending, maintains equal pressures on each side of the record groove regardless of the frictional forces which tend to make conventional arms slide inward. Application of this principle yields a cover table made of aluminum, plus an attractive rubber nut, mitigates the attraction of magnetic pickups. Precision-machined, the Thorens Rotolimpe is adjustable ±3.0 per cent for exact manual pitch. A built-in illuminated strobe allows setting to exact speed while record is playing. Easy levelling is accomplished by means of a built-in level bubble and easily accessible levelling screws. The precision 4-pole motor is equipped with a compliant belt-plus-hider arrangement which provides excellent motor-vibration isolation. The TH-124 operates on 50 or 60 cycles and is designed to rotate at 33-1/3 or 45 rpm. Each motor comes directly to the turntable by means of a small soft rubber wheel, and a simple speed-shift lever selects one motor and disconnects the other. The Weathers method of reducing rumble and other rotational errors by reducing the mass of motors and turntable is utilized in the ML-234 and is reflected in a rumble of -70 db. Wow and flutter are, respectively, 0.15% and 0.15%. The turntable unit is of special design which eliminates transfer of dust from turntable to record. Weathers Industries, 66 E. Gloucester Pike, Harrington, N. J. User net price, $74.50. ML-1 one-speed turntable $59.95

**THORENS**

- **Transcription Turntable.** Engineered for the finest music systems, the Thorens Model TD-114 is a four-speed machine featuring a full 12-in. 11/4 lb. table for lowest wow and flutter. The main table is made of cast iron to provide vibration-bleeding against main pickup, lower record wear, lower distortion, and other desired benefits. The TD-114 can track at stylus forces as low as one gram with a tracking error of less than one degree. Tracking force is determined by a linear spring set by a simple, easily read slide which permits accurate settings to fractions of a gram. The TA-16 gives flat response within 2 db from 30 to 15,000 cps, with 30 db of channel separation up to 10,000 cps. Output is 7 millivolts. Dynaco, Inc., 3912 Powelton Ave., Philadelphia 4, Pa. User net price, $29.95. The 12-in. version, TA-12, sells for $49.05.

**PICKERING**

- **"Gyrophonic" Turntable.** Engineered specifically for microgroove records—both monophonic and stereo—on the Gyrophonic 801.
EMPIRE

Stereo Turnarm. The Empire 960 is a significantly improved version of the Empire Model 98. Maximum tracking error has been reduced to 0.05 deg and arm resonance has been lowered to 8 cps. Dynamic balance is achieved by locating the pivot points at the precise center of mass. Once in balance in one plane, the arm is balanced in all planes. Even the application of stylus force does not upset this balance because a linear torque spring is used which acts directly on the pivot shaft at the center of mass. The 960 is provided with a 5-wire circuit, the 5th wire being an independent ground lead to bring the arm directly to the same ground potential as the rest of the system and thus eliminate hum induced by ground loops. The 5-wire circuit is terminated at the base of the arm by a 5-prong connector, and a 4-foot cable with mating connector is provided. The other end of the shielded cable terminates in phono-plugs for left and right inputs and a spare lug for the ground wire. Pyramid, Inc., 1675 Stewart Ave., Garden City, N. Y. User price: arm and cartridge, $55.00; arm only, $29.95. 501 16-in. arm, $37.50.

ESL

Hi-Fi Balance Tone Arm. Designed on the principle that an arm should be balanced in every plane and the stylus force provided by a spring, the ESL super tyro/balance arm has many advantages. Because of this design, turntable leveling is unnecessary, and on demonstration the ESL 2900 arm is often shown playing records with the turntable in an absolutely vertical plane—in fact, if it were possible to keep the record and platter in place and provide proper bearings for the turntable itself, the arm would play records upside down. Ball bearings are used throughout for all vertical and horizontal motions, assuring smoother operation, increased record life, and longer trouble-free performance. In operation, the spring force is reduced to zero by turning the two knurled knobs backward; the sliding weight at the back is then adjusted for perfect balance of the arm and cartridge. The knobs are then turned forward to obtain the desired stylus force. The head is of molded plastic and is fitted with four terminals. A wire ground lead is carried through the assembly for connection to a terminal strip under the turntable base. Stylus force adjustable from zero up to 7 grams. ElectroSonic Laboratories, Inc., 33-54 36th St., Long Island City 6, N. Y. User price: $41.60; arm rest, $4.90.

GRAY

Fluid-Damped Stereo Tone Arm. Linear fluid damping in both vertical and lateral planes is featured in the Gray Model 212-TG stereo tone arm. Precision balanced for maximum tracking stability, the unit incorporates such features as adjustable static balance and a quick-change holder which will accommodate all standard cartridges. Four leads are included for stereo operation. Tracking error is reduced to an absolute minimum. Available fully assembled or in kit form, this arm will meet every demand of the most discerning music lover. Gray High Fidelity Division, 16 Arbor St., Hartford 1, Conn. User price, $34.90.

LAFAYETTE

Integrated Stereo Tone Arm and Cartridge. Intended to provide optimum stereo performance by integrating the cartridge into the tone arm, the Lafayette Model PK-449 is supplied complete with a 0.7-mil diamond stylus. The raison d’être of integrating the cartridge into the tone arm is to provide exact positioning of the stylus in the record groove and produce a relationship between tone arm and cartridge which is not usually achieved in non-integrated units. Arm structure, balance, and compliance can be precisely engineered to complement the cartridge. The cartridge utilizes the “moving magnet” principle, with cartridge, coils, and other components housed in a Mumetal case to reduce hum and noise. In addition, Mumetal shielding is employed throughout the entire length of the tone arm, the Lafayette Model PK-449 being especially well over 100 db. Frequency range is from 20 to 16,000 cps and is flat ± 2 db from 20 to 15,000 cps. Replacement of the stylus may be accomplished without special tools within a few seconds. Each arm is individually factory balanced to track at 3 grams. Lafayette Radio Electronics Corp., 165-08 Liberty Avenue, Jamaica 33, New York. User price, $32.50.

NEAT

Professional 12-In. Turnarm. Constructed of the finest quality materials, the Neat CA-12 is designed to provide long life under the most exacting conditions. Both horizontal and vertical motion is smoothed by the use of precision ball bearings. The 4-terminal

FAIRCHILD

Pickup Arm and Cartridge. The outstanding feature of the Fairchild model 500 arm is its anti-skiing characteristics. Skating is tendency of an arm to ride towards the center of the record. More pressure is placed on the inner wall than on the outer wall of the groove, this condition being especially undesirable for stereo. Fairchild model 500 overcomes skating by a method that applies an equal but opposite force, one benefit resulting from the anti-skiing characteristic is the ability to employ a very-high-compliance cartridge such as the SM-2. The arm also utilizes a system of dynamic balancing, with out springs, which ensures uninterrupted tracking in the event of sudden shock. Fairchild Recording Equipment Corp., 10 to 45th Ave., Long Island City 1, N. Y. User price: arm and cartridge, $55.00; arm only, $29.95. 501 16-in. arm, $37.50.

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Pickering and Company, Inc., Sunnyvale Bldg., Sunnyvale, L. I., N. Y. User net price: Model 198, $34.68; Model 190, $47.58.

**PRIMO**
- 18-in. Stereo Tonearm. Designed specifically for stereo operation, the Primo A-18 is dynamically balanced and utilizes a jeweled vertical pivot. Stylus force is adjusted by means of a coil spring, adjustment being possible within a gram. Tracking error is less than 2.5 deg. The plug-in head is provided with 4 terminals and will accommodate any style of cartridge. Primo Co., Ltd., 2634 Mure, Mitaka-shi, Tokyo, Japan. User net price: $2,400 (in Japan).

**REK-O-KUT**
- "Omni-Balance" Tonearm. The new Rek-O-Kut Model 320 tonearm can be balanced with any cartridge by means of "Omni-Balance," its means of this new feature (patent pending) the arm can be adjusted for optimum bearing loads and lateral balance. A convenience is the anchored single-jacket cable which terminates in two color-coded plug-in lugs, two shielded and a ground wire. The arm is designed to be balanced statically with the cartridge installed and then the spring-tensioned balance control is set at the desired stylus force, from 0 to 6 grams. The gimbal mounting assembly includes twin sets of five-ball, one-millimeter bearings to provide what the company describes as "the freest vertical and lateral motion found in any tonearm today." The arm is mounted to the base through a single hole, with a single nut being tightened to secure it. Rek-O-Kut Company, Inc., 38-10 108th St., Corona 68, N. Y. User net price: $229.95.

**H. H. SCOTT**
- Integrated Arm and Cartridge. The London-Scott Model 1000 was the result of the combined efforts of London Recording Laboratories and the H. H. Scott engineering staff. Frequency response of 20 to 15,000 cps ± 2 db, and compliance is 3.5 x 10^-6 cm/dyne. Input is 7 mm in the stereo connection. Stylus radii is 0.5 mm, and output impedance is 4000 ohms per channel at 400 cps. Recommended load is 47,000 ohms, and channel separation is better than 20 db. Tracking force is 3.5 grams. The overall length of the arm is 12.5 inches, and the height adjustment range is 1 1/4 in. to 2 1/2 in. above the mounting board. The assembly is complete with arm rest and all mounting hardware and templates, as well as all connecting cable. H. Scott, Inc., 111 Powder Mill Road, Maynard, Mass. User net price, $59.95.

**SHURE**
- Stereo Tone Arm. Modern, high-compliance light-tracking cartridges require arm balance of a high order in all planes to deliver undistorted sound. The new Shure arm pivots on drag-free precision bearings and easily made adjustments for balance, stylus force, arm height, and—for the first time—overhang for any type of cartridge mounting are provided. Available as model M232 (12") or as Model M236 (18") the arm comes with detailed instructions for mounting most of the available cartridges on the market. Removable head is designed to hold cartridge on its mounting plate by single screw through a slot in top of head for first-time overhang. Direct-reading stylus-force gage has instant disconnect, and "micrometer" counterweight assembly permits ideal static balance check. Shure Brothers, Inc., 225 Hartley Ave., Evanston, Ill. User net price: $325, $299.95; M236, $319.95.

**SME**
- Precision Pickup Arm. Featuring an arm mount that permits overhang adjustment without the need for changing original mounting holes. The British-made SME arm employs a mounting plate with a long slot in which the base of the arm may be moved forward and forward as required. The arm rests on knife-edge bearings, and two counterweights are used, one to adjust static balance with the smaller one at the zero position, and then the second weight is moved to the desired stylus force. Lever-operated arm lifter is provided, with hydraulic "dashpot" arrangement to allow gradual set-down of arm even though lever is moved rapidly. Accommodates all standard mono and stereo cartridges, and head is interchangeable with those of the Sumiko type. SME Ltd., 15-26 City Line Center, Inc., 7644 City Line Ave., Philadelphia 31, Penn. User net price: Model 3000 (12") $387.95; Model 3010 (16") $499.95. Anti-skating adjuster .......................... $4.05.

**PHONO PICKUPS**

**ADC**
- Pickup Can Track at Less Than 1 Gram. A new stereo cartridge, model ADC-1, that can track at less than 1 gram has been introduced by Audio Dynamics. Featuring extremely high lateral and vertical compliance, 20 x 10^-6 cm/dyne, it is said to reduce record wear to a minimum. The low tracking force is attributed to the fact that the dynamic mass of the moving system is smaller than any other cartridge now available. As a result the resonance of the moving system is of small magnitude and has a frequency well above that to which human ear is sensitive.

The stylus of the ADC-1 is easily replaced without special tools; the basic design assures correct positioning. With provision for mounting on either 7/8-inch or 7/16-inch centers it can be used in virtually all tone arms. Sensitivity of the cartridge is 7 millivolts per channel plus or minus 2 db at 1000 cps and a velocity of 5.5 cm/sec. Frequency response is within ±1 db from 10 to 20,000 cps. Channel separation is 30 db from 50 to 7000 cps. Stylus tip radius is 0.6 mils. Audio Dynamics, 1677 City Ave., Ridgewood 27, New York. User net price, $18.95.

**ASTATIC**
- Ceramic Stereo Cartridge. Combining the advantages of the ceramic cartridge with those of the magnetic cartridge is the goal of the Astatic Model 451D cartridge. Being a ceramic cartridge it has a much greater output than does a magnetic cartridge and, of course, is impervious to magnetic hum induction. Some of the drawbacks of the ceramic cartridge have been the relatively high tracking force and the need for separate inputs. The Model 451D can track at forces as low as 1 gram and, with the matched networks supplied with the cartridge, it can be plugged into magnetic inputs without change in the amplifier. Frequency range is 20 to 20,000 cps. Output voltage is 0.2 volt direct at 1000 cps at 5 cm/sec and 10 mv at magnetic input under the same conditions. Channel separation is nominally 30 db with each channel balanced within 2 db at 1000 cps. Stylus comes with 0.7 mil diamond tip. Astantic Corp., Connellsville, Ohio. User net price, $27.50.

**DYNACO**
- Stereodyne II Cartridge. Utilizing the variable reluctance principle, this cartridge made by
by Bang and Olufsen of Denmark is designed for superior reproduction from either mono or stereo microgroove records. It has a frequency response from 30 to 15,000 cps ± 2 db, compliance of 5 x 10^-4 cm/dyne, and an output of 7 mv per channel for a stylus velocity of 5 cm/sec. Channel separation is better than 22 db, and tracking force is from 2 to 4 grams. Recommended load is 47,000 ohms for rated frequency response. The unit employs an unusual construction, with the entire moving element being enclosed in a plastic case permanently attached to a metal shell surrounding the body of the cartridge. It is mounted at an angle, as shown. The mechanism consists of a light muntinal cross which is attached to a slender aluminum tube with the stylus affixed to the end. Four terminals. User net price, $29.50. Dynaco, Inc., 3912 Powelton Ave., Phila., 4, Pa.

EMPIRE

- **Stereo/Balance Cartridge.** Featuring wide frequency response and low tracking force, the Empire model 106 is a high-quality stereo cartridge at moderate cost. Frequency response is 15 to 20,000 cps ± 2 db with usable output at 30,000 cps. Output voltage is 10 millivolts per channel balanced within

- **ESL**
  - **Stereo Cartridge.** The new C90 cartridge is of the electrodynamic type, and utilizes

**FAIRCHILD**

- **Low Mass Moving Magnet Cartridge. Designed to fulfill professional studio playback requirements, the Fairchild SM-2 can be used in high fidelity arms and changers. Although compliance is high (5 x 10^-4 cm/dyne), the stylus assembly is still rigid enough to track high-level stereo records without failure. The stylus utilizes a 0.5-mil-diamond tip and the dynamic mass is 2 milligrams. Tracking force is 2.5 grams and the output is 5 mv at 3.8 cm/sec. Compliance is 600 mhs per channel. Frequency range is 20 cps to 15,000 cps. Fairchild Recording Equipment Corp., 14-40 45th Ave., Long Island City, N. Y. User net price, $37.00.

**GRADO**

- **Moving-Coil Stereo Cartridge. Similar in design to the "Laboratory Series" cartridges, the Grado "Classic" employs a moving element consisting of a hollow plastic cube on which are wound two coils and from which extends the stylus bar. This cube is supported in a rubber "nuzzle" which serves to hold the coils in the magnetic field as well as provide the necessary damping. Frequency response is 10-30,000 cps. Inter-channel output balance, 0.5 db; frequency balance, 0.5 db. Output, 6 mv at a stylus velocity of 10 cm/sec; Impedance, 150 ohms; tracking force, 3 grams. Input load, any value over 5000 ohms. Channel separation, in excess of 20 db. Grado Laboratories, Inc., 4014 Seventh Ave., Brooklyn 20, N. Y. User net price, $37.50.

**NEAT**

- **Stereo Cartridge.** Manufactured in Japan by one of their better-known high-fidelity manufacturers, the Neat VS-500 stereo cartridge employs the moving-magnet principle for maximum channel balance and separation. Featuring simple stylus replacement and complete freedom from induced hum, the VS-500 delivers an output of 5 mv at 1000 cps at 3 cm/sec. Optimum stylus force is 3 to 5 grams with a 0.7 mil stylus. Frequency range is 20-20,000 cps. Channel balance is within 1 db at 1000 cps and channel separation at 1000 cps is 30 db and 25 db at 10,000 cps. EIA standard mounting is used. Neat Unkyo Denki Co., Ltd., No. 4-1 chome, Kanda Huto-cho, Chiyoda-ku, Tokyo, Japan.
SONOTONE
- Ceramic Stereo Cartridge. A turnover stereo cartridge for all record speeds, the new Sonotone model 9T also plays monophonic records. Frequency response of the 9T is plus or minus 1 dB from 20 to 17,000 cps. A compliance of 2.5 x 10^-3 cm/dyne permits stylus force of 2 grams for professional pickup arms and 3 grams for changers. Output is 0.4 volts, the feature of the cartridge is the gold-plated metal cover which shields the cartridge both mechanically and electrically. Stylus tip is adjustable to bring the stylus height and stylus pressure within the standard compliance of a needle guard.

SHURE
- Professional and Custom Upgrades. These two cartridges, M5-N21B and M7-N21D, are designed for mounting in transcription arms and in record changers (which do not exceed 2.5 grams tracking force). Both have frequency responses of 20 to 20,000 cps ± 2.5 db, outputs of 5 mv per channel, and channel separations of more than 20 db at 1000 cps. Recommended load impedance is 47,000 ohms. The Professional model M5-N21B has an inductance of 365 milli-gauss per volt, a d.c. resistance of 330 ohms, and a compliance of 9 x 10^-9 cm/dyne when used with N21B stylus. The Custom model M7-N21D stylus has an inductance of 400 milli-gauss, a d.c. resistance of 400 ohms, and a compliance of 9 x 10^-9 cm/dyne. Both have four terminals and are standard mounting dimensions. Shure Brothers, Inc., 222 Hartrie Ave., Evanston, Ill. User net price: M5-N21B, $17.25; M7-N21D, $16.75.

TAPE RECORDERS

SONOVox
- Moving-Magnet Stereo Cartridge. The Sonovox SNX-1 represents a refinement in moving magnet cartridges. The magnet is spherical in shape thus achieving a uniform field. Exceptionally low noise and high compliance of the vibrating system produce minimum record wear. Frequency range is 20 to 20,000 cps at 5 cm/sec at 1000 cps. Tracking force is 2-3 grams with a 0.5 milli-diamond stylus. Channel separation is better than 20 db at 1000 cps. Sonovox Co., Ltd., 101 Tokiwamatsu-cho, Shibuya-ku, Tokyo, Japan. User net price, $18.00.

WEATHERS
- Capacitance Stereo Pickup System. Pulling another rabbit out of the hat of tricks, Weathers has again come up with something new in pickup systems. Utilizing a system wherein a change in capacitance is produced by the movement of the stylus, and then amplifying it in an "amplifier bridge circuit", this system is as careful with records as any pickup system can be. The pickup arm, the arm position, the platter, the load, the stylus, and the pickup arm position are all critical factors in obtaining perfect reproduction. The arm is a high-quality McGee model 934 tape player at $20.00 and 936 tape deck, in a larger portable case with a two-motor stereo amplifier and two tone-arm speakers which are four-footers from the end of each unit. The amp is an 18-inch unit, and the speakers are 10-inch units. The machine is also capable of playing four-track tape.

AMP Ex.
- Portable Stereo Tape Recorder. The Ampex model 570 is a portable stereo tape recorder featuring a 7 tape supply, three channels, two magnetic inputs included. The machine is equipped with a two-channel stereo amplifier, two Tone-arm speakers which are four-footers from the end of each unit. Additionally, the machine is capable of playing four-track tape.

AMP Li.E.
- Transistorized Portable Tape Recorder. The Amplifier Corp. of America Model 612 Series "Trac-Magnette" is a transistORIZED portable tape recorder with a spring-wound motor, a multi-purpose VU meter and a built-in amplifier. The machine is available in single or dual track. It consists of a balanced fly-ball governor and an output of only 0.1 per cent at 1/4 or 15 ips. Six models are available with speeds ranging from 15/16 ips up to 15 ips. Four of the models are temporarily unavailable.
Stereo and plays 610 Series America, $445.00 to $505.00. Amplifier Corp. dual track, the remaining two are single track. The six models range in price from $415.00 to $505.00. Amplifier Corp. of America, 306 Broadway, New York 13, N. Y. 610 Series portable 6 models . . . $315.00-425.00

BELL

• 4-Track Stereo Playback Recorder. The Bell Model 337 records and plays back 4-track stereo and plays back 2-track stereo. The "piano key" mechanical controls permit simple control of the mechanism. Also, pressing the speed keys automatically switches the preamp record equalization to coincide with the speed. Frequency response is 60 to 12,000 cps plus or minus 3 db at 25 ips and 18 cps to 12,000 cps plus or minus 3 db at 3 3/4 ips. Signal-to-noise ratio is better than 50 db. Flutter is less than 0.2 per cent at 75/2 ips and 0.25 per cent at 3 3/4 ips. The T-337 has a Bell Model RP-320 stereo preamplifier built in. The frequency response of the RP-320 during playback is 60 to 20,000 cps. The recording sensitivity is 2.5 mV at the microphone input, 100 mV at the high level input. Total harmonic distortion of the preamplifier is less than 1 per cent at 12-volt playback and maximum recording level. Bell Sound Division, Thompson Radio Machine, Inc., Columbus, Ohio. User net price, $334.55.

CONCERTONE

• 4-Track Stereo Tape Recorder. Permitting the playing of an entire reel of quarter-track tape without attention, the American Concertone Reverse-4-Matic model 205-HI provides up to 11 hours of continuous stereo playback at 1 3/4 ips or three hours at 3 3/4 ips. Performing all functions of the normal 4-track recorder and playback machines, the 205-HI features two separate 4-track playback heads, one for each direction of tape movement, thus ensuring optimum fidelity in both directions. Another feature of the 205-HI is its use of three hysteresis motors for maximum smoothness of tape motion. Concertone is also making available a kit, No. 510, for converting 4-track versions of the model 500 for automatic reverse operation. American Concertone, Inc., 9410 W. Jefferson Blvd., Culver City, Calif. User net price, $729.50.

CONCORD

• Stereo Tape Recorder. The Concord 4019 tape recorder and plays 1-track and 2-track stereo and mono tape. It combines the 400-D tape deck and the Model 400-HI.
now hear this!

You are looking at the new ADC-1 stereo cartridge. It is the most effortless cartridge available today. You'll hear subtleties of timbre and tone you never suspected were in your discs. Hear it at your favorite dealer.

**KNIGHT**

- **1-Track, 2-Speed Tape Transport.** An economy priced transport, the Knight KN-4200 provides performance that far surpasses the price tag. The KN-4200 has a record/play head plus an erase head and provision for adding a third monitor head when desired. The heavy-duty motor drives the dynamically balanced capstan flywheel by means of a fabric covered rubber belt.

**MAGNECORD**

- **3-Head Stereo Recorder.** Designed for professional use, the Magnecord Model 748 is a 3-head machine available in several options to suit individual requirements. The basic machine records and plays two-channel stereo and it is available with or without a portable case. The 748 is also available with a fourth head for 4-track playback, again with or without the portable case. Although the standard machine offers 7 1/2-34 ips tape speeds, the 748 is available with 15-7 1/2 ips speeds. Timing accuracy is plus or minus 3 seconds in 30 minutes. Frequency response is plus or minus 2 db from 40 cps to 15,000 cps at 7 1/2 ips and from 50 cps to 8000 cps at 3 1/2 ips. Signal-to-noise ratio is better than 5 db per channel. Flutter and wow is 0.15 per cent at 7 1/2 ips and 0.25 per cent at 3 1/2 ips. Reels up to 10 ips can be handled. The erase head is split so that either or both channels may be selected. Magnecord Dept., Midwestern Instruments, P. O. Box 7509, Tulsa, Oklahoma. User net price, $369.50.

**NAGRA**

- **Portable Professional Tape Recorder.** The Nagra IIIB is a completely transistorized professional, 3-speed (3 1/2, 7 1/2, 15 ips) tape recorder. Incorporating three heads and a servo-controlled motor, the Nagra IIIB has a speed constancy of 0.2%. Wow and flutter is 0.15% at 15 ips and 0.2% at 7 1/2 ips. Signal-to-noise ratio is 58 db or better. The recorder operates from any 12-volt source or from the self-contained flashlight batteries; battery condition and level being indicated on the built-in meter. Output is 4.6 VU at 600 ohms. A monitor-speaker is built in.
NEWCOMB

Stereo Tape Recorders. Now available in the 1/4-track version as Model SM-310-4 as well as the earlier 1/2-track Model SM-310, the Newcomb stereo tape recorder is "cybernetically engineered for intuitive operation." Control of the tape transport is centered in a "joy stick" which is sensibly moved to the left to rewind, to the right for fast forward, and toward the operator for record and play modes. Both models will operate either vertically or horizontally and take a 3" to 10 1/2" reel, as well as XAB hubs. Two speeds, 3/4 and 3 1/4 ips, are provided, and flutter is less than 0.2% at the higher speed, less than 0.25% at the lower. Response is from 30 to 12,000 cps 2 dB at 3/4 ips, and 40 to 10,000 cps at 3 1/4 ips. Equalization is in accordance with NAB standards, and output is approximately 1.3 volts from cathode followers. Two input jacks are provided for each channel, one for microphone and one for high-level sources. Newcomb Audio Products Co., 6384 Lexington Ave., Hollywood 38, Calif. User net prices: SM-310-4, $499.50; SM-310, $499.50.

NORELCO

Lightweight 4-Track Stereo Tape Recorder. A lightweight version of the Norvelo "Continental" tape recorder, the new "Continental" 200 (Model EL3541) operates at 7 1/2 ips and incorporates a narrow-gap, 4-track record-playback head. The "Continental" 200 will play standard 4-track stereo tapes (head output) through an external system, and will record and play back monophonically on 4-tracks. The 200 is provided with Input Jacks for recording from microphone, tuner, or phonograph, with facilities for mixing (twosources), and for "sound-on-sound" recording. The machine also includes an output Jack for monitoring with headphones. The 200 may also be used as a self-contained public address amplifier and speaker system. A foot switch is available as optional equipment. North American Phillips Co., High Fidelity Products Division, 280 Duffy Ave., Hicksville, L. I., N. Y. User net price, $179.50.

ROBERTS

Automatic Repeat Tape Recorders. Featuring a "Magic Memory" automatic repeat, the new Roberts Models 440 and 114 DPA repeat all or any part of the tape by simply pushing the "repeat" button and setting the "repeat" knob back to the desired position. Complete 1800-foot tape rewind takes just sixty seconds; thus with the "Magic Memory," these Roberts recorders can play for a full nine hour period with just six one-second silent intervals during that time. The Model 440 comes complete with power amplifiers and forward facing stereo speaker system, and is priced at $699.50. The 114 DPA is identical to the 440 except that it comes without the built-in power amplifiers and speakers. It is priced at $499.50. Roberts Audio Products, 328 W. 57th St., New York 19, N. Y.

LOOK AGAIN...

IT'S THE EXCITING NEW ERIC 3560T, 3 CHANNEL STEREO 50 WATT "MUSIC POWER" AMPLIFIER. Ladies admire the satin-gold decor finishes... men can't resist the realism of sound reproduction. Here is tomorrow's amplifier... today! Exclusive visual balanced power output indicator lets you pre-set and determine actual output to speakers. Clean response - 20 to 20,000 cps; total harmonic distortion less than 1% and individual controls for the ultimate in sound reproduction. A touch of the finger and sound comes alive in a way you've never experienced before! Pure sound... excitingly crisp... brilliant! Only Eric, the West's leading AM/FM tuner manufacturer, could develop this advanced amplifier so perfect in engineering and so low in price. $149.95... slightly higher in the East. Write today for complete specifications.

ERIC MULTIPLEX ADAPTOR, MX 6000. Another example of Eric fine engineering and low price! Only the MX6000 has the exclusive "Stereo Announcer" which automatically lights up when stereo is being broadcast. The unit is compatible with all Eric tuners and most others using wide bandwidth. Additional amplifier stage assures strong "fringe area" reception. Separate balance control for optimum separation. Audiphile net... $99.95. MX6000 semi-automatic... $19.95.

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NEW!
FAIRCHILD
TURNTABLE KIT!

2 Speed Turntable Kit, Easy to Assemble Using Famed Fairchild Technical Design. Complete With Mounting Board. A Great Money Saving Buy For All Kit Builders.

MODEL 44D-2K only $55.00

FAIRCHILD RECORDING EQUIPMENT CORP.
Circle 94A

notice to owners of AR speakers

Until now, AR speakers have been sold under a one-year guarantee covering materials, labor, and freight to and from the factory.

On the basis of our field experience we are now able to extend this guarantee to five years. The extension is retroactive, and applies to any AR speakers bought since 1956.

AR speakers are on demonstration at AR Music Rooms, on the west balcony of Grand Central Terminal in New York City, and at 52 Brattle Street in Cambridge, Massachusetts. No sales are made or initiated at these showrooms.

Circle 94B

NEW! FAIRCHILD TURNTABLE KIT!

2 Speed Turntable Kit, Easy to Assemble Using Famed Fairchild Technical Design. Complete With Mounting Board. A Great Money Saving Buy For All Kit Builders.

MODEL 44D-2K only $55.00

FAIRCHILD RECORDING EQUIPMENT CORP.
Circle 94A

notice to owners of AR speakers

Until now, AR speakers have been sold under a one-year guarantee covering materials, labor, and freight to and from the factory.

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Circle 94B
tapes both monophonically and stereophonically. The bias frequency is 80,000 cps. Dual independent VU meters indicate level during recording and playback. Viking of Minneapolis, Inc. 9000 Abbe Ave. South, Minneapolis 20, Minnesota. User net price, $199.50.

**MICROPHONES**

**AKG**

- **Stereo Microphone.** Intended for stereo recording and broadcasting, the AKG D88 microphone consists of two dynamic elements in the same case. Each element has a cardioid pattern and their axes are 90° apart, so that unusually wide stereo coverage may be achieved. The elements may also be paralleled for wide-angle monophonic use. Ideal for FM-stereo control and broadcasting, the AKG D88 is the ideal stereo microphone. The AKG D88 microphone is available in different models suitable for various professional applications.

**ALTEC**

- **Polyester Film Microphone.** One of a new line of modestly priced professional-quality microphones, the Altec model 683A features a polyester-film diaphragm and a sintered bronze filter. The use of polyester film as the diaphragm material, instead of aluminum, greatly increases the ruggedness of the diaphragm thus making it as rugged as the sintered bronze filter. The sintered bronze filter placed in front of the diaphragm protects it from foreign particles such as ferrous filings, dust, and water.

**CHARACTERISTICS**

- **Type:** Cardioid dynamic.
- **Frequency range:** 45 to 15,000 cps.
- **Output impedance:** 30/50, 150/250, and 290,000 ohms (selected by connections in microphone cable plug).
- **Output level:** ±0.1 dB/dyne/cm².
- **Hum:** < 120 dB (ref. 10³ gauss).
- **Weight:** 11 ounces (not including cable and plug).

(Continued on page 99)

**STEREO DEMANDED IT!**

**THE NEW "MONITOR" DUAL CONCENTRIC**

(whose advanced co-axial date)

**INTEGRATING**

- **New revolutionary magnetic shunt circuit increasing useful low frequency flux by more than 20%.**
- **Unique treatment of low frequency diaphragm surround providing improved response and stability.**
- **New acoustic balance cavity improving high frequency response, reducing distortion.**

Tannoy engineers have produced a speaker of unsurpassed quality, already being used as a 'Monitor' by world-wide recording, radio, and television companies. The extended range and increased efficiency of the low frequency unit make it ideal for use in relatively small enclosures, whilst still maintaining the "presence" of unrestricted sound. This, combined with the fully integrated sound source of the 'Monitor' Dual Concentric makes it especially suitable for stereophonic reproduction.

**WRITE FOR DETAILS**

TANNIO (CANADA) LTD., 36 WELLINGTON ST. EAST, TORONTO, ONT. 
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**CONCERTONE WORLD’S FINEST TAPE RECORDER**

Exclusive REVERSE-O-MATIC on world famous 505

Only Concertone brings you the revolutionary new Reverse-O-Matic...a unique, unprecedented playback feature that plays 4-track stereo tape from end to end and back again! No changing reels! Doubles unattended playing time! Doubles your listening pleasure! Two permanently stationary heads assure perfect tape alignment...optimum fidelity! The Concertone 505 with exclusive Reverse-O-Matic is truly the most versatile instrument available in the professional stereo tape recorder field. Standard 505-2 or 4-track stereo recorder from $495. Model 502-4R Reverse-O-Matic from $579.50.

At Better Dealers Everywhere

See CONCERTONE at your dealer. Mail coupon for name of nearest dealer and complete information. Dealer inquiries invited.
FM—STEREO
(from page 92)

A sufficient amplitude of pilot subcarrier is injected into the oscillator tank circuit to lock the oscillator not only on frequency but within a few degrees of phase relative to the incoming pilot subcarrier appearing in the composite stereophonic modulation.

For monophonic reception it is desirable to remove the contribution of the stereophonic subcarrier channel from the output of the left and right channels by killing the oscillator so that the beam deflection demodulator tube electron beam rests between the two anodes, thus equally dividing the beam current between the two anodes.

Adjustment

The circuitry as shown in Fig. 6 is quite simple to adjust for optimum demodulation. The sequence of tuning is as follows:

The 67,000-eps trap shown in the filter portion of the schematic is tuned until a null at 67,000 eps appears at the output of the filter. The anode resonant circuit of the triode portion of the 6AU6 is tuned for maximum pilot subcarrier amplification. The oscillator tank circuit is then adjusted so that the oscillator is locked to the incoming pilot subcarrier frequency (an aural test is adequate here). The doubling tanks, both primary and secondary, in the anode circuit of the electron-coupled oscillator are tuned for maximum output at 38,000 eps, as observed at the deflection plates of the beam deflection demodulator tube. The signal generator is modulated with a composite stereophonic signal having the modulating condition L = R. Each of the carrier tank circuits, namely: anode circuit of the cathode follower, oscillator tank circuit, electron coupled frequency doubling tank circuit, and the driving tank circuit for the beam deflection tube is then retouched for maximum recovered audio at both left and right outputs.

The modulating condition of the signal generator is then changed to left channel modulation only. The 500-ohm matrix control in the cathode circuit of the beam deflection demodulator tube is adjusted for a null at the right channel output. If the matrix resistors are well matched and the gain characteristic of each anode circuit of the beam deflection demodulator tube are well matched, then a null condition will also exist at the left output when a right only signal is applied to the signal generator.

GRADO “Truly the world’s finest...”

What customers say about the new GRADO STEREO CARTRIDGES

"Fantastic sound, equal to the finest tape I have ever heard"

"That one year unconditional diamond warantee plus the five year guarantee against wear, is the best yet. Excellent sound"

"I was only able to purchase an inexpensive system, but my Grado makes it sound like twice the money"

"The greatest improvement to my system for the least money. Difficult to believe I am listening to records"

"The quietest surface I have ever heard. The sound is a dream come true"

NEED WE SAY MORE?

GRADO SENATOR SERIES STEREO CARTRIDGE audiophile net $24.95
GRADO CLASSIC SERIES STEREO CARTRIDGE audiophile net $37.50
GRADO LABORATORY SERIES CARTRIDGE audiophile net $49.50
LABORATORY SERIES TONE ARM net $39.50

For further information write: GRADO LABORATORIES, INC.
4814 Seventh Ave., Brooklyn 20, N. Y. • Export—Simontronic, 25 Warren St., N. Y. C.

RECORD REVIEW
(from page 75)

many unexpectedly contrasted sub-sections woven into a continuous whole. It is top Bach, a style one could wish he had not put aside later as "antique".

I do wish I could recommend this major pair of works heartily. But the effect of the excellent young solo singers being dragged rigidly along by the Craft human metronome, the casually rushed big moments, the lack of sense of restitative "speaking" as a contrast to the arias, add up to a necessary condemnation. The sprightly professional chorus trained by Margaret Hills (who can be pretty rigid herself) is about the best element here— if one doesn’t count some extremely fine detail work among the instrumental players.

AUDIO ETC
(from page 16)

Horrible racket. The birds positively shrieked at me, like those utterly fake bird calls you get in the movies when somebody wants to indicate that spring has come at last.

PISTON I: EXPRESSING THE SOUL

I’ve been saving a publicity release that came to me earlier this year from the Philadelphia Orchestra, concerning a new modern symphony that was to be performed in one of the Philly’s weekly concert programs, a work by the American composer Walter Piston. Prof. Piston just happens to have been my own teacher in my salad days. He taught advanced harmony and beginner’s orchestration, and
I took both of these courses under his benign and gently satirical direction; so, of course, my eye caught his name quickly enough. It was his Seventh Symphony that won him his world premiere with the Philharmonic in a forthcoming concert.

I should say that Prof. Piston, in the far-off college days of my education, got my slightly grudging respect by his obviously keen observation of human foibles, carefully hidden by him under a mask of comfortable indifference. Piston never orated nor emoted. He put up an elaborate act of shiftlessness, as though teaching were no more than a pleasant bore. He affected to be lazy; he'd rather give a high mark to anybody (he didn't to me, alas), than bother with a lot of fancy arguments. He underplayed everything he did, being ultra-careful never to suggest that it might be exciting or interesting—be even forbid.

Even the dumbest of us students caught onto the act; the more deadpan was Prof. Piston, the more important was the stuff he gave us in that slow, monotone drawl of New England casualness.

My particular purgatory came one day during our weekly set-to with a performing member of the RSO—the Boston Symphony—who came to class in order to play the exercises we had composed for his instrument. This was obviously Piston's favorite moment; the opportunities abounded for that quietly devastating satire that was his specialty. Three or four words out of the side of Piston's mouth and your musical pretensions were demolished in a heap.

I was a very young super-idealitst then. Most of the students tossed off elaborately professional and vastly complex tidbits for the week's solo instrumental player to try—perhaps it was an oboe, or a bassoon, or a trombone. Nothing looks as professional on paper as a beginner's technical exercise, springing his elders! The only trouble, of course, was that half of them were completely unplayable. These kids really didn't know from nothing, but they had to put on the big bluff. So Piston would sit there, trying to hide a quiet smile, as his friend the bassoonist would huff and puff through one preposterously elaborate exercise after another, as prepared by us novices. A marvelous way to show up false schoolboy pretensions and gain real, down-to-earth knowledge, thus to have your own attempts actually performed, read at sight before your eyes and those of your rivals and fellow-students by a top professional in the field.

Well, as I say, I was a young idealist. No flabby scale passages and roulades and technical tours-de-force for me. I wanted to Compose Music. Of course I really didn't know how very well, but my soul was unshakable; I wasn't going to allow mere technical virtuosity to impede my expressiveness, nor to sully the simplicity of my Mozart-like melody.

One day I composed a particularly lovely little tune for some instrument or other, let's say the bassoon. I slaved over it for hours, shaping the thing down to utter simplicity; I was enraptured with my own highmindedness. That day, after seven or eight of the typical flabby virtuoso exercises had been negotiated with reasonable success by the solo player, each one more elaborate than the last, it came my turn. And out floated my lovely, simple, undecorated little tune, straight from Heaven—or so I felt.

A dry half-voice came from the rear of the room. Was it merely a clearing of the throat, Mr. Piston professing to hate early-morning classes; or was it a chuckle? I couldn't say. But my world was demolished with four drawled words. "Grumph," said the voice, to no one in particular, "canily expressing his soul."

I blushed pink and sank practically through the bottom of my chair; I was put down in the flower of my youth as a composer! Nobody dared titter; but the titters absolutely roared in my imagination. I nearly wept on the spot; I assure you. And from that time onward I took care to avoid any soul-expression within a half-mile of the devastating Prof. Piston.

It did not occur to me until at least twenty years later that just possibly Prof. Piston had been on my side; that in his own gruff way he might have—maybe—been passing a backhanded compliment to me, for a reasonably musical exercise, if a somewhat naive and simple-minded one. Perhaps if I'd had a little more gumption I might have been a composer after all. Bit late to start now.

What was I saying? Oh yes, about Professor Piston's latest Symphony and his very decidedly keen sense of observation, behind that mask of dry indifference. Mr. Piston is quoted by the Philadelphia Orchestra people in the following terms, concerning his Symphony, and I think you will see the point. This composer listens and observes, not only to music but to the impact of music in the actual sound. That is our business, in audio.
PISTON II: THIN PISTON

Speaking of Pistons—this seems like an opportune moment to note in advance a speaker development that has me intrigued on theoretical grounds, the introduction of a new Jensen line of speakers (both within cabinets and separately as driver units) which are "actual" pistons. My interest at this point is theoretical. You see, for years and years it has been dunned into all of us that the theory of loudspeaker operation depends on a moving piston that pumps air, straight ahead with a forward-and-backward motion. In actuality, these "pistons" have been something slightly less than pistons as matched up against the theoretical ideal. Most cones, over the years, have been variably flexible, pushing out energetically from their centers, pushing from their outer edges with less excursion because of the necessary mounting and centering of the piston element itself. In their complex motions, cone-pistons have managed to produce some notably piston-like sound over these decades, i.e. sound of reasonably push-pull high fidelity. Cones break up into weird and involved subpatterns, modes of vibration that go round and across and back; but together with the coupled enclosure, many a complicated cone action has produced remarkably impulsive and sometimes rather galling sound, ingeniously cancelling out faults by playing them one against another, hauling in as it were third force coupling and the whole electrical and magnetic circuitry as part of the intricate adjustment. So we've had pistons of paper that, though not really pistons at all, produce piston-like sound-results. Not to perfection, for the loudspeaker still is the biggest distaster in our business by a wide margin. But to an ingeniously high degree of semi-perfection.

Moreover, thanks to the newly-high compliance built into recent speakers (thanks to the many new materials, new papers, and new plastics now being put to work), some of our new cone pistons act mightily like a true piston, the pistons in and out. The edge pumps in and out in very nearly the same path. The cone itself remains reasonably rigid, even if it is pushing air at angles, diagonally to the forward direction.

So—along comes, for the first time that I know of, a real piston-like type—true pistons are pretty close to it, a sort of infinite piston limited by the finite edges of the cone. Unfortunately possible in woofer sizes, this is an actual piston element as its front end, instead of the traditional curved or pyramidal cone shape. This Jensen speaker for the first time really looks the way the theory looks on paper. It pushes flat, straight and neatly ideal in the effort to go back again. It has a compliant edge mounting like standard speakers and a center mounting also of relatively normal sort, but the pushing area is a round plane-literally. A disc. Really looks funny, to see it on paper, diagrammed or in photos.

Now the interesting question is, how are these piston-speakers going to sound? I've found the literal application of this theory to a practical rounded woofer result in a dramatic improvement, as per theory. dusk—this is where I stop. At least for now. I don't know. I haven't heard. But I can give a smart guess that I think will come no one, nor step by step, because there is no need to do so. I'll be willing to bet that Jensen's new speakers are excellent in sound. However, I bet, too, that many another speaker with a cone shape can come up in actual practice with very good sound too, piston or no piston.

It is an old story, I think, that in many a technology the efforts towards ingenious compromise as a go-between, as in itself simple but unattainable usually end up with results almost as good—and in no face practicality. As the blind man sharpens his ears and his touch in the endless search for the unattainable sight, so we perfect our multitudinous compromise every year after year with persistence, seeking the unattainable ideal until the ideal model itself becomes almost superfluous. Almost, but not quite. We can never put our simple, idealized models entirely aside, even when the trickler comes along and seems to duplicate the very model itself.

The chances are, I'd guess, the Jensen's pistons are much too good to be impractical. Rather, it seems to me that we'll find that this development is more significant as another practical step towards happily unattainable perfection, a step made possible by the persistence and developments in precisely controlled plastics and papers. Nevertheless, to turn out a commercial speaker that really does have a flat piston-like element up front is quite a feat. We'd better keep our eyes on it and, more important, we'd better listen and compare.

Oversquare

Of course the really practical aspect of Jensen's piston speakers is not their piston-ness but a much more down-to-earth aspect, their thinnest front to back. Never
Saw such odd shapes! The impact that will hit first of all when these speakers get around in a room is obviously one of the new shallow-depth enclosures they make possible. As the auto engineers put it, this piston driver is “overwound”—decidedly.

Jensen is well aware of this. The company has designed a series of enclosures to test out in practical form a set of alternatives in the enclosed air space, as between back-to-front thickness and side-wise dimensions. The thinner the enclosure, the bigger its front area. Jensen's thinnest is pretty close to the “picture frame” concept pioneered by the electrostatic and condenser types recently in such piston-like rectangles as the Bi-Phonic Coupler speaker.

I suggest that we take a long and close look at this thin-line feature; it is clearly the coming decor bonanza, and with reason.

If look-a-like boxes were a bonanza a few years back because of living room convenience, then thin-line speaker boxes, that stand free as a panel or can fit against a wall like a picture, are going to be an equally big hit, given even reasonably good sound. Compromise—yes. Though a good audio engineer hates compromise when it means compromise in ideal sound quality, every good practical engineer knows that compromises are the stuff of his life—and that the better the ingenuity he can summon up to compromise with, the better the ratio, say, of bass to space, the happier will be his engineering life. I would suggest that there is clear promise of continued useful compromise with ingenuity in this coming area of the ultra-thin speaker box. There is promise, because clearly we are just now getting well into the numerous constructive advances that will allow better speaker systems that are not at all thin in tone. (It’s easy enough to make a thin speaker that sounds terrible; there’ll be plenty of them, too.)

So, if you want my real estimate of the significance of Jensen’s piston units, it is simple enough. These are thin pistons. That’s what matters. Where else will you find a big woof-a with a total depth of something like three inches? Boy, that’s really a practical piston.

LIGHT LISTENING
(from page 50)

at his disposal in the band’s heyday. Luckily, we still have this music on discs in the memorable Carnegie Hall performance. In Waiting For The Robert E. Lee and Bill Hayles, Martin Marshall demonstrates a better sense of rhythm than do many band vocalists of the present. Although the aud- ience heard in the background shows full signs of content during the up-tempo selec-
tions, I would have preferred a few more slow tunes in the famous crooner manner. At only one point in this program—during a quiet personal of Where or When—do we get a sample of the gentle, easy-swinging style he patented so many years ago.

Irma La Douce/Bells Are Ringing
Richmond @ RPE 45024

In the entire catalog of United Stereo Television, this is the only widely-distribut-
ed label being offered at a $1.95 price tag. In addition to the popular orchestras of Frank Chacksfield and Cyril Stapleton, who first gained fame on the parent label of London Records, Richmond also features a unique series of show tapes made in Eng-
land by the London Theatre Company. These tapes give us a chance to hear the lyrics of leading Broadway shows without incurring the expense of the original cast performances.

No one contends that a series such as this, of which these versions of "Irma" and "Bells Are Ringing" are a vital part, competes directly with the casts that first presented the shows on Broadway. Yet, while listen-
ing to the selections from "Irma" and "Bells Are Ringing," I was tempted to concede that this English group has almost as much on the ball as the crew heard in Columbia's original cast recording. Joyce Blair is a fine Irma, win-
some in personality and believable in her suavity. Other members of the cast have the zest and crisp enunciation called for by a continental locale. That's a Crime is tossed off with just the right flair. Most Eng-
lish productions of shows that originate in this country are usually burdened by a difference in accent. In this version of "Bells Are Ringing"? the greatest surprise is in the distinctly American approach of the lead-
ing players. The leading lady's imitation of our own Judy Holliday is downright stir-
ing. The dance steps that are part of the duet "Dust in Time" are retained here for ex-
ploitation of stereo side-to-side motion. These performances may not give you as complete a cross-section of the two shows as you're apt to find in a typical original-
cast recording but they do represent an excel-
lent buy for the money.

PRODUCT PREVIEW
(from page 95)

Finish: Two-tone baked enamel, black and dark green, brown and platinum pink, or bright chrome plating.
Altec Lansing Corpn., Anaheim, Calif. (for manufacturer price, $60.00.)
681A omni-directional ........................................... $30.00
682A omni-directional ........................................... 49.50
26A desk stand ......................................................... 12.00

DYNACO
- Ribbon Microphones. Suitable for the highest-fidelity recording and broadcasting applica-
tions, the Dynaco & O Model 53 microphone uses a replaceable duranide ribbon only 0.011 in. thick and weighing 1.3 milligrams. The extremely small mass eliminates resonances within the audible range. The unit is bidirectional, which allows controlled dis-
crimination of the pick-up area and facilitates a natural balance of the primary pick-up with

Audio August, 1961

Stereo Product Preview

| Features: High impedance transformers, inputs to permit use with all studio 800, 300, 150, or 75 ohm grounded or ungrounded line systems, as well as with any high fidelity component. |
| Function: Switch converts the PHASE COORDINATOR to a dual channel balance meter. |
| May be removed from all finished wood cabinet for easy rack or panel mounting. |
| Cabinet Dimensions: 9½" wide. 4½" high, 3" deep. |
| Price: $25.50 Audiophile net at your high fidelity dealer. |

For further information write to DEPT. P

Stereo Product Preview

Stereo Sound: The Stereophonics Phasing Coordinator provides a simple and effective way to determine the phase of any audio signals or stereo high fidelity components. It may be used to measure the phase and stereo effectiveness of discs, tapes, multiplex broadcasts and microphone setups, and to distinguish honest two channel stereophonic material from pseudo or doctor-
room acoustics. When used with the Stereospacer—an acoustically absorbent "partition" between the microphones—these units provide the effect of 10 ft. separation while avoiding unnatural phase-posed effects typical of poor stereo. A 3-position switch provides music, speech, and off positions, and a built-in transformer enables operation at 50, 250, or high impedances. Model 50 is identical in all particulars except output impedance, which is fixed at 50 ohms.

**CHARACTERISTICS**

- **Frequency range:** 20 to 10,000 cps ± 2.5 db.
- **Pattern:** Bidirectional.
- **Output impedance:** Model 53—50, 250, or high.
- **High:** Model 50—50 ohms.

**Dimensions:** 7 7/8" x 1 x 13/16" dia.

**Dynamic, Microphone.**

- **Model 666** is a cardioid microphone of the dynamic type with only one moving element. The cardioid pattern is obtained through use of three sound entrances located in the microphone case at different distances in back of the diaphragm. These three entrances, each utilizing the proper acoustical impedance, combine to form one effective back entrance which varies in distance from the diaphragm in varying with frequency. This variable front-to-back distance, along with dynamic construction, affords high resistance to mechanical shock and produces virtually no proximity effect. Because of its uniform polar response, the Model 666 is especially useful in locations where ambient noise and severe reverberation are problems.

**CHARACTERISTICS**

- **Pattern:** Cardioid.
- **Frequency response:** 40 cps to 15,000 cps ± 2.5 db.
- **Impedance:** 50, 150, and 250 ohms (wired for 150-ohms).
- **Finish:** Non-reflecting gray epoxy.
- **Weight:** 1 lb.


444 "Sound Spot" .............................................. $110.00
664 card dyn .............................................. $85.00
636 omni dyn ............................................... 72.50

**NEUMANN**

- **Professional Condenser Microphone.** Contains many innovative features, the Neumann U-67 microphone is designed to anticipate future needs as well as satisfy present requirements. Features include: electronically switched directional characteristics—cardioid, omni-directional, figure 8; a newly developed input circuit which rolls off sharply below 40 cps—and which may be disabled for flat response down to 20 cps; separate "Voice-Mute" switch which raises the rolloff point from 40 cps to 100 cps; a switch to reduce

- **Impedance:** Switchable 30/50-ohms.
- **Power requirements:** N-67 power supply, 8 watts.

- **Cable length:** Normal length 25 feet; 250 feet permissible.

- **Unidirectional.**
  - **Weight:** U-67, 1-lb; N-67, 4-lb.
  - **User net price:** $45.95, Gotham Audio Corp., 2 West 46th St., New York 36, N. Y.

**NORELCO**

- **Cardioid Ribbon Microphone.** The "Avon" is the most outstanding microphone in the Reslo Mark III Series. This ribbon microphone is intended for live recording as well as stereo and critical PA applications. The "Avon" has a front-to-back discrimination of 15 db over the high- and mid-frequencies.

**CHARACTERISTICS**

- **Pattern:** Cardioid.
- **Impedance:** Switchable 30/50-ohms.
- **Power requirements:** NU-67 power supply, 8 watts.

- **Cable length:** Normal length 25 feet; 250 feet permissible.


**RESLO**

- **Cardioid Ribbon Microphone.** The "Avon" is the most outstanding microphone in the Reslo Mark III Series. This ribbon microphone is intended for live recording as well as stereo and critical PA applications. The "Avon" has a front-to-back discrimination of 15 db over the high- and mid-frequencies.

**CHARACTERISTICS**

- **Pattern:** Cardioid.
- **Impedance:** Switchable 30/50-ohms.
- **Power requirements:** NU-67 power supply, 8 watts.

- **Cable length:** Normal length 25 feet; 250 feet permissible.


**SHURE**

- **Unidirectional Microphone.** The new Shure Model 546 "Unityne III" was developed primarily for the broadcast market but is also ideal for top-quality public address installations and recording. The Unityne III features vibration isolation, improved performance, and a V-room connector.

**CHARACTERISTICS**

- **Pattern:** Cardioid.
- **Impedance:** Switchable 30/50-ohms.
- **Power requirements:** NU-67 power supply, 8 watts.

- **Cable length:** Normal length 25 feet; 250 feet permissible.

User net price, $39.95. Shure Bros. Inc., 222 Hartrey Ave., Evanston, III. The Shure line of microphones is extensive and includes all price ranges.

**SONOTONE**

- **Matched Microphone.** Intended for stereo recording, Sonotone paired "Ceramics" are acoustically matched at the factory to a toler ance of 2.0 db. Plugged into any quality inputs, the units will provide a "Matched Pair" performance. Here are a few of the models available in 150-ohms and 600-ohms versions:

- **Model 61:** Cardioid.
  - **Impedance:** 600-ohms.
  - **Power requirement:** 1 watt at 1 volt.


**Audio**

- **August, 1961**
stereo recorder, the CM-T10A feeds the tape a substantially flat signal. The heart of every Ceramite is a rugged, rubber-encased ceramic transducer which is immune to extremes of both temperature and humidity. Controlled response is assured by an all-metal damping grid of a new design. The one-piece die-cast metal case is designed for easy hand use. For table and floor use there are matching stands.

CHARACTERISTICS

Frequency response: 50 to 11,000 cps.
Output level: -56 db ± 2 db
User net price, matched pair $36.75.

SONY

- Variable-Directional Pattern Condenser Microphone. The Sony CM-11A is designed for professional recording and broadcast application where utmost performance, dependability, and fidelity are essential. Frequency response is stated to be entirely free of resonant peaks and dips within the specified range of 20 to 18,000 cps. The CM-11A is operated in conjunction with the Model C-202 power supply unit. This power supply incorporates a variable switch permitting three different frequency characteristics for complete versatility in any acoustic surrounding. A small screw switch on the back of the microphone housing offers a choice of unidirectional cardioid pattern, or conventional omindirectional pattern. Microphone and power supply may be separated by as much as 240 feet without affecting performance characteristics.

CHARACTERISTICS

Frequency response: 20 to 18,000 cps ± 2.0 db.
Pattern: Choice of cardioid or omnidirectional.
Output level: Omnidirectional, -72 db; cardioid, -70 db.

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Audio • August, 1961

(Continued on page 105)
FM STEREO
(from page 25)

connections are provided even in the AC-Off position for listening to FM, AM, and FM-AM programs from any tuner connected to the adaptor. An additional position of the panel selector switch designated "Noise Filter" permits listening to stereo programs with full frequency response, but reduced noise, if required on weak and distant stations. The final amplifier of stereophonic and monaural signals is accomplished in a low-impedance anode-follower stage (V1). It contains a 12-db per octave filter, which only passes audio frequencies up to 15,000 eps. This is important for recording of stereophonic programs on tape, to prevent any possibility of frequency-beating between the 38,000 eps subcarrier, its harmonics, the L-R sidebands and the bias-oscillator in the tape recorder.

One interesting final point should be noted, concerning the operation of adaptors in conjunction with tuners having muting facilities. The composite stereo signal for all adaptors is derived from the multiplex output of an FM tuner prior to the audio stages. Therefore, regular audio muting circuits do not mute this signal when tuning between stations. Muting, Flanken KM-56 microphones.

One common source of pickup is the feedback loop. Loudspeakers are connected to the output transformer and this, in turn, is coupled to the cathode of a previous stage via the feedback resistor and capacitor. This cathode may be bypassed to ground by a small capacitor or you may bypass the speaker leads to ground. In the case of an amplifier having a damping factor control, each side of the speaker will have to be bypassed to the chassis and ground. It is also possible that you will need to use a series choke in the "hot" speaker lead or, in the case of the amplifier having the damping control, in each speaker lead, with each side of the chokes bypassed to ground. These interference filters are mounted right at the amplifier.

Good luck!
THIS MONTH'S COVER

The installation shown on this month's cover was recently completed in the home of Mr. and Mrs. Albert W. Gilkerson in Arcadia, California, in consultation with Antoni E. Dolinski, a professional photographer who is also an audio enthusiast.

After completing all the kits himself, Mr. Gilkerson hired the competent skill of the Mitchell Cabinet Shops in South San Gabriel, a neighboring town, for the cabinet work. The equipment consists of a Harman-Kardon Citation III tuner, a Dynakit PAS-2 preamplifier, followed by a Citation V power amplifier. The tunable is a single-speed Gray, complemented by the ESI, tone arm and a Shure M7-N21D cartridge combination. A Concertone 505 stereo tape recorder rounds out the system.

Flanking the equipment cabinets on each side are two 8-cu.ft. infinite baffle enclosures, each of which houses two Claron Cathedral 12-in. woofers and an Electro-Voice RB-3 system in a wooden horn built into each cabinet. Finish of the entire ensemble is maple, which complements the decoration scheme of Mr. Gilkerson's large wood-panelled den.

ABOUT MUSIC

(from page 81)

on. Note, too, how the lines fit harmonically and move in opposing directions, in good old contrapuntal style. Finally, observe its length—most quodlibets made up of well known tunes generally don't get beyond the first phrase or two.

And who is the anonymous quodlibetist who discovered that Dvořák's Humor-que and Foster's Old Folks at Home were meant for each other?

As you can see, quodlibets can be a fascinating pastime for both the amateur and professional musician, as well as for anyone who can carry a tune.

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Permissible Feedback: 30 db.

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A-430 60 watts KT-88, EL-34 29.95
A-440 120 watts KT-88, 6L6 39.95
A-450 120 watts pp pur KT-88, EL-34 39.95
A-470 35 watts pp pur EL-84, EL-34 24.95

(all with tapped primaries except A-440 which has tertiary for screen or cathode feedback)

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AmericanRadioHistory.Com
PRODUCT PREVIEW
(from page 101)

The headphones accept any one of the microphone modules. Thus there is a large variety of accessories available. Conversely, there is a large variety of microphone modules available to fit the standard accessories.

**CHARACTERISTICS**

**Patterns:** Cardioid.
**Frequency range:** 30 cps to 16,000 cps.
**Impedance:** 30/50, 150/250, 2000, 3000 ohms.
**Output level:** 30/50 and 150/250 ohms.
**Weight:** 2 lb.
**Finish:** Acrylic silver.

**HEADPHONES**

**AKG**

- **Dynamic Headphones.** The AKG feather-weight K-50 headphones feature extremely light weight, and a wide frequency range. Its 3-oz. weight and frequency range from 30 to 20,000 cps make the K-50 ideal for applications involving many hours of listening. It can be used for monophonic or stereophonic listening, and requires less than one milliwatt input. Impedance is 400 ohms. Electronic Applications, Inc., Stamford, Conn. User net price $22.50.

**BEYER**

- **Dynamic Headphones.** Featuring a frequency range of 20 to 15,000 cps, and a sensitivity of 25 mv for a sound pressure level of 100 phons, the Beyers B-17/18 dynamic headphones are fully professional in performance. Their resonance-free characteristic and extreme frequency range, together with very low distortion—less than 0.1 per cent from 50 to 15,000 cps, and less than 0.3 per cent from 20 to 20,000 cps—makes them ideal for professional monitoring, recording, or broadcast. Impedance is 5 ohms on each side, and ickling transformers are available for broadcast monitoring across 600-ohm lines. Sorted Audio Corp., 72 W. 45th St., New York 36, N. Y. User net price $29.95.

**S. G. BROWN**

- "Super K" Professional Headphones. Actually two miniature high-quality speakers, the "Super K" headphones can be connected to any sound system, tape recorder, or similar equipment. Frequency range is 30 to over 16,000 cps. Utilizes a beryllium-coated diaphragm and an iron core driver. Wired for stereo, they may be utilized for a mono- or phonic system. Sensitivity at 1000 cps is 25 db above 1 phono/10 for 1 mW input. Will handle inputs up to 1/2 watt. Headphones come complete with rubber ear cushions and a highly flexible, 6-foot, one-piece, nylon covered cable. British Industries Corp., Port Washington, N. Y.

**KOSS**

- **Stereo Headphones.** Extremely useful for the tape recording enthusiast, Koos "Stereophones" model 8P-3 provide complete separation of stereo channels, consisting of a specially designed 31/2-inch reproducer in each earpiece. The 8P-3 has a frequency range from 20 to 13,000 cps. Ideal in both stereo or monophonic systems. Comes complete with a plug and jack that connects easily to any amplifier or directly across speaker leads. Soft sponge foam ear and headpieces provide comfortable wearing and shut out 95% of outside noise. Impedance 4 ohms. Koos, Inc., 2227 North 31st Street, Milwaukee 8, Wisconsin. User net price $24.55.

**MONARCH**

- **Stereo Headphones.** Useful for either stereophonic or monophonic listening, the Monarch Model 280-S00 features foam ear pieces, which are comfortable and also provide an excellent seal. The lightweight ear pieces and padded headband are completely adjustable to give a "custom fit" for utmost comfort; only one conveniently long plastic cord is attached to the earphone. The cord is terminated in a final plug which may be plugged directly into the source, or into a four-way switchbox connected to the speakers. This switchbox is provided. Impedance is 8 to 16 ohms. Monarch Electronics International Inc., 7053 Laurel Canyon Blvd., N. Hollywood, Calif. User net price $19.95.

**PERMOFLUX**

- Headphone Series. Available in a variety of impedances, the Permoflux D/H/S series of binural headphones achieve the full depth and presence available in binural sound. The close coupling of the earphones eliminates the adverse factors of improper room acoustics and poor speaker placement. Available with 12/12, 16/16, 300/300, 600/600, and 10K/10K ohm earpieces, and with several styles of ear-cushions, the D/H/S series is adaptable to a wide variety of circumstances. In addition various adapters are available which permit connecting up to four sets of headphones to one program source. Permoflux Products Co., 4111 San Fernando Road, Glendale, Calif. User net price $40-52.50.

**TELEX**

- **Dyna-Twin Headset.** This Telex headset is intended essentially for private listening to stereo program material. The twin wide-range dynamic receivers have a frequency range of 20 to 15,000 cps. They are engineered...
specifically for headset application, and are equipped with two comfortable, foam-rubber ear pieces with secondary ear seals. The Lynnpit has a one-piece construction, a Mylar diaphragm, Tenite cups, stainless steel by Green Tree Electronics, is now available in the new American which is a plastic tape box designed in tan and ivory, and which makes the enclosed tape instantly available by pressing a button. The Americanpak contains interconnect to form a homemade and functional tape rack. American tape comes in either acetate or Mylar base in 1/2 mil, 1-mil, and 2-mil thicknesses. Green Tree Electronics Corp., 1122 N. La Cienega Blvd., Los Angeles, Calif. User net price for 1200 ft. of 1/2 mil adhesive base tape is $2.50.

AMPEREX

- Minature Pentele for Input Stages. Representative of the large Ampere line of audio tubes is the EPX6/625T nine-pin miniature pentele, which is designed for preamplifier and input stages having stringent requirements with regard to hum, noise, and microphones. It is a direct plug-in replacement for the older 2726. It is one of the Ampere "preferred" types for high-quality audio applications. Ampere Electric Corp., 220 Duffy Ave., Hicksville, L. I., N. Y.

AMPLICORP

- Bulk Tape Eraser. Designed to serve a dual function, the new "Magnemasr" offered by the Amplicor Corp. of America completely erases tape on the reel, without rewinding.

MISCELLANEOUS

AES

- Equipment Cabinet. The AES "availer" equipment enclosure features construction of 3/16-in. to 1/2-in. thick wood. It is made from birch stock, completely assembled, and ready to be finished. Dimensions are 16" x 27 1/2" x 30". Blank panels are provided for mounting components without cases. Matching speaker enclosures available. AES Int., 3338 Payno Ave., Cleveland, Ohio. User net price $55.50.

AMERICAN

"Ameripak" Magnetic Tape. The American brand recording magnetic tape manufactured by American Radiocord, Inc., 3338 E. 77th St., Chicago, Illinois, is available in two models: Model 230, for 100-130 volt operation; Model 230C, for 200-250 volt operation. Price of either model is $19.95. Amplifier Corporation of America, 200 Broadway, New York 13, N. Y.

BIB

- Tape splicer. An indispensable accessory for any tape recordist, this new British-made splicer is extremely simple to use and can be employed for both mending broken tapes and for editing purposes. Made of nickel-plated brass, the BIB splicer comes mounted on a flock-sprayed base, or can be mounted directly on any tape deck. The body of the splicer has two pivoted clamps which lock the tape sections in a channel. Both vertical and diagonal mitres are provided for perfect fitting or mending. Horizontal mitres are also provided for use in trimming off surplus mending tape. Distributed in the United States by Ercossa Corporation, 16 W. 46th St., New York 36, N. Y. User net price $3.85.

ESL

- Automatic Record Cleaner. Cleaning the record as it is played the ESL "Dust Bug" solves the problems of dust, lint, and static build-up on phonograph records and pickup stylus. The Dust Bug cleans records thoroughly and quickly, and it is easily installed on turntables or record changers. It removes the dust and lint immediately before the moment of playing. The Dust Bug incorporates an individually painted tuft of nylon fibers in front of a cylindrical rubber pad. The bristles and pad are mounted with a special harmless, anti-static fluid, supplied in a replaceable dispenser. This fluid helps to loosen dust and lint, which is then collected by the pad. It also eliminates the static charge on the record, and maintains it. This neutralized condition is maintained by Electronic Solubility Laboratories, 35-54 36th St., Long Island City 6, N. Y. User net price $3.75.

FAIRCHILD

- playback compressor. Intended to recreate full dynamics in home playback systems, the new Fairchild, "Compressor," was developed from operating data compiled by the professional products division of Fairchild. The "Compressor" complements many of the controls placed on recordings due to the geometric limitations of the disc and the magnetic limitations of tape. The device senses the output of the home playback amplifier, and dynamically increases signal levels in order to improve the dynamics of the studio or concert hall performance which existed before any controls were placed upon the recording. The unit does not affect low-level or medium-level passages. Features of the unit include action indicators which visually show operation of the sensing device, plus providing an insight into left and right information on the disc or tape; threshold controls; and the ability of the device to be reversed and used as a level control in home tape recording, or public address. The "Compressor" is complete and requires no ancillary equipment. It is connected to both the output and input of the amplifier. All necessary cables are provided. The "Compressor" does not introduce distortions because it is not in itself an amplifier, only a sensing and control device. It is definitely not a reverberation.
to form the delay line. The delay time built into this unit is 33 milliseconds which is intended to simulate the natural reverberation of a well designed auditorium. Fisher Radio Corp., 2121 44th Drive, Long Island City 1, N. Y. User net price $69.95.

GENALEX
- True Powered Petrolux. Intended as a replacement for the 6L6GB, the EL34/6CA7, and the 7581, the Genalex KT77 permits 32 watts of audible dissipation maximum, and an output of 72 watts per pair. Grids are gold plated and optically aligned to ensure freedom from grid emission. The KT77 is built to very exact specifications, and in addition is quite rugged. This tube is only one of a long line of high-quality audio tubes which have won renown throughout the world. British Industries Corp., Fort Washington, N. Y.

NEUMANN
- Disc Recording Lathe. The Neumann AM-121 disc recording lathe has many features which ensure longer of unusually high quality. These include three-speed synchronous-motor drive without belts, gears, or chains, 63-Bs, turntable which is oil coupled to the drive shaft, illuminated microscope which moves with cutting-head transport, and many other indispensable features. Specifications are fully professional and of the highest order. Gotham Audio Corp., 2 W. 40th St., New York 36, N. Y. User net price $415.00 including "Spanner" microphone and mounting arm.

MULLARD
- Matched Pairs of Output Tubes. The Mullard EL34/6CA7 high-fidelity output tubes are now available in matched pairs. This is of especial importance to owners of high-fidelity amplifiers because matched output tubes will keep distortion to a minimum. Undoubtedly the original manufacturer either used matched pairs, or went to the trouble of matching them himself. These tubes are a small sample of the extensive Mullard audio line of tubes. International Electronics Corp., 81 Spring St., New York 12, N. Y.

STATICMASTER
- Record Brush. The Staticmaster record brush Model 3D60 employs a polished strip as a static neutralizer to make cleaning records rapid and simple. The brush of the Staticmaster is made of genuine Jaguar hair which is both strong and soft. Nuclear Products Co., 10173 East Rush St., El Monte, Calif. User net price: $8.36 11.50.

LANGEVIN
- Straight-Line Mixer Control. Langevin Model MX-111 straight-line mixer control is a highly developed slide wire unit using resistances in a ladder configuration to afford unusual flexibility in operation of control components. It is used to blend signals of various origins for music scoring, re-recording, high-quality public address, radio and TV broadcasting. The MX-111 has a nylon bearing which rides longitudinally along a boxed, hardened, chrome-plated shaft. Only two grams of force is required to overcome the inertia and bearing friction of the control assembly. The single-contact brush fabricated of the same material as the resistance wire prevents generation of thermal voltages, contact oxidation, and consequent noise. An accessible lint and dirt trap over the windings eliminates the cleaning nuisance formerly associated with this form of control. Langevin, a Div. of Soneter Inc., 503 N. Grand Ave., Santa Ana, Calif. User net price: $69.95.

FISHER
- Reverberation Unit. The Fisher "Space Expander" K.10 is a self-powered reverberation unit of the type which uses coil springs to form the delay line. The delay line built into this unit is 33 milliseconds which is intended to simulate the natural reverberation of a well designed auditorium. Fisher Radio Corp., 2121 44th Drive, Long Island City 1, N. Y. User net price $69.95.
The Reeves Soundtrack Developer is a solution that lets you see the magnetic track recorded on your tape. Making the tape visible affords a fast, simple and accurate way to check for head alignment, track uniformity, balance, and wear. The Magna-see kit contains one half pint Magna-see solution, plastic bath, eyepiece magnifier for close inspection of tracks, roll of pressure-sensitive tape, and five glass slides. Reeves Soundtrack "Magna-see" is a label used to see the magnetic track recorded on your tape.

ROBINS

Economy Tape-Head Demagnetizer. A new economy priced tape head demagnetizer which will remove permanent magnetization—a significant cause of high noise level and harmonic distortion—has been announced by Robins Industries, known as Model H1-3. It features a plastic sleeve on the tip of the probe that prevents accidental scratches to the tape. Special shaped probe makes any head accessible and the H1-3 can be used equally well for both monophonic or stereophonic tape heads. Claimed to be the first quality, low cost American made demagnetizer, the H1-3 is priced at $5.95 which should make it very attractive to amateur tape fans. Robins Industries Corp., Flushing 54, N. Y.

SARKES-TARZIAN

Magnetic Tape. A relatively new entry into the magnetic tape field, Sarkes-Tarzian offers a variety of packs in 1 1/2 and 1 mill acetate. Shown is the 1 1/2 mill acetate, 1200 ft. pack on a 7-in. reel. Also available is this thickness 2400 ft. on hub or reel, and 3-in. and 5-in. reels with respectively 150 ft. and 600 ft. The 1 mill thickness also offers 3-, 5- and 7-in. reels, and 3000 ft. on hub or reel. Naturally in this thickness the reels contain more footage. Also, within the next few weeks they expect to have Mylar-base tape available. Sarkes-Tarzian, Inc., Magnetic Tape Div., Bloomfield, Ind. User net price of the 1 1/2 mil acetate 7-in. reel is $2.95.

ULTRASONIC

U'line New Mixer. Ultra-Audio Products, a division of Oberline Inc., has introduced a mixer amplifier offering features hitherto unavailable in either professional or home units. Designated Model M-5 Custom Mixer it is available for rack, console or carrying case use. The amplifier offers five mixing positions for microphones, phones, tuner, tape output, and so on, and a master gain control, with high and low-impedance inputs and output, illuminated Vu meter, and an adjustable treble, midrange, and equalizing. The mixer utilizes a standard 5 1/2 x 10-in. panel, weighs just 20 pounds, complete with self-contained power supply. Special features are the plug-in input transformers and preamps which one may only if needed. Here the patented "straight-line" volume controls. Replaceable destination strips permit quick change of time. The mixer is connected to each mix position. Ultra-Audio Products, Dept. P-1, 7471 Melrose Ave., Los Angeles 46. User net price, $430.00.

14100 output transformer. Regarded by them as one of their greatest steps forward for many years, the P14100 is a C-core transformer in a seamless steel case, and weighs a total of 10% lbs. Primary impedance is 6000 ohms with Ultra-Line taps at forty per cent of primary turns. On the secondary there are eight sections of 0.95 ohms each. This will give 60 ohms when all sections are in series. Power rating is 20 watts from 20 to 30,000 cps. Frequency range is 20,000 cps. Partridge Transformers, Ltd., Horsley Park, Surrey, England. User net price in U. S. $4.50.

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For Several Years, Viking has used this space to talk of current products for the home music system. Foregoing the usual format, we would like to use this month's space to better acquaint our readers with other, and little known, phases of our activities.

The use of magnetic tape has now become a part of our daily living. Seldom are we beyond the range of taped music or communication, or tape automated services. Example? Here are a few Viking products which are not so likely to be found at your hi-fi dealer's showroom.

SPACE AGE TEACHING

Perhaps you, a son or daughter, or a friend study in a modern language laboratory. The chances are about seven out of ten that the equipment in that laboratory relies on dependable Viking tape transports. Although the equipment carries the respected name of one of several major companies who build language laboratories, you'll probably find that the tape decks employed strongly resemble, and actually are, the familiar Viking "75" or Viking "85" used in home music systems.

DINING OUT?

There is a good possibility the background music in the restaurants you patronize comes from a surprisingly small, continuous loop tape cartridge player, the Viking Model "35". In this unit, which must provide day-in, day-out, continuous service, you will find the same bearings, capstan assemblies and drive motors used in your dependable Viking home tape equipment.

TOP FORTY?

When you listen to an automated radio station, the chances are better than average the equipment used for injection of commercials uses the same dependable Viking endless loop tape cartridge players (in this case, solenoid operated mechanisms, remotely controlled). Service life? Several years under constant duty!

BLAST OFF!

In this day, it's customary to feature ascending rockets and immaculate blockhouse control rooms when you talk about tape and the space age. However, for Viking, this would not be a true picture. We do not build elaborate, specialized data recorders or "read-out" devices. But, we take pride in pointing out that you will find four-channel Viking "95" recorders, Viking "85's", and even "75's" doing a big, professional recorder's work in many military and defense installations. These, without exception, are production, high-fidelity recorders, completely comparable to those on your hi-fi dealer's shelves.

Our next ad will again deal with new things—new products for the home high-fidelity music system.
Tiny though the transistor might be, Transis-Tronics has used it to set a new pace for the entire high fidelity industry. TEC all-transistor amplifiers and tuners have become the "mighty oaks" of high fidelity—no hum, no heat, no microphonics. The transistor, unlike the old-fashioned tube, is a "life-time" device, therefore, both the TEC amplifier and the TEC FM tuner come to you with full two-year unconditional guarantees. Regardless of price, the S-15 and FM-15 are the most efficient amplifiers and tuners on the market today. TEC S-15 STEREO AMPLIFIER is all sound, rated at 20 watts of music power per channel with a 4 ohm load. With 8 and 16 ohm loads, the power is slightly reduced. TEC FM-15 TUNER, the perfect companion to the TEC S-15, will give you years and years of trouble-free listening. The low power consumption characteristic of transistors means that both the TEC amplifier and tuner can be operated with either 117 vac at 18 to 24 vdc as the power source. AND, NATURALLY, EQUIPPED FOR MULTIPLEX.

Transistor Engineered Components • Transis-Tronics, Inc. • 1601 W. Olympic Blvd., Santa Monica, Calif.  

The FM-15 (top) and the S-15 (bottom) are available as separate units or in a handsome walnut or teak combined package. How? No heat means the tuner can be stacked with the amplifier without danger of drift.