AUDIO

DECEMBER, 1957
50¢

...the original magazine about high fidelity!

www.americanradiohistory.com

FROM THE LINE MOST WIDELY USED BY PROFESSIONALS...

PRESTO High-Fidelity Turntables for Home Installations

PRESTO T-2

A crowning achievement in engineering design—the T-2 two speed model offers superb high-fidelity performance at modest cost. Its heavy, balanced aluminum turntable and rugged drive system eliminate wow, flutter and rumble. The interchangeable idler wheels disengage in the "off" position to prevent flats. Heavy-duty, 4-pole motor insures accurate speeds. Shift mechanism permits quick change from 33⅓ to 45 r.p.m. while table is spinning. Comes equipped with built-in strobe disc, 45 r.p.m. adapter, and rubber record mat. *Only $59.50*

PRESTO T-18AH

Undoubtedly the finest high-fidelity turntable for home use that money can buy. Three speeds; precision-made throughout; wow, flutter and rumble are virtually non-existent. Employs 12", cast-aluminum turntable and constant-speed hysteresis motor. Speed selector has five positions: 45—off—33⅓—off—78. *Only $131.00*

PRESTO T-18A

Has all the features of the T-18AH (above) except that it is equipped with a heavy-duty, 4-pole induction motor. *Only $75.00*

For over 20 years, Presto transcription turntables have been the choice of broadcast-station and sound-studio engineers. Today, more are in professional use than any other make.

Now, Presto offers the audiophile three precision turntables for high-fidelity installations, incorporating many of the design features that have made our transcription turntables famous. See them at your local high-fidelity shop—or for full details and specifications, write for catalog to Dept. G12. Presto Recording Corp., Paramus, N. J.

PRESTO

TURNTABLES • TAPE RECORDERS • DISC RECORDERS
DISCS • STYLI • AND HIGH FIDELITY CABINETRY

A SUBSIDIARY OF THE SIEGLER CORPORATION

www.americanradiohistory.com

THE BRITISH INDUSTRIES

Sounding Board

MODEL 301

"The Professional"

TRANSCRIPTION TURNTABLE

WORLD'S FINEST!

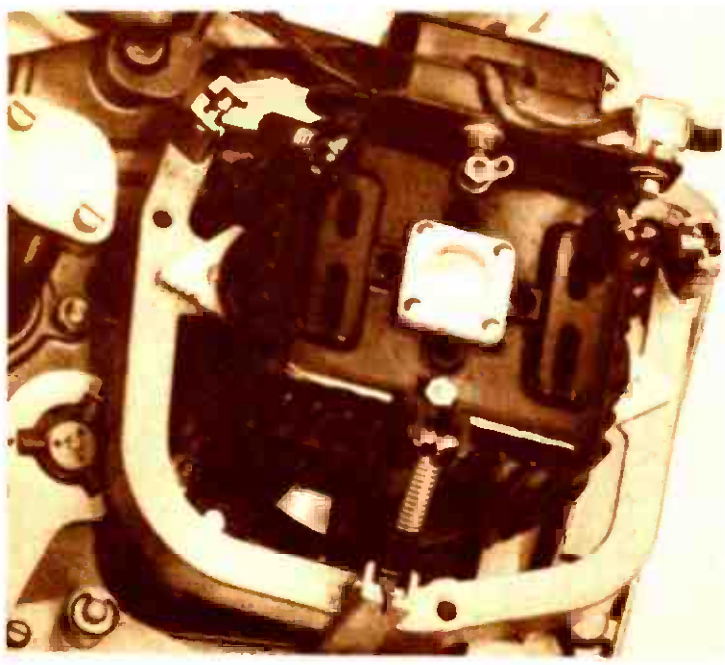
by

Garrard

A simple explanation of the thinking behind this great turntable!

IN any transcription turntable, there are two potential sources of noise which produce the effect commonly termed "rumble". These are the motor . . . and the spindle on which the turntable itself revolves. Since any turntable and motor rotate on bearings which create heat and noise, the problem is to reduce the noise to a point of inaudibility, first by minimizing the source and then by isolating it.

The motor used in the Garrard Model 301 is a precision-engineered, dynamically-balanced 4-pole unit, encased in a heavy die-cast frame. Designed by Garrard, it is also built in Garrard's own plant. This guarantees its quality. However, in any motor, some vibration may be evident. Therefore, the 301 motor is completely isolated from the unit plate, suspended by three tension and three compression springs, so that it is actually isolated in a 360° sphere. This method of suspension is unique, and it is one major reason why the Garrard 301 is so remarkably free of vibration.



In addition, the one lever which connects the motor to the unit plate (the speed control lever) is also ingeniously suspended within three springs, rather than by using a conventional bushing or pivot. The Garrard 301 is the only unit wherein the motor is entirely suspended by springs from *every* lever and even from the unit frame itself!

(OVER)

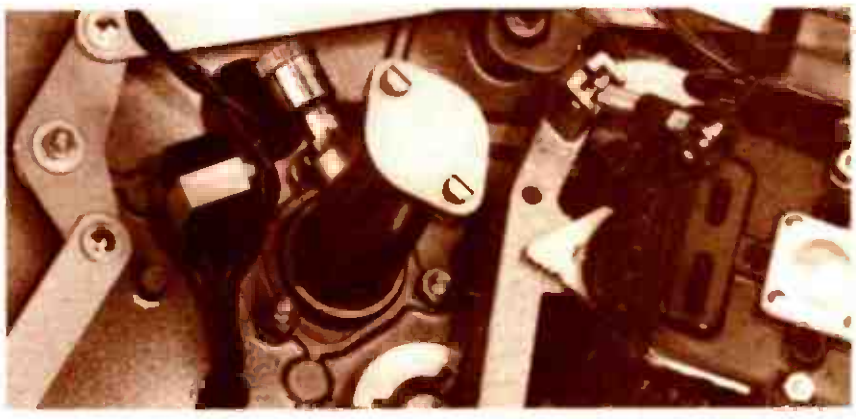
www.americanradiohistory.com

cut along dotted line and save

The Sounding Board

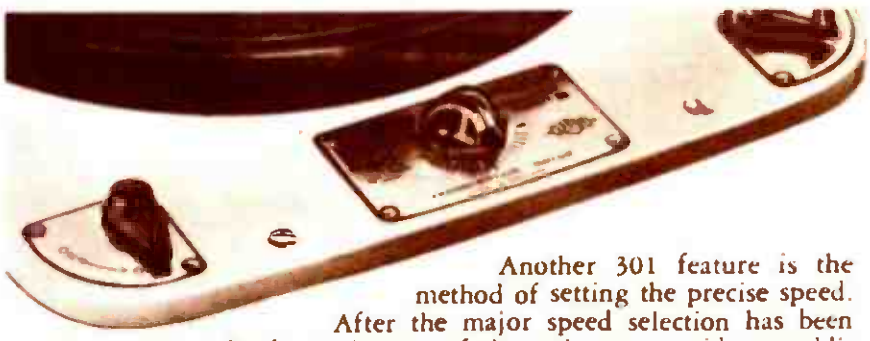
The Sounding Board

The 301 turntable weighs a full 6½ lbs. and it is made of precision-machined cast aluminum. Being heavy and dynamically balanced as well, it imparts flywheel action, which tends to override a variation in speed.



The all-important turntable spindle is polished to mirror finish. This minimizes any turning noise. Then, by setting the spindle in a die-cast housing which is completely filled with a special lubricant under pressure, even that minimum of noise which remains is isolated and prevented from reaching the turntable or unit plate. This, in turn, also prevents vibration from reaching the pickup.

In order to insure that the spindle is at all times under the influence of strong damping pressure, a reservoir for the lubricant is built into the housing. By simply turning a knurled knob, a new supply of grease is forced into the housing whenever required.



Another 301 feature is the method of setting the precise speed. After the major speed selection has been made, a control knob on the top of the unit can provide an additional 2½% variation, plus or minus. This magnetic speed control operates as an eddy current brake. Two permanent magnets are set on either side of a rotating disc, which is attached to the motor armature. By increasing or decreasing the distance of the magnets from the center of the discs, the field strength of the magnets is varied and reflects in the speed of the motor. The eddy current method of control is instantaneous, precise, permanent and fool-proof.

The wow, flutter and rumble specifications of the 301 are well below those required by the NARTB. The 301 was developed in conjunction with the highly critical British Broadcasting Corporation, and it is used in their broadcasting work. This great product meets all the qualifications which are desirable in a turntable. It is quiet, precise, rugged and proven through countless hours of use under the most arduous conditions.

The performance of every Garrard 301 unit is checked exhaustively by the factory and appears on an individual test card supplied to the purchaser.

For literature write Dept. 6X17S.

GARRARD SALES CORPORATION

PORT WASHINGTON, N. Y.

www.americanradiohistory.com

DECEMBER, 1957 VOL. 41, No. 12
Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

C. G. McProud, Editor and Publisher
Henry A. Schober, Business Manager
Harrie K. Richardson, Associate Editor
Marie Caspe, Assistant Editor
Janet M. Durgin, Production Manager
Edgar E. Newman, Circulation Director

Sanford L. Cahn, Advertising Director
Special Representative—
H. Thorpe Covington,
814 Lincoln St., Evanston, Ill.,
DAvis 8-8874
Mid West Representative—
Sanford R. Cowan, 300 W. 43rd St.,
New York 36, N. Y.
West Coast Representative—
James C. Galloway
6535 Wilshire Boulevard, Los Angeles 48, Calif.

CONTENTS

COVER PHOTO—From "Down Under" comes this attractive arrangement created by A. E. Haydon of Haydon & Wright, Ltd., Radio & Audio Engineers, of 45 Victoria Street West, Auckland, N. Z. The equipment consists of a Philips AM tuner, Pye amplifier, Garrard changer with Tannoy cartridge, a Tannoy 15" dual Concentric speaker (on opposite wall) and a Philips tape recorder— removable for portable use. The cane frame at the lower right ventilates the main amplifier.

AUDIO (title registered U. S. Pat. Off.) is published monthly by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary. Executive and Editorial Offices, 204 Front St., Mineola, N. Y. Subscription rates—U. S. Possessions, Canada and Mexico, $4.00 for one year, $7.00 for two years, all other countries, $5.00 per year. Single copies 50¢. Printed in U. S. A. at Lancaster, Pa. All rights reserved. Entire contents copyright 1957 by Radio Magazines, Inc. Entered as Second Class Matter February 9, 1950 at the Post Office, Lancaster, Pa. under the Act of March 3, 1879.

RADIO MAGAZINES, INC., P. O. Box 629, MINEOLA, N. Y.

for Ultimate Fidelity

SHERWOOD*

*outstanding honors bestowed, unsolicited, by most recognized testing organizations.

No matter what your source of music —FM, your own discs, or tape—you will enjoy it at its best coming from Sherwood's complete home music center ... most honored of them all! Sherwood tuners for example ...

First to achieve under one microvolt sensitivity for 20 db FM quieting increases station range to over 100 miles. Other important features include the new "Feather-Ray" tuning eye, automatic frequency control, flywheel tuning output level control and cathode-follower output.

Model S-2000 FM-AM Tuner $139.50 net
Model S-3000 FM (only) Tuner $99.50 net

For complete specifications, write Dept.

SHERWOOD
ELECTRONIC LABORATORIES, INC.
2802 West Cullom Avenue, Chicago 18, Illinois

The "complete high fidelity home music center"

In New York hear "Accent on Sound" with Skip Weshner, WBAI-FM, week nights, 9 P.M. In Los Angeles, KRHM-FM, 10 P. M.

www.americanradiohistory.com


James Melton makes his tape recordings on
irish BRAND ferro-sheen recording tape
That's not the reason why you should use
irish BRAND ferro-sheen recording tape
Here's why you should use
irish BRAND ferro-sheen recording tape:
It's the best-engineered tape in the world...
...gives you better highs...better lows... better sound all around! Saves your tape recorder, too – because the **irish** FERRO-SHEEN process results in smoother tape ...tape that can't sand down your magnetic heads or shed oxide powder into your machine. Price? Same as ordinary tape!

Available wherever quality tape is sold.
ORRadio Industries, Inc., Opelika, Alabama
Export: Morhan Exporting Corp., New York, N. Y.
Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

AUDIOCLINIC??

JOSEPH GIOVANELLI*

Note: One of the results of the various recent high fidelity shows is that we have gained numerous new subscribers. For their benefit, let me state that it is the function of this column to answer any and all inquiries put to it, regardless of their suitability for use in the column itself. Write to me at the address shown and *not* to AUDIO magazine, and please enclose a stamped, self-addressed envelope. Because all letters are answered by mail, it is obvious that your help in this regard will save me considerable time in getting the answers to you. Should you prefer not to have your name appear in the column, please so indicate in your letter. Unless we receive word to the contrary, we shall assume that we may use your name.

Tape Direction

Q. In AUDIOCLINIC *in September, 1957, discussing conversion to stereo, you say that with the shiny side of the tape facing the viewer, the upper half is intended for the left speaker. Which way is the tape running: from left to right or from right to left? Paul M. Gerhard, Beverly, Mass.*

A. The upper channel always feeds the left speaker as the listener faces the speakers in listening position, and it is assumed that the tape is travelling from left to right.

Two Amplifiers

Q. How can I connect two 40 watt amplifiers to drive one 4-ohm speaker system? Both are to be fed from the same preamplifier. Frank A. Cappi, Chicago, Illinois.

A. I do not advise connecting your two amplifiers to one speaker system unless you are sure that the speaker system can handle their combined power. One of your amplifiers has more than enough power output to overload the speaker system. The only value of so connecting your amplifiers would be that of obtaining slightly less distortion. Although the decrease in distortion could be measured by laboratory methods, it is doubtful that it could be detected aurally. Should you still wish to try this, proceed as follows:

1. Connect the output of the preamplifier directly to the input of each of the power amplifiers.

2. Connect together the common, or ground, terminals on the power amplifiers.

3. Join the two four-ohm taps. This will provide the necessary four ohms to operate the speaker.

By so connecting the equipment, more power output is obtained than could be had from a single amplifier. It should be remembered, however, that the internal impedance of the output circuit has been halved, which is the reason that the 4-ohm speaker had to be connected to what had been, for each unit, the 4-ohm takeoff.

Since the output of most preamplifiers is terminated in a cathode follower (having low output impedance), two or more high-impedance circuits may be directly bridged across its output terminals without significantly affecting the performance of the system. When connecting power amplifiers as described, be sure that the amplifiers are identical. Should one have one more stage than the other, the output signals would be 180 deg. out of phase, causing a cancellation rather than a reinforcement of the signal. Even if the amplifiers have the same number of stages, but are of different circuit design, there is likely to be enough phase difference between their output voltages so that at least partial cancellation will result.

Cabinet Dimensions

Q. I am thinking of building a large bass reflex cabinet of approximately these dimensions: 2½ ft.×2½ ft.×6 ft. I would like to know whether these dimensions are suitable, provided that the port is properly tuned. W. A. Long, Akron, Ohio.

A. In theory, the optimum ratios for the dimensions for a bass-reflex enclosure are 1:2:3. Therefore, assuming the largest dimension of your cabinet to be 6 ft., the others should be 2 ft. and 4 ft., respectively. Because of the large volume of such a cabinet, it will probably be necessary to scale down all dimensions, keeping their ratio intact.

Balance

Q. I have a fine amplifier in most respects, but I do notice that, as the gain is reduced, the balance between highs and lows is not of the same proportion as when the gain is turned up. There seems to be a very definite point at which the frequency becomes good. What is this condition and how can it be corrected? Name Witheld, Lake Worth, Fla.

A. This sounds as though it might be an advanced case of Fletcher-Munson trouble, and the effect is due to the lowered sensitivity of the human ear to low frequencies as level is reduced. On a perfectly flat reproducing system, music will appear to have the proper balance only when the reproduction level is identical with that of performance. If this is the problem in your case, you might find a solution in installing a compensated type of volume control in place of the "flat" or uncompensated control now in use. There are other causes which could result in a loss of highs as the volume is lowered, the most common of which is due to high stray capacitance in a grid circuit. As capacitive reactance at the higher audio frequencies approaches the input impedance of the amplifier, the amplitude of the high frequencies is diminished with respect to middle and lower frequencies. One form of such capacitance is that between the resistance element of a volume control and its case. This varies with the setting of the control, so that when the control is in the most advanced position, the effects of the shunt capacitance are at a minimum. The larger the resistance of the control, the smaller will be the shunt capacitance needed to cause this high-frequency loss. To minimize this effect, replace the present volume control with one whose resistance is no more than half that of your present control. By whatever amount this resistance has been decreased, the value of the coupling capacitor feeding this control should be increased, so as not to impair the low-fre-

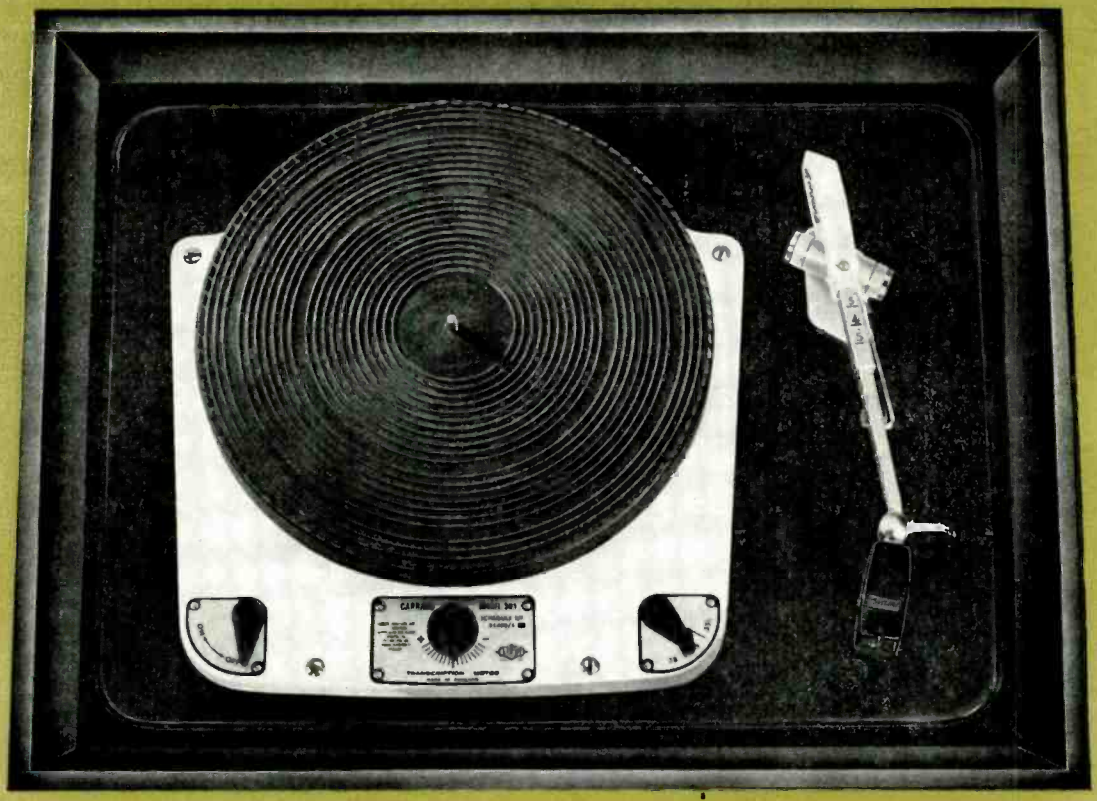
*3149 Newkirk Ave., Brooklyn 3, N. Y.

www.americanradiohistory.com

He who is fortunate enough to own the Garrard 301 Transcription Turntable and the Garrard TPA/10 Tone Arm can enjoy the unique pleasure of knowing that *his* is the finest . . . the handsomest . . . record-playing combination in the entire high fidelity galaxy. A pair of great products . . . great because they reflect 35 years of skill and the standards of leadership. No gadgets . . . no compromises . . . only the time-proven features which guarantee continuing, undeviating excellence.

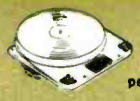
Garrard

WORLD'S FINEST RECORD PLAYING EQUIPMENT



There's a Garrard for every high fidelity system

B. I. C. ENDORSED QUALITY



Model 301 PROFESSIONAL TRANSCRIPTION TURNTABLE
Each speed variable! Each unit with its own performance test report. $89.00

Model RC98 4-SPEED SUPER AUTO-MANUAL CHANGER
Continuous + or — variable control on all speeds. $87.50

Model TPA/10 TRANSCRIPTION TONE ARM
—Professional performance, jewel-like construction and exceptional versatility. $24.50

Model RC88 4-SPEED DELUXE AUTO-MANUAL CHANGER
Exclusive pusher platform protects your records. $54.50

Model T Mark II
4-SPEED MANUAL PLAYER
A superior unit for quality budget systems. $32.50

Model RC121 4-SPEED MIXER AUTO-MANUAL CHANGER
Fine performance with economy and compactness. $42.50

For information, write Dept. GX-17 **GARRARD SALES CORPORATION, PORT WASHINGTON, N.Y.**

www.americanradiohistory.com

COMING

To Your City . . .

HIGH FIDELITY music SHOWS

SEE and HEAR the latest in HIGH FIDELITY from leading high fidelity manufacturers . . .

Don't miss these public showings of Hi-Fi Equipment . . . from the most economical units for the budget-minded to spectacular home music theatres . . . compare and enjoy them all.

*Complete Hi-Fi Systems and Components.

*Amplifiers — Pre-Amplifiers — FM-AM Tuners — Turntables and Record Changers — Phono Cartridges — Microphones — Music Control Centers — Speakers.

*Speaker Enclosures and Equipment Cabinets — Finished and Assembled or Do-It-Yourself Kits.

THREE FULL DAYS OF CONTINUOUS DEMONSTRATIONS FROM 1 P.M. TO 10 P.M. FOR EACH SHOW

Rigo Shows 1958

Jan. 10, 11, 12	Minneapolis	Hotel Dyckman
Jan. 17, 18, 19	Indianapolis	Hotel Antlers
Jan. 24, 25, 26	Buffalo	Hotel Statler
Feb. 7, 8, 9	Denver	Hotel Cosmopolitan
March 7, 8, 9	Pittsburgh	Hotel Penn-Sheraton
March 21, 22, 23	Newark	Hotel Robert Treat

ADMISSION 50¢

RIGO Enterprises Inc. 500 N. Dearborn, Chicago 10, Ill.

quency performance of the amplifier. If the value of the coupling capacitor is not increased to meet the decreased control resistance, losses will occur because of the voltage divider formed by the reactance of the capacitor and the resistance of the control. As frequency decreases, the reactance of the capacitor increases until finally there comes a point where that of the capacitor equals that of the volume control. As frequency proceeds below this point, it is obvious that more voltage will be lost across the capacitor than across the control. From this point on, low frequencies will be attenuated at the rate of 6 db per octave.

Power Output

Q. I have been checking the power output of my Williamson-type amplifier and have had some disappointing results. I am using 6L6-GB tubes as power output stages, driving a UTC LS63 output transformer, right into an 8-ohm speaker. The tube manual states that these tubes, operated with cathode bias with 360 volts on their plates and 270 volts on their screens, would deliver 24.5 watts in class AB. I'm operating the tubes at 340 volts on the plates and 250 volts on the screens, and with a 250-ohm cathode resistor, bypassed with 250 μf. The grids are wired with 470,000-ohm resistors. If I disconnect the driver stage from the 6L6 grids and feed it into separate 470,000-ohm resistors, I can obtain 15–16 volts RMS to drive the grids of the 6L6's. This waveform is clean as seen on a 'scope. However, as soon as I connect the driver to the 6L6 grids can only drive them to 10 volts RMS. Beyond this point, the waveform flattens off. At this point I can get only about 10 watts out. Can you explain why I cannot approach at least the 20-watt level with the above parameters? W. E. Henry, Albuquerque, New Mexico.

A. It is logical to expect that, when the output of your driver stage is connected to a dummy load, more output would be obtained than when the same driver was connected to its proper grid load, with the remainder of the circuit made operative. This is because the output stage is designed to feed back a certain amount of its energy in such a direction as to cancel a portion of the driver's output voltage. A driver stage of higher capacity would have to be used to overcome this difficulty. Such a stage might take the form of a push-pull parallel configuration.

Think back to the original Williamson circuit, in which 807's were used. In some circuit arrangements as these tubes are easily capable of delivering 40–50 watts output, and hams use them as Class B linear amplifiers and easily obtain 100 watts from them. Williamson got 8 watts out, using them as triodes, but with very low distortion.

Speaker Demonstrations

Q. I wish to demonstrate the frequency range of the various speakers in my three-way system, both singly and collectively, isolating them one from the other, using one, two or three. Can you suggest a means which will permit this sort of thing? Name Witheld, Lake Worth, Fla.

A. When removing a speaker from your crossover network as you plan doing for demonstration purposes, a resistor whose value equals that of the impedance of the speaker which it replaces must be used.

(Continued on page 88)

www.americanradiohistory.com

NEWEST University achievements in High Frequency reproduction!

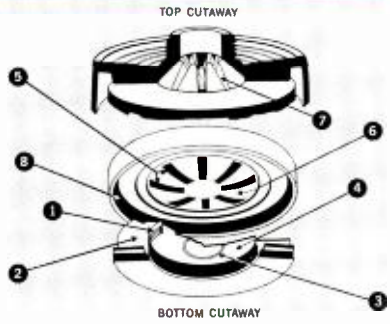
NEW HYPERSONIC T-50 DRIVER*

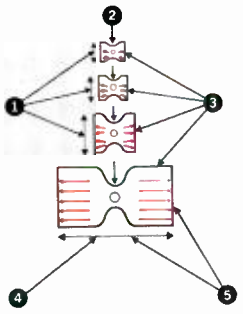
***Smooth*, distortion-free sound reproduction from 600 cps to inaudibility!**

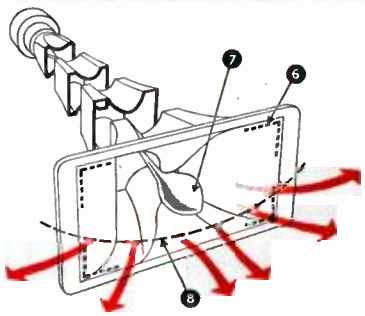
NEW RECIPROCATING-FLARE† H-600 HORN

***Uniform*, wide-angle dispersion of sound over the entire operating range!**

T-50 Hypersonic H-600 THE ONLY TWEETER IN THE WORLD WITH NO HIGH FREQUENCY PHASE CANCELLATION







Exclusive features of the T-50

1 2 Special type aluminum voice coil for high fidelity and long life

3 4 **The only known "front concave" hypersonic diaphragm with absolutely uniform path lengths**

5 6 **The only hypersonic acoustic head with "radial slots" to achieve absolutely no high frequency cancellation**

7 **The only one piece integral hypersonic mixing chamber available today for super precision close tolerances**

8 Rim-centering for long life

SPECIFICATIONS: Response: 600 cps to inaudibility; **Recommended crossover:** 700 cps; **Power capacity:** 50 watts, integrated program; **Diameter:** 4¼"; **Depth:** 4⅛"; **Throat:** 1⅜"-18; **$49.50 net**

** Patent pending*

Exclusive features of the H-600

1 2 Initial expansion vertical

3 4 Horn contours** in horizontal direction

5 6 Ultimate expansion in horizontal direction

7 Front plane equalizer**

8 Uniform front wave pattern

*** Exclusive with University*

SPECIFICATIONS: Air column: 7¾"; **Horn Cut-off:** 600 cps; **Recommended crossover:** 700 cps; **Dispersion:** 125° horiz. x 55° vert.; **Bell mouth:** 8¾" x 4¾" over-all; **Depth (less driver):** 7¾"; **Throat:** 1⅜"-18 thread; **$18.00 net**

† U. S. patent #2,690,231

More University tweeters, mid-range horns and drivers . . . for maximum versatility of application and flexibility of operation

LISTEN *University® sounds better*

UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVE., WHITE PLAINS, N. Y.

HF-206 Hypersonic Tweeter. Response to inaudibility. Crossover 5000 cps. Wide angle "reciprocating flare" die-cast aluminum horn. 8 ohms $33.00 net.

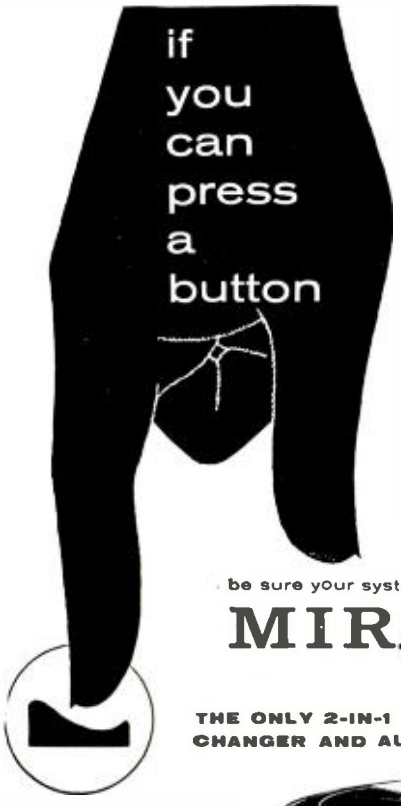
UXT-5 Super Tweeter. Crossover 5000 cps up. Wide-angle response to 17,500 cps. 8 ohms. $21.00 net.

4401 Tweeter. Crossover 2500 cps up. Wide-angle response to 15,000 cps. 8 ohms. $18.00 net.

T-30 High Frequency Driver. As tweeter with H-600 in 2-way system; as mid-range with H-600 or Cobreflex in 3 or 4-way. Response: 200-15,000 cps. 8 ohms. $30.00 net.

Cobreflex Horn. Crossover 350 cps up. Exclusive twin-flared 27" exponential air column. Dispersion: 120° x 60° Heavy precision aluminum die casting. $23.00 net.

www.americanradiohistory.com



you
can
enjoy
the
best
in Hi-Fi

be sure your system includes

MIRACORD XA-100

THE ONLY 2-IN-1 FULLY AUTOMATIC CHANGER AND AUTOMATIC MANUAL PLAYER

MIRACORD XA-100 is the 4 speed record changer that makes Hi-Fi easy for everyone. It does everything *automatically*, at the push of a button . . . starts, stops, repeats, pauses, filters! It intermixes 10" and 12" records! It changes from automatic to manual in a moment. And it has the unique "free-wheeling" tone arm that *can't jam!* No other record-player has *all* these features! So get a MIRACORD XA-100, if you're assembling your own system . . . or having your dealer hook-up a system for you! $67.50

. . . and for transcription quality in a 4-speed manual player . . .

MIRAPHON XM—110A

at only $37.50 complete with every feature to satisfy the most critical listener!

ask your dealer for a demonstration

FAR AHEAD› THE FINEST BY FAR

AUDIOGERSH CORP. 514 BROADWAY, NEW YORK 12, N. Y.

WORTH 6-0800 IN CANADA: Atlas Radio Corp., Ltd., Toronto

LETTERS

Etaoin Shrdlu

SIR:

Thank you for the splendid presentation of the writer's article "Stereo-Monaural Conversion Amplifier" in your November issue. I am very grateful for your encouragement which made the whole thing possible.

That "ol' debbil" Etaoin Shrdlu let only a couple of small errors creep in on the Preamp diagram:

1. The resistor in series with the tape head input (shunted by 200 μμf) should be 100 *K* rather than 10,000 ohms.
2. The Radio input voltage divider is 270 *K* and 27 *K* instead of 27,000 and 2700 ohms.

Do you have any plans for a double Preamp with balance control and ganged volume controls? This might be an item which would interest your readers.

LOUIS BOURGET,
3996 McKinley Blvd.,
Sacramento 19, California

(*Answer to last paragraph: it's on the way and should arrive about March.* ED.)

SIR:

We were, of course, pleased with the review of the new Wharfedale 3-way Speaker System which appeared in the November issue.

However, I should like to point out a factual error which was contained in the review concerning the speaker placements. You state that in one of the systems the 3-in. cone faces forward and that in the Deluxe model it faces upward. This is not so. Both of these speaker systems are identical as far as the speaker placement is concerned and both have the 3-in. speaker facing upward. The only difference in the two systems is the framing of the cabinet on the more expensive model.

FRANK HOFFMAN,
British Industries Corporation,
80 Shore Road,
Port Washington, N. Y.

(*Thanks for the correction. We occasionally make some that aren't noticed, too. On the Philips Tape Recorder review in the November issue we said that when the microphone was plugged in it cut off the radio input. This ain't so either. Actually, when the microphone is plugged in along with a radio input, they are mixed. The volume control on the recorder controls both inputs, while the radio signal level may be adjusted independently by the volume control on the tuner. We trust this will not have influenced anyone unduly.* ED.) (*Incidentally, we wonder if it has ever been explained to readers who are not in the graphic arts why the peculiar combination of letters,* ETAOIN SHRDLU, *is often seen in typeset material. Anybody want to know?* ED.)

Stereo Discs

(*The following is an excerpt from a letter by Ruben E. Carlson, vice-president of Fairchild Recording Equipment Company to its dealers and representatives. It does such a clear job of describing the two methods of cutting stereo discs that it is believed that readers will find it instructive and interesting.* ED.)

. . . There are two systems at present competing: the first of these is the WESTREX so-called 45-45 system, and the second is the LONDON Vertical-Lateral system. We were privileged to attend demonstrations of both of these and to inspect very closely all aspects of both.

www.americanradiohistory.com

It is encouraging to note that everyone seems determined not to make any stereo records before adopting an industry-wide standard method, since all are anxious to avoid the errors of the past in connection with LP's and 45's. This is the attitude of both Westrex and London, and we know of very few new developments which have been approached so sanely.

In the LONDON system of recording, the two channels are fed to a specially designed cutter in which the cutting stylus moves vertically for one channel and laterally for the other. The groove is therefore a complex engraving in three dimensions, having vertical and lateral components representing each individual channel, and the record has a most peculiar appearance because of the shape of the modulation. The playback cartridge (their experimental model was a variable reluctance type) is so designed that a lateral component affects one of two separate pickup coils, and a vertical component affects the other coil. There are, therefore, three leads from the pickup, one being a common ground. The two signals are fed through two independent amplifier and speaker systems. Of the two demonstrations, the London system exhibited slightly better sound. It was the general opinion that this was not inherent in the system but was rather due to a better prototype pickup in the case of the London system. There are certain inherent disadvantages in vertical recording which are well known (pertaining to distortion and dynamic range in particular) which would seem to be an argument against this system. We must say, though, that the London sound was excellent.

The WESTREX system is a little harder to understand without actually seeing and handling a model of the cutter, as we were privileged to do. The idea is, however, that the cutter is designed so that there are two driving rods attached to the cutting stylus, each of these coming down to an angle of 45° from the vertical and forming a "V" with 90° included in the "V". These driving rods are attached to moving coils set higher up in the cutter, and the stylus is supported on a rather long cylindrical tube running horizontally (and perpendicular to the plane of the driving rods). Either moving coil alone will therefore move the stylus up and down along a slanted line at 45° to the verticle. If both coils operate together and in phase, the stylus will be pushed equally and will move up and down vertically. If both coils operate together but out of phase, the stylus will be pushed only sidewise or laterally. Since each coil is connected to a separate channel, a 45° or slantwise motion corresponds to one channel, and either vertical or lateral motion has information for both channels. For this reason, the 45-45 system achieves complete compatibility for standard microgroove records and this is felt to be very important. That is, the WESTREX system enables playing of stereo discs monaurally with a standard LP cartridge, or binaurally with a stereo cartridge; also, the stereo pickup will play standard LP discs monaurally, as well as stereo discs binaurally. The user can make the transfer partially or completely and without making obsolete any of his present records or equipment.

Of course with any stereo system, including the Westrex, two amplifiers and preamplifiers, and two speakers are needed for stereo results. The Westrex cutter is also compatible and will cut either 45-45, vertical-lateral, or regular LP records, so we are in the fortunate position that both principal parties are willing to adopt the system best suited to the public's need.

RUBEN E. CARLSON

MIRATWIN

world famous quality cartridge brings out

THE BEST IN ANY HI-FI SYSTEM!

MIRATWIN
mst-1 single
with diamond stylus for LP
or standard diamond stylus
Formerly $34.50 **NOW $26.50**

MIRATWIN
mst-2 turnover
with sapphire stylus
for standard and diamond
stylus for microgroove
Formerly $45.00 **NOW $31.50**

NOW AT NEW LOW PRICES!

If you have a hi-fidelity system, bring out its finest tonal values with MIRATWIN. Because MIRATWIN is as smooth and sensitive a cartridge as man can make . . . faithfully transmits the *complete* recorded sound! Acclaimed by audio engineers and music appreciation enthusiasts alike, MIRATWIN fits *all* standard tone arms, has instant stylus replacement. Enjoy it in your hi-fidelity system for the *best* in recorded music! Recommended tracking force when used in separate tone arms 4 to 8 grams; in record changers 6 to 8 grams. Ask your dealer to give you an A-B Test today.

MIRATWIN CARTRIDGES		REPLACEMENT STYLI	
MST-1D *Single Diamond*	$26.50	DM-2 *Micro-Diamond*	$16.50
MST-1S *Single Sapphire*	10.00	DN-2 *Standard Diamond*	16.50
MST-2D *Dual-1 Sapph.. 1 Diam.*	31.50	SM-2 *Micro-Sapphire*	5.00
MST-2A *Dual Sapphire*	15.00	SN-2 *Standard Sapphire*	3.00

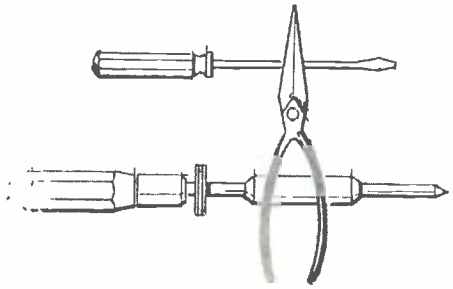
FAR AHEAD) THE FINEST BY FAR

AUDIOGERSH CORP. 514 Broadway, New York 12, N. Y.
WORTH 6-0800 IN CANADA: Atlas Radio Corp., Ltd., Toronto

www.americanradiohistory.com

treat your family
to all the fun and enjoyment
of fine high fidelity at
one-half the price you
would expect to pay

HERE'S ALL YOU NEED



to build your own **HEATHKIT HI-FI**

HEATHKIT
HIGH FIDELITY FM TUNER KIT

This FM tuner is your least expensive source of high fidelity material! Stabilized oscillator circuit assures negligible drift after initial warmup. Broadband IF circuits assure full fidelity, and 10 microvolt sensitivity pulls in stations with full volume. High-gain cascode RF amplifier, and automatic gain control. Ratio detector gives high-efficiency demodulation. All tunable components prealigned. Edge-illuminated dial for easy tuning. Here is FM for your home at a price you can afford. Shpg. Wt. 7 lbs.

MODEL FM-3A $25.95 (with cabinet)

HEATHKIT
BROADBAND AM TUNER KIT

This tuner differs from an ordinary AM radio in that it has been designed especially for high fidelity. The detector uses crystal diodes, and the IF circuits are "broadbanded" for low signal distortion. Sensitivity and selectivity are excellent. Quiet performance is assured by 6 db signal-to-noise ratio at 2.5 uv. All tunable components prealigned. Incorporates AVC, two outputs, and two antenna inputs. Edge-lighted glass slide rule dial for easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 8 lbs.

MODEL BC-1A $25.95 (with cabinet)

HEATHKIT "MASTER CONTROL"
PREAMPLIFIER KIT

This unit is designed to operate as the "master control" for any of the Heathkit Williamson-type amplifiers, and includes features that will do justice to the finest program material. Frequency response within ±1½ db from 15 to 35,000 CPS. Full equalization for LP, RIAA, AES, and early 78's. Five switch-selected inputs with separate level controls. Bass and treble control, and volume control, on front panel. Very attractively styled, and an exceptional dollar value. Shpg. Wt. 7 lbs.

MODEL WA-P2 $19.75 (with cabinet)

www.americanradiohistory.com

HEATHKIT "BASIC RANGE" HIGH FIDELITY SPEAKER SYSTEM KIT

The very popular model SS-1 Speaker System provides amazing high fidelity performance for its size because it uses high-quality speakers, in an enclosure especially designed to receive them.

It features an 8" mid-range-woofer to cover from 50 to 1600 CPS, and a compression-type tweeter with flared horn to cover from 1600 to 12,000 CPS. Both speakers are by Jensen. The enclosure itself is a ducted-port bass-reflex unit, measuring 11½" H x 23" W x 11¾" D and is constructed of veneer-surfaced plywood, ½" thick. All parts are precut and predrilled for quick assembly.

Total frequency range is 50 to 12,000 CPS, within ±5 db. Impedance is 16 ohms. Operates with the "Range Extending" (SS-1B) speaker system kit later, if greater frequency range is desired. Shpg. Wt. 30 lbs. **MODEL SS-1 $39.95**

"BASIC" SPEAKER SYSTEM

HEATHKIT "RANGE EXTENDING" HIGH FIDELITY SPEAKER SYSTEM KIT

The SS-1B uses a 15" woofer and a small super-tweeter to supply very high and very low frequencies and fill out the response of the "Basic" (SS-1) speaker system at each end of the audio spectrum. The SS-1 and SS-1B, combined, provide an overall response of ±5 db from 35 to 16,000 CPS. Kit includes circuit for crossover at 600, 1600 and 4000 CPS. Impedance is 16 ohms, and power rating is 35 watts. Measures 29" H x 23" W x 17½" D, and is constructed of veneer-surfaced plywood, ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

MODEL SS-1B $99.95

RANGE EXTENDER

. . . *and save!*

HEATHKIT "LEGATO" HIGH FIDELITY SPEAKER SYSTEM KIT

The fine quality of the Legato Speaker System Kit is matched only in the most expensive speaker systems available. The listening experience it can bring to you approaches the ultimate in esthetic satisfaction.

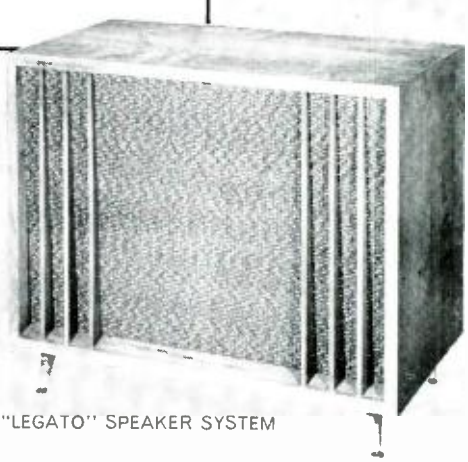
Frequency response is ±5 db 25 to 20,000 CPS. Two 15" theater-type Altec Lansing speakers cover 25 to 500 CPS, and an Altec Lansing high frequency driver with sectoral horn covers 500 to 20,000 CPS. A precise amount of phase shift in the crossover network brings the high-frequency channel into phase with the low-frequency channel to eliminate peaks or valleys at the crossover point. This is one reason for the mid-range "presence" so evident in this system design.

The attractively styled "contemporary" enclosure emphasizes simplicity of line and form to blend with all furnishings. Cabinet parts are precut and predrilled from ¾" veneer-surfaced plywood for easy assembly at home. Impedance is 16 ohms. Power rating is 50 watts for program material. Full, smooth frequency response assures you of outstanding high fidelity performance, and an unforgettable listening experience. Order HH-1-C (birch) for light finishes, or HH-1-CM (mahogany) for dark finishes. Shpg. Wt. 195 lbs.

MODELS HH-1-C or HH-1-CM $325.00 each

HEATHKITS

World's finest electronic equipment in kit form . . .



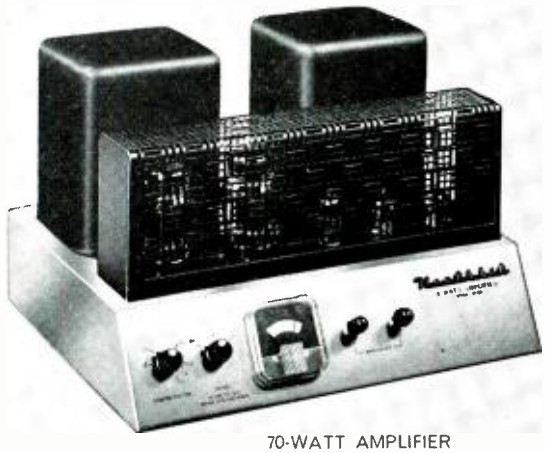
"LEGATO" SPEAKER SYSTEM

Pioneer in "do-it-yourself" electronics

HEATH COMPANY

A subsidiary of Daystrom, Inc.
Benton Harbor 25, Mich.

www.americanradiohistory.com



70-WATT AMPLIFIER

25-WATT AMPLIFIER

ELECTRONIC CROSS-OVER

easy-to-build designs by HEATH *insure*

You get more comprehensive assembly instructions, higher quality circuit components, and more advanced design features, when you buy HEATH hi-fi!

HEATHKIT 70-WATT HIGH FIDELITY AMPLIFIER KIT

This new amplifier features extra power reserve, metered balance circuit, variable damping, and silicon-diode rectifiers, replacing vacuum tube rectifiers. A pair of 6550 tubes produce full 70-watt output with a special-design Peerless output transformer. A quick-change plug selects 4, 8 and 16 ohm or 70 volt output, and the correct feedback resistance. Variable damping optimizes performance for the speaker system of your choice. Frequency response at 1 watt is ±1 db from 5 CPS to 80 KC with controlled HF rolloff above 100 KC. Harmonic distortion at full output less than 2%, 20 to 20,000 CPS, and intermodulation distortion below 1% at this same level. Hum and noise are 88 db below full output. Variable damping from .5 to 10. Designed to use WA-P2 preamplifier. Express only. Shpg. Wt. 50 lbs. **MODEL W-6M $109.95**

HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

The 25-watt Heathkit model W-5M is rated "best buy" in its power class by independent critics! Faithful sound reproduction is assured with response of ±1 db from 5 to 160,000 CPS at 1 watt, and harmonic distortion below 1% at 25 watts, and IM distortion below 1% at 20 watts. Hum and noise are 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8 and 16 ohms. Employs KT66 tubes and Peerless output transformer. Designed to use WA-P2 preamplifier. Express only. Shpg. Wt. 31 lbs. **MODEL W-5M $59.75**

HEATHKIT ELECTRONIC CROSS-OVER KIT

This device separates high and low frequencies electronically, so they may be fed through two separate amplifiers driving separate speakers. The XO-1 is used between the preamplifier and the main amplifiers. Separate amplification of high and low frequencies minimizes IM distortion. Crossover frequencies are selectable at 100, 200, 400, 700, 1200, 2000, and 3500 CPS. Separate level controls for high and low frequency channels. Attenuation is 12 db per octave. Shpg. Wt. 6 lbs.

MODEL XO-1 $18.95

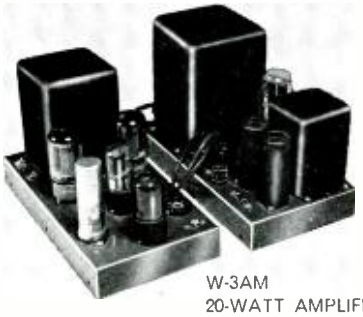
HEATHKIT W-3AM HIGH FIDELITY AMPLIFIER KIT

Features of this fine Williamson-type amplifier include the famous Acrosound model TO-300 "ultralinear" transformer, and 5881 tubes for broad frequency response, low distortion, and low hum level. Response is ±1 db from 6 CPS to 150 KC at 1 watt. Harmonic distortion is below 1% and IM distortion below 1.3% at 20 watts. Hum and noise are 88 db below 20 watts. Provides output taps of 4, 8 or 16 ohms impedance. Designed to use WA-P2 preamplifier. Shpg. Wt. 29 lbs. **MODEL W-3AM $49.75**

HEATHKIT W-4AM HIGH FIDELITY AMPLIFIER KIT

A true Williamson-type circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can give you fine listening enjoyment with a minimum investment. Uses 5881 tubes and a Chicago-standard output transformer. Frequency response is ±1 db from 10 CPS to 100 KC at 1 watt. Less than 1.5% harmonic distortion and 2.7% intermodulation at full 20 watt output. Hum and noise are 95 db below full output. Transformer tapped at 4, 8 or 16 ohms. Designed to use WA-P2 preamplifier. Shipped express only. Shpg. Wt. 28 lbs. **MODEL W-4AM $39.75**

www.americanradiohistory.com



W-3AM
20-WATT AMPLIFIER

W-4AM
20-WATT AMPLIFIER

A-9C
20-WATT AMPLIFIER

A-7D
7-WATT AMPLIFIER

HEATHKITS

World's finest electronic equipment in kit form . . .

. . . *top* **HI-FI** *performance*

HEATHKIT A-9C
HIGH FIDELITY AMPLIFIER KIT

This amplifier incorporates its own preamplifier for self-contained operation. Provides 20 watt output using push-pull 6L6 tubes. True high fidelity for the home, or for PA applications. Four separate inputs—separate bass and treble controls—and volume control. Covers 20 to 20,000 CPS within ±1 db. Output transformer tapped at 4, 8, 16 and 500 ohms. Harmonic distortion less than 1% at 3 db below rated output. High quality sound at low cost!

Shpg. Wt. 23 lbs. **MODEL A-9C $35.50**

HEATHKIT A-7D
HIGH FIDELITY AMPLIFIER KIT

This is a true high fidelity amplifier even though its power is somewhat limited. Built-in preamplifier has separate bass and treble controls, and volume control. Frequency response is ±1½ db from 20 to 20,000 CPS, and distortion is held to surprisingly low level. Output transformer tapped at 4, 8 or 16 ohms. Easy to build, and a fine 7-watt performer for one just becoming interested in high fidelity. Shpg. Wt. 10 lbs. **MODEL A-7D $17.95**

Model A-7E: Same as the above except with extra tube stage for added preamplification. Two switch-selected inputs, RIAA compensation, and plenty of gain for low-level cartridges. Shpg. Wt. 10 lbs. **$19.95**

HOW TO ORDER . . .
Just identify the kit you desire by its model number and send check or money order to address below. Don't hesitate to ask about HEATH TIME PAYMENT PLAN.

Pioneer in "do-it-yourself" electronics

HEATH COMPANY

A subsidiary of Daystrom, Inc.
Benton Harbor 25, Mich.

FREE CATALOG

NAME _____

ADDRESS _____

CITY & STATE _____

Please send **FREE** *Heathkit Catalog*

www.americanradiohistory.com

DEPENDABLE!
VERSATILE!
PRICED
RIGHT!

precisioneered
DECADE
INDUCTOR
UNITS

Here's vital help for your design and experimental work on audio filters, equalizers and tuned circuits at frequencies between 150 and 20,000 cycles.

Four units available in ranges from 10 x .001 Henry to 10 x 1.0 Henry. When all four units are connecting in series, 11,110 steps from .001 Henry to 11.11 Henries are obtained.

Excellent stability vs. current and temperature changes. Reasonable amount of D.C. may be run through the units with little effect on inductance.

Write for Bulletin D-2, describing this low-priced line of high quality HYCOR Decade Inductor Units. Dimensions: 5¼" L. x 3" W. x 2¼" H.

IRC
INTERNATIONAL RESISTANCE CO.
HYCOR DIVISION
12970 Bradley Ave., Sylmar, California

ABOUT MUSIC

Notes on Request

HAROLD LAWRENCE*

"HOLD IT A MINUTE!" cries the composer, hurrying toward the podium, score in hand. The conductor raps his baton and the music stops. After a brief conference, the latter says: "Let's have it from Number 22, please." After the repetition, the composer exchanges a meaningful glance with the conductor who turns to his right: "Violas, your first note at 22 should be A flat, not A natural. Please write in the correction."

The work in question was being played from manuscript parts and a copyist's mistake had been responsible for the offending note. In the laborious process of copying out orchestral parts, errors are bound to crop up. In some cases, the fault may be with the composer who neglected to indicate the right transposition, or it may simply be that his manuscripts are wellnigh indecipherable.

Although a handwritten copy can be perfectly legible, musicians prefer the printed page. Yet, apart from the standard repertoire and certain moderns, large segments of the libraries of symphony orchestras all over the world are still in manuscript form. Contemporary works head the list, of course, but a surprising number of well known pieces of pre-Nuclear Age vintage may also be found here. The first examples that come to mind are Offenbach's *Gaité Parisienne* (arr. Rosenthal), Carpenter's *Adventures in a Perambulator* (rev. 1941), and quantities of Strauss waltzes and polkas. Outside of the concert hall, orchestral scores for musical comedies, TV spectaculars, popular singers and the movies go unprinted for obvious reasons—all of which provides the copyist with a steady stream of assignments.

The copyist has been an important part of the musical scene for centuries. Before the application of the printing press to music in the late 15th century, he was the source of all available music copies. Since printing could not keep up with the flood of composition that poured from the pens of musicians from that time on, his livelihood was far from threatened. In fact, the copyist was in a position to make more money from a work than the composer himself. After the first rehearsal of Mozart's opera, *Mithridate*, in Milan on December 12, 1770, father Leopold wrote home to his wife: "The copyist is absolutely delighted, which is a good omen in Italy, where, if the music is a success, the copyist can earn more from the sale of arias than the composer does from the entire opera." Rehearsals in those days were scheduled not only for the performance, but to ascertain whether all the notes had been correctly copied. In the case of the Milanese copyist, only a single correction had to be made at the recitative rehearsal, and that was not a musical one, but a letter change from *della* to *dalla*.

In the middle of the 18th century, some 300 years after the appearance of the first printed music, printing activities came to a virtual standstill in Europe. Manuscripts outnumbered printed copies in the Breitkopf catalogue of 1755, and most people found it more convenient to obtain music from a copyist than to wait for its publication. For this reason, publishing houses employed staffs of copyists to handle business of this sort.

Naturally more printed music is relatively available today than 200 years ago. In other respects, however, the situation remains basically the same. Successful composers see their works printed at the time of their premières, but most contemporary music is played from manuscript. Orchestral parts for a half-hour symphony amount to approximately $1000. Professional copies of the full orchestral score being somewhat of a luxury (the copyist's fee equals that for all the parts together), the conductor usually has to cope with the composer's squiggles. And the precise and crystal clear musical calligraphy of Igor Stravinsky is a rare exception. Besides, the latter's works are generally available in print.

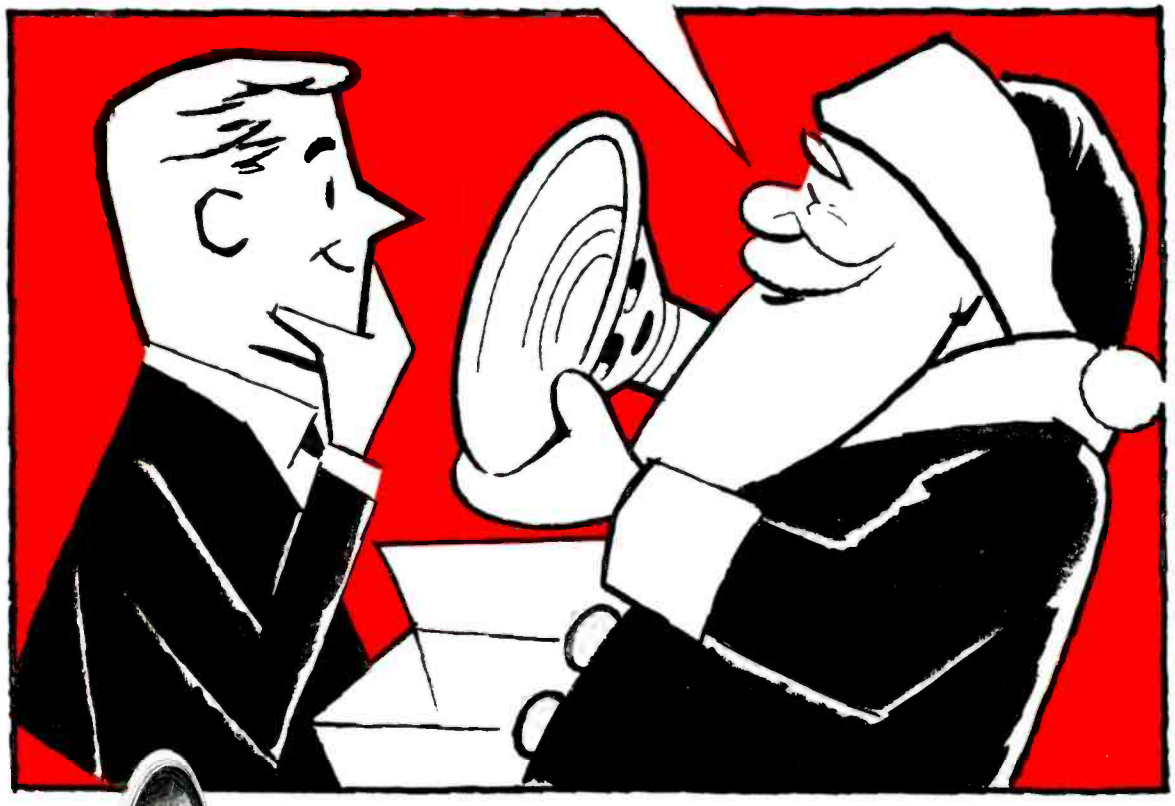
All musicians who have had to squint at blotchy manuscripts, or who have struggled with recalcitrant music quills, can now take heart. Two years ago, a composer-inventor named Cecil Effinger (associate professor of music at the University of Colorado) brought forth his "Musicwriter"—a music typewriter that may eventually replace finished handwritten copies of music just as surely as the alphabet typewriter made handwritten letters obsolete in the business world. The Musicwriter was some ten years in the making. After numerous experiments and prototypes, Effinger finally evolved his 79-character, free-moving carriage, device that can produce results comparable with that of a printed score. Resembling an office typewriter in shape and design, the Musicwriter is the final step in a century-and-a-quarter attempt to bypass pen and ink for finished copies. Dozens of patents for music typewriters have been issued in this country and abroad since the 1880's, reports Effinger, but they were all either impractical or impossibly complicated.

History is replete with examples of in-

* *26 W. Ninth St., New York 11, N. Y.*

www.americanradiohistory.com

Yes sir! It's my suggestion everytime!



What is?
Norelco Full Response Speakers. As your choice for true high fidelity reproduction, Norelco's twin-cone speakers will bring you a new dimension in musical enjoyment for a long time to come. They make a perfect family treat at Christmas time.

Yes, but money gets tight at this time of year.
Why, that should be no problem.

How's that?
Simple, penny for penny, note for note, Norelco *FRS speakers reproduce sound more faithfully than any other sound radiator anywhere near its price range.

What makes Norelco speakers so much better?
I always say, listen to be convinced—your ears will soon tell you. But to make a long story short—These Norelco people have been in the sound business for years. They designed these twin-cone speakers to accurately register highs through the smaller cone and lows through the larger cone. Both are operated from the same voice coil and the same magnet—producing a flat response with exceptional reproduction of transients. On low loudness levels, relative tonal balance is clearly maintained with clean bass, smooth middle tones and clean, sharp highs—free from undesirable harmonics and spurious effects . . . Need I say more?

In what sizes are they supplied?
Five, eight, ten and twelve inch models, and there are specially built Norelco enclosures available for them too. They are obtainable at better dealers everywhere. They all produce real sound, brother . . . real sound!

Norelco *FRS Speakers are available in 5", 8" or 12" sizes in standard impedances. Priced from $6.75 to $59.98. Blueprints are available for the do-it-yourself enclosure builder. Norelco Enclosures are available in three sizes, priced from $33.75 to $119.95.

ADD TO . . . and improve any sound system with Norelco® *FULL RESPONSE SPEAKERS.

Write today to Dept. A12 for brochure and prices of these unique speakers.

NORTH AMERICAN PHILIPS CO., INC., High Fidelity Products Division, 230 Duffy Ave., Hicksville, L. I., N. Y.

www.americanradiohistory.com

it's new

The TRC triple-duty microphone by American

Actual size of new TRC microphone

for hand...

stand...

or lavalier

it's versatile... lightweight... low cost, too!

Elgin's new TRC dynamic microphone offers faithful audio reproduction in the 80-8500 cps range, yet lists from $11.50. It is designed for use with tape recorders . . . yet has the versatility to perform ideally at meetings and assemblies, wherever p.a. systems are used. The TRC is less than five inches long, weighs only nine ounces, has a polished, chromeplated case. It is omnidirectional and picks up voices within a radius of ten feet under average conditions.

The TRC is also available in crystal and ceramic types.

Get the facts on this new addition to Elgin's complete line of "American" microphones. Write today for specifications and complete descriptive literature.

ELECTRONICS DIVISION

ELGIN NATIONAL WATCH COMPANY

107 National Street, Elgin, Illinois

ventions and discoveries being made simultaneously in different parts of the world. In London, an ex-music-hall entertainer who used to have special musical numbers written for her, often thought of the problem of music copying. After she retired, she quietly began work on her own music typewriter. This year, she finally came out with a prototype of a machine which differs in certain basic respects from Effinger's model. The operator of the Musicwriter must type with his right hand while he manipulates the carriage with his left. The English machine's carriage can be moved by means of keys so that the writer can type with both hands, thereby turning out larger quantities of music. Each invention was developed independently of the other.

In view of these developments, the copyist can soon put aside his traditional quill and adopt the slogan: "Have machine, will copy." Æ

COMING EVENTS

HI-FI SHOWS

January 10–12—Minneapolis: Hotel Dyckman (*Rigo*).

January 17–19—Indianapolis: Hotel Antlers (*Rigo*).

January 24–26—Buffalo: Hotel Statler (*Rigo*).

February 7–9—Denver: Hotel Cosmopolitan (*Rigo*).

February 14–16—San Francisco: Whitcomb Hotel (*IHFM-NCAS*).

Feb. 26–Mar. 2—Los Angeles: Biltmore Hotel (*IHFM*).

March 7–9—Pittsburgh: Hotel Penn-Sheraton (*Rigo*).

March 14–16—Washington, D.C.: Shoreham Hotel (*Independent*).

March 21–23—Newark: Hotel Robert Treat (*Rigo*).

Sept. 30–Oct. 4—NEW YORK High Fidelity Show, New York Trade Show Building (*IHFM*).

OTHER EVENTS

Dec. 8–11—Eastern Joint Computer Conference; Park Sheraton Hotel, Washington, D.C. IRE–AIEE–ACM.

February 20–21—Conference on Transistor and Solid State Circuits. Philadelphia, Pa. IRE–AIEE–Univ. of Pa.

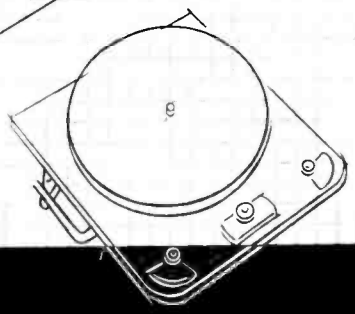
April 14–17—Radio Component Show, organized by the Radio and Electronic Component Manufacturers Association; Grosvenor House and Park Lane House, London.

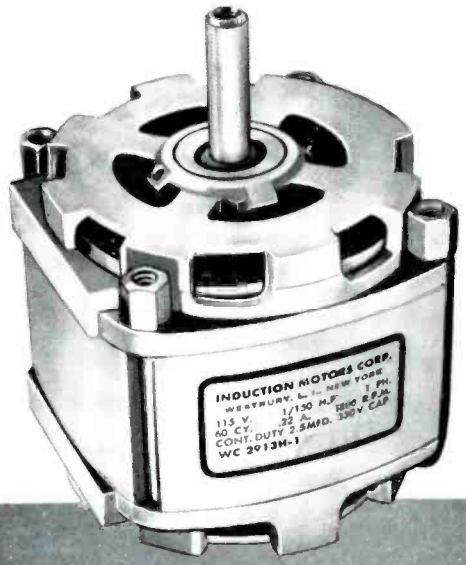
March 24–27—Institute of Radio Engineers National Convention, New York City.

www.americanradiohistory.com

A new standard in

HYSTERESIS MOTOR DESIGN





imc

- Uniform Speed To Meet Exacting Requirements.
- Low Noise Level approaching Inaudibility.
- High Starting Torque for instantaneous efficient operation.

SPECIFICATIONS*

	WC2913H Turntable	WC2913H-1 ** Tape Recorder
Volts	115	115
CPS	60	60
Watts Input	21	24
Amperes	.25	.22
Number of Poles	4	4
RPM	1800	1800
H.P.	1/150	1/125
T.P.I. (oz. in.)	3.0	4.5
T.P.O. (oz. in.)	3.5	5.0
T.ST. (oz. in.)	2.3	4.0
Capacitor (mfd) 220 Volts A. C.	1	2.5
Weight	1 lb.	1 lb.

*All specifications are relative to frame size. The hysteresis series is available in seven frame sizes from 3/4" diameter to 4 1/2".

**Can be supplied with magnetic shielding (Mu-Metal)

A new era of electronic enterprise continues to place greater and greater emphasis upon engineering design and creative production. New tape recorder and turntable applications have required hysteresis motors unusually precise in their performance, rugged construction to withstand continued use, built within smaller and smaller frames . . . all this to meet the competitive price requirements of the end product.

A large order— but Induction Motors has done just that in its line of hysteresis motors—compact in size, precision manufacture with assured reliability. Typical of these design achievements are the types which today find themselves in such fine recorders as those made by Ampex.

Induction Motor's reputation of quality has been proven over the years in their manufacture of a complete line of precision subfractional horsepower motors.

For complete information on IMC hysteresis and torque motors for tape recorders and turntables, write for catalogue HT.

Induction Motors Corp.

570 Main St., Westbury, L. I., N. Y. • Phone EDgewood 4-7070

6058 Walker Avenue, Maywood, Calif.

www.americanradiohistory.com

Christmas and New Year Greetings from the Editors and Staff of Audio

EDITOR'S REVIEW

STEREO COMMENTS

WITH THE ALMOST CERTAIN CONVERSION of many thousands of home systems to stereo within the next year—both with existing tape equipment and with the coming stereo discs, we feel that some pertinent observations might be made. To date, we do not recall having seen any treatment of the importance of speaker phasing, yet the over-all quality of stereo reproduction depends greatly on this one condition.

To best observe this for oneself, it is only necessary to connect two speakers to a single amplifier, placing the speakers at a separation which would be normal for the listening room. Such a separation, we feel, would be somewhere in the vicinity of one-half the length of the shorter wall of the room, speakers being placed about one-fourth of the distance from each of the two adjoining walls. Then reproduce some well known selection through the two speakers, with the acoustic outputs adjusted to as near the same level as possible—by means of a pad in the more efficient of the two speakers.

When you listen to an arrangement of this sort, the sound should appear to come from a virtual speaker located half way between the two—in fact, we once told an exhibitor at a Montreal show that we would take the speaker in the center because it was so small. If you seem to hear both speakers when you are standing in front of them, it is almost certain that the speakers are out of phase. Then simply reverse the two leads to *one* of the speakers, not both. The sound should then appear to come from the center.

This solution would serve perfectly well if we were to use a single amplifier to drive the two speakers always, or even if we were to reproduce a monaural tape or disc through two amplifiers and speakers—once we had them connected properly we could assume that they would stay that way.

What happens, however, when we go to stereo tapes or discs. (For a description of the two stereo disc systems now being considered by record manufacturers, we suggest you read Mr. Carlson's letter on page 7.) Let us assume that we set up our system using a tape from a given manufacturer, and that we are completely satisfied with the results *on that particular tape*. We then get some more tapes, and some sound good and some sound horrible, with little or no stereo effect. Naturally, we would first blame the manufacturer for the poor tape quality.

On the other hand, it is likely that any record or tape manufacturer—and more and more of the former are becoming also the latter—who was trying to turn out good quality would have been satisfied as to his quality in his own studio and on his own system. However, he may be using two different types of amplifiers, one having one more stage of amplification than the other, and even though his inputs were properly phased (for two identical systems) his outputs would be out of phase. Can we assume that every manufacturer will make sure of his phasing by playing a full-track recording across the two heads whenever he sets up a new system? Can we be sure that the phasing will remain constant through the various systems used in making multiple copies of the master tape?

Let us consider another possibility. Suppose we have a system which we set up (without being aware of the possible pitfalls in phasing) with a specific pair of amplifiers and speakers. Then we change amplifiers *or* speakers, and we find out that nothing sounds right after the change. If we are aware of this problem, we can change speaker connections and everything will be satisfactory again. On the other hand, there is nothing we can do to ensure that every stereo tape or record is phased exactly right for our own particular system.

There is a cure, however—not automatic, to be sure, but certainly one which will allow us to make a check whenever we hear a tape or disc that doesnot sound just right. We feel that EVERY stereo system should be set up with a reversing switch on one of the speakers. This would make it possible to check every time we were not satisfied with the sound.

All that is required is a simple double-pole, double-throw switch. In our own installation this is mounted on the back of the speaker housing, readily accessible from the top. It is likely that there will be some standardization of phasing at some future date, but until then we find the phasing switch most useful.

www.americanradiohistory.com

NO FINGERNAIL FUMBLING!

Exclusive

"T – GUARD"

STYLUS

only with the

PICKERING

fluxvalve

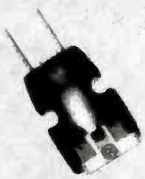
PICKERING'S introduction of the *truly* miniature FLUXVALVE magnetic phonograph cartridge represents a new era in high fidelity cartridge design. This newest of PICKERING cartridges brings the music lover the most exciting and *safest* idea in a stylus assembly since PICKERING introduced the first lightweight high fidelity pickup more than a decade ago.

The "T-Guard" stylus assembly is a quick-change, easy to slip-in unit which eliminates precarious finger-nail fumbling. Its practical "T" shape provides a firm and comfortable grip for safe and easy stylus change.

The most flexible cartridge in the world . . . the FLUXVALVE is the *only* cartridge with the remarkable ½ mil stylus . . . exclusive *only* with PICKERING. The FLUXVALVE can be used with any one of *five* styli, to meet any requirement or application . . . to play any record, at any speed.

If you are planning to buy a new cartridge—the fact that PICKERING developed this revolutionary stylus is *important to you!* All of the research, development and planning that went into the "T-Guard" stylus is conclusive proof of the superlative engineering skill in every FLUXVALVE model you buy

FLUXVALVE TWIN SERIES 350 – A turn-over cartridge providing a rapid change of stylus point radius. Available in 12 models featuring many combinations of styli, prices start at a modest $24.



FLUXVALVE SINGLE SERIES 370 – A miniature high quality cartridge for use in any type of auto-changer or manual player arm. Available in 5 models, prices start at a low $17.85.

The FLUXVALVE features exclusive hum rejection circuit— requires no adjustment!

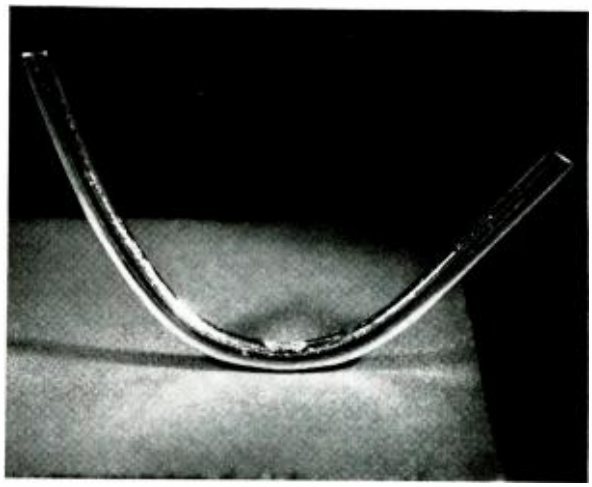
Model 194D UNIPOISE Pickup Arm—A new . . . lightweight . . . integrated arm and cartridge assembly containing the FLUXVALVE with exclusive "T-Guard" stylus. The complete assembly – tone arm and cartridge – is only a fraction of the weight of conventional tone arms. The high compliance of the "T-Guard" stylus, with the lightweight tone arm and single friction-free pivot bearing assures distortionless tracking of microgroove and standard groove recordings. Available with the ½, 1 or 2.7 mil diamond stylus, prices from $59.85.

"For those who can hear the difference" **FINE QUALITY HIGH FIDELITY PRODUCTS BY**

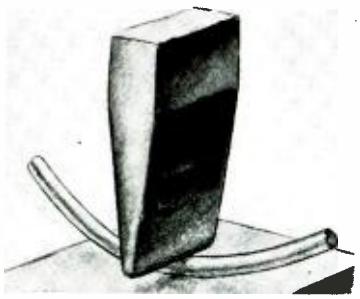
PICKERING & COMPANY, INC., Plainview, N. Y.

www.americanradiohistory.com

Thermo-compression bonding—



Wire bonded to germanium by thermo-compression technique (enlarged). Wires only 1/10 the breadth of a human hair have been successfully anchored to germanium wafers only three hairs thick. The bond may be an ohmic contact or rectifying contact by adding suitable impurities to the wire and the semiconductor.



One method of thermo-compression bonding. A heated wedge presses a wire against a heated semiconductor with enough force to deform the wire. Adhesion occurs in seconds.

new way to join metal to semiconductors

Thermo-compression bonding provides a new way to attach a wire to a semiconductor. It calls for heat and pressure—nothing else. The wire and the semiconductor are moderately heated, then pressed together under moderate pressure. The resulting bond is very strong—stronger actually than the wire. No chemical flux or molten metal is required.

Eliminating molten metal provides an enormous advantage in fixing electrical connections to transistors. That's because molten metal tends to spatter and spread uncontrollably over the surface of a semiconductor. And it may alloy with the semiconductor to alter its all-important crystalline structure and chemical purity. Thermo-compression bonding easily and quickly makes a strong permanent electrical connection without damaging the semiconductor. Furthermore, the lead may be attached to microscopic areas and precisely positioned, a most valuable aid in the construction of high-frequency transistors.

Thermo-compression bonding will speed the production of transistors . . . the transistors needed to fill all the new jobs Bell Laboratories finds for them in the quest to provide still better telephone service to our growing country.

At Bell Labs Howard Christensen and Orson Anderson discuss their discovery of new bonding principle with Peter Andreatch, Jr., who collaborated in the studies.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

www.americanradiohistory.com

The Stereo Recorder— A Revelation and an Education

JOSEPH E. FREDA*

Unlike most other products, the stereo tape recorder is often sold to us without a complete treatise of how it can be used for many purposes other than simply for the reproduction of music. The author tells his experiences in several areas of application.

THE WRITER is a confirmed don't-do-it-yourselfer to whom a term like "cathode follower output" means nothing more than some object a salesman thinks one ought to love. So it was with some diffidence that this article was submitted to a magazine whose writers, and presumably a fair proportion of its readers, are highly competent technicians.

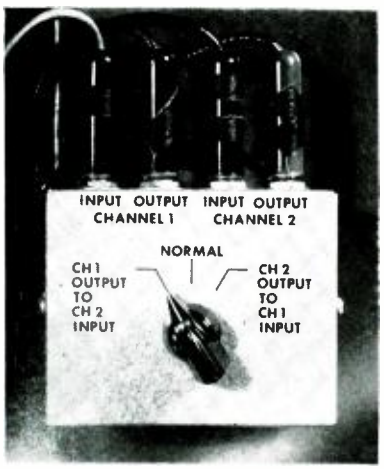
On the other hand, what I really have to tell is a story that I think might be of some interest to both audio technicians and to non-technical users of audio equipment. It concerns the search for a special-purpose tape recorder that ended up with the arrival in our home of a stereo recorder (not playback only) which has wrought dramatic changes in many of our family activities and which is only incidentally used for stereophonic music reproduction.

The moral of the story, for us at least, is that a stereo tape recorder with provision for both single and two-track recording is probably the most useful and satisfying piece of audio equipment one can have around the house.

I have no desire to make a special display of my initial ignorance about the construction and operation of tape recorders, but that *is* part of the story. Just incidentally, the reader should not be surprised if he also meets a few baffled technicians in the course of adventures in equipment selection.

Like many parents, my wife and I are intensely interested in the education of our son, Larry. We are prepared to participate, when necessary, in home activities associated with his studies to plan programs we know will interest him, and to provide him with fascinating and unusual types of instruments and equipment as well as the more common types.

Most of his studies are taken care of adequately through his school activity and somewhat routine homework. There are, however, dramatic exceptions. The most obvious of these is music. The once-a-week lesson period must be prepared for by hours of home practice in which we become involved in one way or another. Again, his school activities hardly justify any optimism about his ever learning *to speak* the French language without extra-curricular activity. Finally, he could obviously stand some extra work outside of school on good English speech.



The Channel Integrator. With the switch in the position shown, the output of Channel 1 is switched to the input of Channel 2 without the need for disturbing connections at the rear of the recorder.

Our objective has been to arrange activities at home in these three fields which are pleasant for us and fun for Larry. Long before the tape recorder came into the house, I think we accomplished something. We often play together, Larry on his clarinet and dad on the flute. And who *always* made mistakes before the tape recorder recorded them? Parents will know well enough what Larry thought about that. And, of course, he had the most difficult lessons down pat after the first couple of hours of practice. It was clear that in some way Larry (and dad, too) had to be made *to listen to himself in an entirely new way*, quite different from the way he listened as he played. The same thing was true in relation to French and English speech practice.

I got so wrapped up in the problem of what to do that I even took to reading educational journals, and it was thus that I came across descriptions of college language laboratories with their extensive use of tape recorders, and also descriptions of how recorders are used in the music and speech departments.

The Starting Step

My first impulse was to go right out and buy one of the common home varieties of tape recorders. Such a machine can indeed be very useful, and much material can be found on its educational applications in books, articles, and magazine departments. Farther on in this article I will offer some suggestions for owners of these recorders. But by this time I had become completely fascinated with the highly specialized techniques developed in the language and music departments of schools, and I wanted to apply them, even improve upon them, in the home. After weeks of having my ears dinned in hi-fi showrooms while examining all types of tape recorders, and after further reading on the subject of educational recorders, I became reluctantly convinced that no monaural recorder used alone could possibly meet all my requirements.

It was in C. J. Le Bel's book *"How to Make Good Tape Recordings"*[1] that I found the best short description of special educational techniques and why they require a stereo recorder:

"A binaural (stereo) tape recorder can be used in any of the following ways:

a) Recording on channel 1 in one direction and channel 2 in the opposite direction (dual-track recording).
b) Recording the same signal on both tracks simultaneously (single-track recording).
c) Recording separate signals from separate microphones on each channel simultaneously (binaural recording).

* *44-10 Ketcham St., Elmhurst, L.I., N.Y.*

[1] Published by Audio Devices, Inc., 444 Madison Ave., New York 22, N.Y.

www.americanradiohistory.com

Making a Live French Recording. Allen Counteraud reads French expressions into the microphone under Larry's direction to introduce pauses of the proper length in the recording.

d) Recording on channel 1 while listening to playback of channel 2. . . . particularly valuable in educational work and has led to the fairly widespread use of specialized two channel recorders in schools and colleges. . . . student can listen to pre-recorded instructional material or language drills on channel 2, and during pauses provided, record his own responses or oral repletion on channel 1.

e) Recording the playback from channel 1 onto channel 2 while simultaneously adding a microphone recording on channel 2 (sound-on-sound recording). This feature is particularly valuable to music students who wish to practice vocal or instrumental solo parts with recorded accompaniment. The original "accompaniment" track is not destroyed in the process and if any mistakes are made, the student can simply rewind the tape and give it another try."

While it is not the case, as Mr. Le Bel unintentionally seems to suggest, that every stereo recorder has all these features, this is a brilliant summary of the features a tape recorder *should* provide if it is to be a truly flexible educational instrument.

That settled it—or so I thought.

In a tape recorder directory I found a few specialized two-channel educational recorders. Their *claimed* fidelity was low enough to curl your hair if you also expected to use the recorder as a part of a music reproduction system, as we did. So I turned to the only three stereo recorders known for good music reproduction—Ampex, Berlant-Concertone, and Magnecord. None of them was cheap, but since my only other alternative was two tape recorders it would have to be one of these.

At this point, when everything seemed to be nicely resolving itself, I discovered my problems were only beginning. When Mr. Le Bel referred to *a* binaural recorder I had taken him to mean *any* binaural recorder. So the description of the Ampex stereo model S-5290 as having full-track erase, two-track record and two-track playback" would not by itself have discouraged me from ordering that machine. But when I examined the Ampex and tried to plot out in some detail how it would handle each of the items listed by Mr. Le Bel I found that items (d) and (e), the most important of all, were quite impossible. Since the full-track erase is going to erase *both* tracks simultaneously whenever *any* recording is in process, the erase of recorded material on channel 2 before it even reaches the playback head effectively precludes either recording on one channel while listening to playback on the other, or sound-on-sound recording from one channel to the other. Since the Magnecord stereo recorder has the same head configuration as the Ampex, it too could not be used without special modification.

The description of the Berlant 33 and Concertone 23 recorders, on the other hand, showed separate upper and lower track erase heads as a standard feature, which obviously makes it possible to record on one channel without erasing on the other by the simple expedient of operating only one of the two preamps while recording. I suppose it *should* have been equally obvious that such a machine would also be designed to provide for recording on either channel alone with *both* preamps in operation, which is what is required, in addition to separate erase heads, for recording on one channel while listening to playback on the other and for channel-to-channel sound-on-sound recording. But by this time I had learned not to make easy assumptions, and nowhere in Berlant's descriptive literature did I or anyone else find specific reference to these last two techniques or to the "recording selector" switch which makes them possible. So I presented to a number of salesmen handling Berlant equipment what appeared to them a formidable list of requirements—Mr. LeBel's five points. I was invariably told "it couldn't be done." One salesman reported that he got the same answer from the regional Berlant representative. For salesmen and others whose experience with tape recorders has been primarily limited to music reproduction, those aspects of stereo recording having to do with techniques like sound-on-sound are evidently not quite so obvious as the writers of Berlant promotional literature apparently think they ought to be.

The Realization

It was only in the operator's manual which came *after* purchase and delivery of the recorder that we really got final answers to our questions. The Concertone 23 comes equipped with four heads (upper-track erase, lower-track erase, stacked record, stacked playback) and space for a fifth. I had ordered a modified 23 with an additional (half-track) head and I had a perfectly valid, almost brilliant, scheme for sound-on-sound operation. To my great embarrassment the manual not only showed how to get channel-to-channel sound-on-sound with *no* modification whatever, but also described an accessory switch, which they hid under the function-obscuring name of "channel integrator," that enables the operator to get the sound-on-sound without even pulling a plug. The key features were, of course, the combination of upper and lower track erase heads and a "recording selector" switch permitting recording on just one channel, simultaneously with playback (only) on the other.

There is nothing unusual about our installation of the recorder and associated equipment, but since reference will be made from time to time to our special equipment it may be well to briefly describe the entire set-up at this point.

For recording on a single track from phonograph or radio and for playing back a single track, a Marantz consolette is used as a control center. All the RCA output and input jacks at the back of this instrument which might be useful with the tape recorder are extended to a telephone jack panel at the front of the cabinet housing the audio equipment. An old, slim 10-watt amplifier, modified to operate as a straight power amplifier, was installed in the case housing the two recorder preamps, and is used for mon-

www.americanradiohistory.com

aural playback outside the house or as a second amplifier for stereo music playback at home. Larry has a Viking 75SU tape player as a part of his own music set-up in his room, and this player is sometimes used in conjunction with the Concertone for copying and editing tapes.

More detailed description of specific features of the recorder and associated equipment, and of the mechanics of the all-important sound-on-sound recording technique, will be found in the succeeding parts of this discussion, dealing with the application of the stereo recorder for music and speech training in the home. First for music.

The Recorder as a Music Coach

It is a rare music student who can evaluate his playing at the time he is practicing, and our son is not one of the exceptions. Simply recording his practice at intervals and listening to the playback gives him a new insight into his weaknesses and suggests what to concentrate on in further practice. For this we can use one channel of the Concertone 23 as monaural recorder.

For anything beyond this we must use the two tracks of the stereo recorder in various ways.

We often use them to provide a rapid A-B comparison between Larry's playing and that of a competent professional, playing the same piece of music. On channel 1 we make a live recording of his routine practice material as played by an instructor, or we transfer from a phonograph record to this tape track a portion of a well-known work. Larry records his playing of the same material onto channel 2, timing his start by listening through earphones, though for this purpose precise timing of the two channels is not critical. He may then continue on his own without listening to channel one or he may attempt to play right along with the professional musician. When the tape is played back the two recorder outputs are connected to the TV and EXTRA inputs of the Marantz preamp. Setting the recorder playback controls at the proper level, he can alternate between the two channels by simply flicking the selector switch. Since the material on channel 1 is not erased during recording on channel 2, Larry may repeat his own recording as often as he wishes.

But nothing has so fascinated Larry or so fired him into activity as has the possibility of emulating those highly-publicized popular singers and musicians who make duets, trios and quartets in which they sing or play all the parts themselves. At first sight this might seem to be mere doodling, but it does in fact serve an extremely useful purpose. Young music students often think they are holding a steady beat and are getting precise attack. They will not accept the statement of an observer that this is not so, and may not even recognize their failings when listening to the playback of a monaural recording they have themselves made. But they can't argue with a tape of a duet, trio or quartet which they have made. A *merely acceptable* result requires an absolutely steady beat and extreme precision of attack. Any failure is immediately obvious. Larry found this out as soon as he attempted a duet and has since worked hard at developing the precision required for trios and quartets. He is having a barrel of fun, but more important is the fact that this special type of practice has resulted in greatly improved performance on his instrument.

Inserting Pauses in Continuous Speech Records. Output of Viking goes to Channel 1 input of Concertone; latter runs continuously, while Viking is stopped at the end of each sentence or phrase for the desired pause.

A useful variant of this procedure applies only to duets. The instructor's playing of one part of a duet is recorded on channel 1. Larry rerecords this part simultaneously with his own microphone recording of the other part on channel 2. I sometimes transpose for flute one part of a clarinet duet and record this on channel 1, giving Larry an opportunity to make duets with it when I am not around.

When he is preparing for a student concert, the piano accompaniment part may be recorded on channel 1 by his accompanist, giving him a chance to practice with the accompaniment at home, recording himself and the accompaniment simultaneously on channel 2.

The same procedure is followed in practicing with the "Music minus one" records which provide just the symphonic or chamber accompaniment to a concerto or provide chamber works minus one of the instruments played in the standard chamber group.

What is required for one-man ensembles and for playing with recorded accompaniments and duet parts is some sort of sound-on-sound, and this is a good place to pause for a general discussion of s-o-s techniques.

Two-Recorder Operation

Two separate recorders provide a sound-on-sound procedure which, while not as elegant and convenient as that offered by the Concertone 23, will nevertheless make possible all the special applications described. Each recorder must have a two-input mixer and an earphone jack that automatically disconnects the recorder's speaker when the phones are plugged in. There are inexpensive mixers on the market for recorders that do not have them, and the installation of a phone jack is a simple matter. Duet and accompaniment parts are recorded on machine A. When the tape is played back the student will listen with earphones to the output of machine A and will record this output simultaneously with his own microphone recording on machine B. Since the first tape is not erased, this may be repeated as often as the student

www.americanradiohistory.com

Making a Duet. Larry plays the second part of a duet along with the first part recorded previously by his instructor or by himself on Channel 1. Both parts are recorded together on Channel 2.

wishes. For one-man ensembles the first part is recorded on machine A, then this with the second part on machine B, and so on ad infinitum.

An example of a monaural s-o-s recorder using a single tape transport is the Concertone 24. The standard three heads (erase, record, playback) are preceded by an extra playback head connected to a playback-only preamp. We have, in effect, a tape player and a tape recorder sharing a single transport. When the player output is connected to the recorder input the recorded signal is *re*recorded a little farther along on the same tape, from which the recorded material that has already passed the first playback head has been erased. Since the output of the tape player and a microphone can be recorded simultaneously on the recorder section, we have a form of s-o-s in which the original recorded material is destroyed. This is all right for one-man ensembles, but it is disastrous for playing with duet and accompaniment parts or when using the recorder for learning a foreign language. In all these cases it is necessary to conserve the pre-recorded material for further practice.

The Concertone 23 combines the convenience and high quality of the monaural s-o-s Concertone with the greater flexibility of two separate recorders. An accompaniment or duet part is, for instance, recorded on channel 1. When this tape is re-run the output of channel 1 is plugged into the line input of channel 2, the microphone is plugged into the mike input of the same channel, and the record selector switch is set for "channel 2 only" to avoid erasure on channel 1. After balancing the output level of channel 1 and the two input levels of channel 2, simultaneous recording is made of channel 1 output and microphone. The same procedure is followed for combining the first part of a one-man ensemble recorded on channel 1 with the second part. To add the third part simply plug output of channel 2 into line input of channel 1. And so on.

While the unplugging and replugging of the inputs and outputs is not at all difficult, it does require accessibility to the back of the recorder and is at best something of a nuisance. So Berlant has provided a special three-position switch, the channel integrator referred to earlier. All recorder inputs and outputs pass through this switch. In the center position all are left in their normal position. In a second position the output of channel 1 is connected to the input of channel 2. In a third position the output of channel 2 is connected to the input of channel 1.

Our Private Language Laboratory

After reading reports about the great effectiveness with which tape recorders have been used for language instruction in schools, I expected a great deal from our stereo recorder in this area and have not been disappointed.

We have had a great deal of fun setting up our own language laboratory. Obviously it could not be simply a copy of the kind of laboratory set up in the colleges. We don't have either the advantages or disadvantages of an instructor and class. As students, we have to dig up our own material, getting it from records and recorded tapes, taking it off the air, and finding native French speakers to record material for us. Also, as a family, we are even less homogeneous with respect to interest in learning a foreign language and willingness to put serious effort into it than is an average high school or college class. The machine means something different and contributes something different to each member of the family.

For his own private reasons, which probably would not make much sense to anyone else, pop has become determined that he is going to read French literature in the original language, that he is going to comprehend French spoken at normal conversational speed (which is fast), and that he is going to speak French as well as he can in spite of the great handicap that he has little or no opportunity to converse in the language. So the recorder doesn't need to "motivate" him, merely provide the materials for learning and the opportunity to practice.

Mother is terribly eager to learn the French she never did learn in seven years of school courses. But with so many other interests and duties she wants to get it by some form of Osmosis. And she is convinced that, being literally enveloped in tape recorder French from time to time, she is succeeding in this utterly painless method of learning the language.

Larry's problems are something else again. From about six to nine, he was terribly interested in learning a language. Unfortunately I could not then do anything about it and the New York City school he attended had no language program for the elementary grades. Now that he is in Junior High School and is required to learn a foreign language, he seems to be past the stage of active interest and is a somewhat reluctant learner. But we do not want him to learn a foreign language, and it is already pretty clear that we can't depend on his school class to develop his interest and do an adequate job of teaching. If our private language laboratory is to do any better it must revive his interest and put some real fun into the learning process.

The planning of this private language laboratory and the mechanics of its operation have in themselves been important elements in the effectiveness of the recorder for language learning in our home. Like most twelve-year-olds, he gets a big wallop out of using the machine—what with its numerous knobs, switches, meters, reels, microphone, provision for recording from the air, from records and from other tapes, and—particularly—sound-on-sound recording. He is both willing and anxious to undertake

www.americanradiohistory.com

projects from which he will absorb a great deal of the French language, and I don't hesitate for a moment to plan some pretty insidious gimmicks to keep the excitement at a high pitch. He takes programs off the air for the family, he dubs records onto tape for later sound-on-sound use, and he assists me in a tricky technique for inserting silent spaces in continuous speech material. For this last he is paid a modest but well-earned sum and has been promised an increased fee when he can handle the whole thing by himself (he'll have to learn a lot of French to do that). We recently met a French family just arrived from France and they have enthusiastically agreed to record for us. Larry is, of course, the sound engineer on all projects, and learns more French from the recording sessions than he realizes.

The Laboratory in Operation

As I pointed out earlier, the home language laboratory does not have a corps of instructors to record precisely the material the laboratory needs, and we have to dig up material from any source we can. At least for the language we are learning and the area in which we live, there is plenty available.

The most available source of material is phonograph records. And I would to like to start off the discussion of records with some conclusions. I know that the word "learning" can be given many meanings, but I don't think any of them can be stretched far enough to justify the claims made by some makers of language records that you can learn the language by listening to records for x minutes a day. Believe me, you won't learn a language in x minutes or x hours a day solely through the use of records. You will find some of them tremendously useful in improving your pronunciation and your ability to comprehend the spoken language. You will not get the fluency that comes from extensive conversation with French-speaking people. We have, incidentally, found the records for which the wildest claims have been made to be the least useful of all those we have obtained.

There are roughly three types of language-teaching records and tapes available:

(1) Those which consist entirely of continuous speech, in the form of phrases, sentences, dialogues, or a story.
(2) Those which consist largely of phrases and sentences, each followed by a pause which gives the listener time to repeat the speech unit immediately after hearing it.
(3) Those which consist of a mixture of these two forms.

I am amazed to find that there is some debate as to the comparative usefulness of the first two types. Language learning is one field where the educational dogma "you learn by doing" seems unassailable, and the most important bit of doing in this field is *speaking*. Speech practice is obviously essential for the development of good pronunciation and fluent expression, and the contention of many experts that one must *speak* the language in order to *comprehend* native speakers is certainly supported by our experience with records and radio. We had listened to continuous speech records and radio broadcasts for some time before we began to work with records containing pauses and with the tape recorder. During that period our progress in aural comprehension was slow. It picked up quite rapidly as soon as we began to use these special records and developed even more rapidly after we got the stereo recorder. I would say that our ability to comprehend rapidly spoken French has improved in almost direct proportion to our own ability to speak at approximately the same speed. Even our ability to *read* French has improved with speech practice.

For fun and for specialized practice in aural comprehension we do use many continuous speech records from the wonderful variety of dramatic, poetry, and literary records produced in France and distributed by such companies as London International and Period Records.

Using Language Records

While the record with pauses is, we think, superior to the continuous speech record, when used alone it has one serious drawback. You can repeat the phrases and sentences immediately after they are spoken, but it is not possible to evaluate how well you have performed and what progress you are making. The great value of the tape recorder is that it permits such evaluation.

For speech practice, as for music, we sometimes use the Concertone 23 as a single-channel recorder. If Larry is going to practice straight through an entire record containing pauses, he feeds the output of the phonograph into the line input of the recorder and connects a microphone into the mike input. He starts the record going, listens with earphones to the input monitor, and repeats each phrase or sentence into the microphone immediately after he hears it. His own repetition is thus recorded in the pause during which the French speaker is silent. When the completed record is played through the loud speaker we will hear each sentence spoken by the native French speaker followed immediately by Larry's version. My own first experiment with this technique was a shattering experience. While I had been using these records without the tape recorder I was under the happy impression that I was doing just fine—not perfect, mind you, but pretty good. After I heard myself for the first time all I could say was "Ugh!" However, while I am still far from satisfied, I can see real improvement through practice with the recorder.

For those with the usual home tape recorders who want to use this technique the machine will have to be equipped with a two-input mixer and a phone jack if it does not already have these features.

Sometimes we want to practice intensively just a portion of a record, but don't want to ruin it by constantly picking up and putting down the stylus. Then we take advantage of the sound-on-sound feature of the Concertone 23, even though we are not actually blending sounds as we did with music. The record is dubbed "as is" on channel 1. When the tape is replayed the output of channel 1 is recorded on channel 2 while the learner records his repetitions on the same channel during the pauses. Any portion of the recording may be selected for practice, and a single short section may be practiced over and over again, without damage to the tape or to the disk from which channel 1 was recorded. For home learning this would appear to be a much more convenient procedure than that followed in many college laboratories where the student records his repetitions on channel 2 while listening to playback on channel 1, then must use binaural phones to hear the French speaker in one ear and his own repetition in the other.

It should be clear from the above description why it is that when we have a choice of the same learning material on either records or recorded tapes we always choose the *records*. Almost every owner of a tape recorder also owns a record player and is thus fully prepared for at least the record-plus-microphone-to-tape technique, while the use of a recorded tape for the same procedure would necessitate a second tape recorder or player. Besides, the records are cheaper.

We do, incidentally, find a valuable use for Larry's Viking tape player as an occasional part of our language laboratory. We sometimes come across a continuous speech record—such as RCA's Modern French By Sound—which contains wonderful practice material, if only it had the pauses to permit immediate repetition! Well, we put them in. The records are first transferred to tape. This tape is then played on the Viking, with its output connected to the line input of channel 1 of the Concertone, which is allowed to run continuously with the recording selector switch set for channel 1. The operator listens through earphones to the input monitor amplifier of the Concertone. He stops the Viking at the end of each sentence for a period of time long enough to permit repetition of the sentence. Since the

(Continued on page 89)

www.americanradiohistory.com

How to Plan Your Hi-Fi System

C. R. TIEMAN*

The author offers a method for making comparative listening tests in order to evaluate performance of audio equipment on a quantitative basis as a logical means for choosing components.

WHEN ONE'S INTERESTS turn toward the acquisition of a high fidelity audio system, he is introduced to a comparatively new world of elusive values, and he most likely will find that to lay a sound plan for either constructing or assembling his system is a very interesting but involved task.

Aside from the barrage of claims and counter-claims of the equipment manufacturers, advice from all quarters is likely to appear to be in serious conflict. The beginner may be unable to plan effectively because the values of which so many speak glibly are subjective in nature and depend upon personal tastes and interests. Naturally, these different interests as expressed by different advisors can be mutually conflicting, and he has not been able to establish his own standards or recognize his own particular needs. The measures of system effectiveness are related to personal tastes.

The purpose of a plan is to provide the system which most nearly satisfies the listener's interests at a minimum cost. We all have heard of the fellow who, after spending much time, effort, and money to acquire a suitable system somehow fails to be satisfied; and after a while, has actually acquired enough equipment to assemble several systems. If your aim is not to "tinker," then some time spent in planning a system will pay off handsomely in the long run.

Regardless, whether we wish to design circuits or assemble a system from completed components, we first must establish some planning objectives or goals toward which to work. The second step is to choose individual components which will satisfy these objectives at a minimum of cost. The first and most important step is to set one's sights: if you aim too high, the budget suffers directly; and if you aim too low, the results will ultimately be unsatisfactory. Within the confines of the space here, we will spend most attention on the first step in planning, that of getting the objectives or goals outlined to satisfy personal tastes.

High fidelity means different things to different people, and a "good" system for one person may be a "bad" system for another. We may all have seen at least three kinds of enthusiasts which could be grouped about as follows: the "sound engineer," the "music critic," and the "interested listener." The "sound engineer" is the fellow who, above all, needs a variety of gadgets so that he can exercise complete control over the signal and compensate for any situation. In addition, he may require a multiplicity of inputs to his amplifier to give him flexibility in changing from tuners to microphones, or to any one of several recorders. He enjoys the thrill of being able to shape or modify the musical output to taste. Individuals in this category tend to emphasize the importance of the amplifier, preamplifier, and the auxiliary circuits; but so far as listening is concerned, frequently their needs are satisfied with an 8-inch speaker of moderate quality.

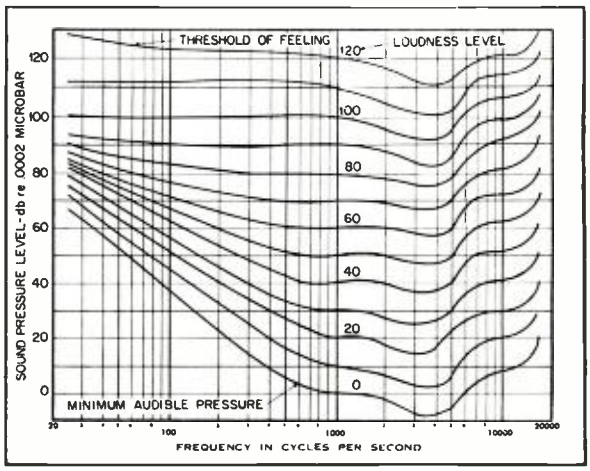


Fig. 1. The Fletcher-Munson curves of equal loudness at the listener's ear.

The second fellow is the perfectionist who demands the ultimate in performance and scrutinizes each individual unit to make sure that it is the best available within the state of the art. These people emphasize the importance of hearing every last note and overtone the music offers. The are impatient with the slightest noticeable distortion, and ask for accurate compensation for both the recording and the ear; some are concerned with the effects of the temperature and humidity of the room in which the music is played. Occasionally a few perfectionists tend to join a cult of "fanatics" who demand improvements beyond what the ear is able to hear. Another subclass of the "music critic" is the person who feels that the symphony concert must be duplicated in the home in both tonal range and volume. He requires the 30- to 80-watt system, while the average single speaker home system will be well served with a 10- to 20-watt system.

The "interested listener" is the one who aspires to have a musical system of a quality that is much better than is afforded by the average commercial radio and TV equipment, but he borrows from the "sound engineer" and the "music critic" for what they can contribute to his listening pleasure. He wishes to use his system to satisfy his personal needs which may range from a dance party or background music, to occasional serious attention to musical masterpieces.

Importance of Individual Taste

Because high fidelity means different things to different people, the first thing that a hi-fi sales agent will want to discover when you visit his shop, is what your individual tastes are, and what you expect to do with the proposed system. Naturally, he will get to the point regarding the size of your proposed budget, for he can cite systems that can be assembled for less than $100, as well as those which will cost over $1,000.

To the salesman, one may quite innocently state that he would just like to have a simple system that accurately reproduces what the microphone picked up in the first place. To this remark, an experienced hi-fi "expert" may present a

* *3425 N. Randolph St., Arlington 7, Va.*

www.americanradiohistory.com

disquisition on why this is very difficult, if not impossible. In addition, one expert proclaimed that some persons do not want to hear music as it originally sounded, but they prefer the modifications that are afforded by the electronic system. The guiding principle, they say, is: "let your ear be the judge," and if you get the impression that the original orchestra is present as the recording is played, then the system is "good"—this is the feeling of "presence." Some experts further assert that accurate quantitative analysis of sound reproduction for the listener is futile, because the listening pleasure derived from the sound system is largely subjective, and is purely a matter of personal taste.

Standard practice for evaluating system performance is to make a series of listening tests to ascertain the differences in the ways in which the same recording can sound from different systems. If the local hi-fi shop does not have some arrangement whereby different systems may be compared, then the beginner would be faced with some rather difficult choices, for it is virtually impossible in the final analysis to evaluate listening performance from advertising literature.

After a few listening tests, one can readily appreciate the advantages as well as the limitations of the subjective method of measuring listening pleasure or system performance. Qualities seem to be present in some systems that are not adequately described by the specifications. I found it virtually impossible at the outset to make any judgments on the basis of a few isolated demonstrations and without some coaching regarding what features were good or bad. The untrained ear can overlook a variety of desirable as well as undesirable features in a system. Without some experience, one can readily become confused when evaluating system performance by playing recorded music because one is exposed to a myriad of sounds in rapid succession that cover a wide range of frequencies and volumes, and a wide range of waveforms. Certainly, peculiarities or idiosynchrasies of the speaker, enclosure, amplifier, or turntable could be missed by the beginner; and poor performance could be judged as adequate. Experience and some instruction are, indeed, needed.

Because we rely on the ear to such a great extent, we must consider the ear as much a part of the entire system as the amplifier or the speaker. It is the ear that is either sensitive or insensitive to certain tones, or levels of volume. There is no point in paying attention to sounds that only the dog or the canary can hear, or that can be detected on an oscilloscope. The hi-fi equipment transforms the signals derived from a tuner or a recording into acoustic waves which excite the listener's ear. Hence, the first step in understanding one's needs and planning objectives is to learn something about what the ear actually hears.

The hearing characteristic of the average listener is shown in Fig. 1. These curves are called the Fletcher-Munson curves of equal loudness, and they illustrate how the ear—the physical termination of the hi-fi system—acts for various sound levels and various frequencies. Note particularly that as the loudness level of sound is decreased, the sensitivity of the ear at low frequencies changes with respect to the mid-frequency range: a sound at 0 db at 1000 cps is just as loud to the ear as a sound at 30 cps having an intensity 60 db greater. This is a factor of 1,000,000 in terms of acoustic power. However, the same two frequencies at the 100 db level both have the same loudness insofar as as the ear is concerned.

This characteristic of hearing plays a very important part in the hi-fi system, for it means that at a reduced level of sound a given musical selection will appear to lose its low tones; conversely, boosting the volume will increase the apparent intensity of the lower tones.

For high fidelity reproduction we wish to maintain a balance between the highs and lows so that the sound resembles the original production to get the feeling of "presence." But the original, such as a symphony orchestra, may in the concert hall be at a level of 80 to 90 db. In the home, the level is normally reduced to a range from 60 to 70 db; hence, the home system must accentuate the lows by a substantial amount—almost 20 db for a 35-cps note—to compensate for the ear's characteristics.

Accentuating this loss of low, tones with reduced volume is the reduction in performance of many components at low frequencies, and the difficulty of radiating such waves from speakers and their enclosures. Some speakers, for instance, may have a characteristic drop in power radiated below 100 cps, so that by the time the signal gets to 35 cps the radiated power is off by 10 to 20 db.

The rule "let your ear by the judge" is a fundamental one, but one that should be exercised with considerable caution and understanding of the way the ear reacts.

The basic need for control over the level of volume, and the amplification of the low frequencies in relation to the highs is certainly established experimentally if you conduct several listening tests. Adequate control over "selective" amplification is ordinarily provided by the "bass" and "treble" controls of the preamplifier or the first few stages of amplification.

Value of Listening Tests

The principal value of a series of listening tests lies in simultaneous comparison of different systems against each other. The facilities of several hi-fi shops are such as to allow one to synthesize a wide variety of systems simply by throwing a few switches. With such a facility, one may listen to systems ranging from the least to the most expensive.

For the purpose of planning, we recommend that one should approach the first series of listening tests in such a way as to establish his own preferences rather than attempt to make a selection of equipment. This author believes that component selection should be deferred until one has firmly in mind the standards of performance he feels are worth the cost in time and money. Only when one has an idea of the performance he seeks can he assemble a system in which the components make their full contribution and are still held to the minimum cost.

As a practical matter one is usually well acquainted with what might be called the "lower level" of performance because of familiarity with TV and radio. Based on this starting point, the tests described here were initiated to determine the best system performance available, and how various high fidelity systems compared with the best. Wide ranges of price and performance were found, and technique was sought to place them in a suitable line of succession for comparison. Assembled amplifiers ranging from $100 to $150 gave very high quality performance; speakers and their enclosures ranged from less than $40 to over $700, and the tonal range and generally pleasing quality of the sound varied widely. Turntables, on the other hand were almost universally of one make and model in the places visited, so there was no particular choice available in this item.

The techniques used to determine personal preference commensurate with the pocketbook was to make use of the several amplifiers recommended as best by the salesman, and then substitute speakers and enclosures to make up successive systems, because the speakers displayed the widest range of price and performance. We are, in effect, attempting to match the hi-fi equipment to the ear at best we can within budget restrictions.

Stressing the need for listening tests, and the inability of technical specifications to convey a measure of listening performance, one consultant asserted, "Now, in these multiple speaker units you will notice more depth of tone, a quality which we cannot adequately describe by our instruments, but which is, nevertheless present. That depth is a psychological effect caused probably by the sound coming from an area rather than from a point source."

Although not always the case, it is usually true that the systems with higher price tags gave a higher level of per-

(Continued on page 81)

www.americanradiohistory.com

Impedance and Feedback in Audio Circuits

HERMAN BURSTEIN* and HENRY C. POLLAK

A simple presentation of the entire problem of feedback as applied to audio amplifiers. The authors explain Miller Effect and show how feedback can reduce distortion, improve frequency response, and change the effective impedance of amplifier circuits.

AN UNDERSTANDING of the roles played by circuit impedance and feedback facilitates analysis of audio equipment design, which is often fairly sophisticated, and helps one to fathom troubles due to component failure or improper wiring. It may be of further aid in solving problems inherent in the design or in the manner that a particular piece of equipment is connected to other elements of an audio system. The audiofan has much to gain from such knowledge, particularly if he is of an experimental nature and every now and then inclined to make a change in his audio amplifier, control amplifier, or tape recorder on the basis of a schematic appearing in a periodical or elsewhere. There are pitfalls to be avoided and possible improvements to be made.

This article is concerned with the manner in which impedance and feedback affect gain, frequency response, and distortion. While the subject cannot be fully covered within the limits of one article, the following discussion will try to highlight some of its most important aspects in relation to audio circuits. It is hoped the discussion will make clear that one cannot achieve maximum gain, maximum frequency response, and minimum distortion all at once, but must make some compromises. In other words, the design considerations are often different for each performance characteristic.

Impedance and Gain

Figure 1 shows a typical two-stage audio amplifier, designed to handle a low-level signal at the grid of V_1. To make clear the factors that affect gain, the equivalent circuit for V_1 is presented in *Fig.* 2.

In this figure, (A) shows a fictitious signal generator, designated μe_{gk}, feeding a resistive circuit. The term e_{gk} denotes the voltage between grid and cathode of V_1, in this case the input

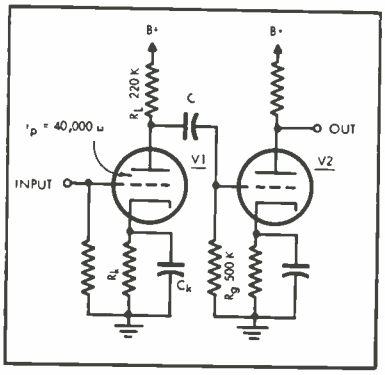


Fig. 1. Typical two-stage voltage amplifier.

voltage. Multiplying e_{gk} by the tube's amplification factor, μ, gives us the fictitious signal source in the *output* circuit of V_1. The term r_p designates the effective resistance, called plate resistance, of the tube. By Ohm's Law, given a voltage and given a corresponding current, resistance is implicitly defined; r_p is derived from the relationship between a small change in plate voltage and the associated change in tube current with grid voltage constant. The value of r_p in *Fig.* 2 is typical. The coupling capacitor, C, of *Fig.* 1 is omitted in *Fig.* 2 because it is assumed for the moment to be large enough to have no appreciable effect on the lowest frequency of interest. Plate resistor R_L is shown connected to ground because its top end is at B+ and the B+ filter capacitor is a virtual short to ground for a.c. signals. Thus R_L and R_g are effectively in parallel.

In *Fig.* 2, (B) is a simplification of (A), the parallel plate and grid resistors being combined into a single load resistance, which we shall call R_{LD}. It can be seen that r_p and R_{LD} form a voltage divider. The signal at the output, e_o, is therefore $\mu e_{gk} R_{LD}/(r_p + R_{LD})$. If we refer back to the original signal at the grid V_1, we may say that gain, A, of the stage is equal to $e_o/e_{gk} = \mu R_{LD}/(r_p + R_{LD})$.[1]

Under typical operating conditions, μ is a nearly constant quantity, so that gain varies essentially with the ratio $R_{LD}/(r_p + R_{LD})$. If a medium-mu triode were used, such as a 12AU7, which has an r_p of only about 8000 ohms, then the effect of r_p upon this ratio would be negligible, and A would approximately equal $\mu R_{LD}/R_{LD}$, or simply $A \cong \mu$. For triodes of higher mu, such as a 12AX7, r_p may range up to values as great as 100,000 ohms. Therefore r_p cannot be ignored for triodes of this sort. The higher the value of r_p, the smaller becomes the ratio $R_{LD}/(r_p + R_{LD})$. If the ratio drops below 0.7, gain declines significantly.

Referring to (B) in *Fig.* 2, it is assumed that r_p is 40,000 ohms and R_{LD} is 153,000 ohms. Therefore $R_{LD}/(r_p + R_{LD}) = 0.79$, representing a loss of about 2 db from maximum possible gain. However, if R_L were 68,000 ohms and R_g 100,000, R_{LD} would become about 40,000 ohms, and the ratio would be only 0.5, a drop of 6 db. For triodes of higher plate resistance the loss in gain due to insufficient load resistance would be still greater.

The reduction in available gain due to the output load assumes much greater proportions in the case of pentodes, which typically have a plate resistance of 0.5 to 1 megohm. In fact, the gain of a pentode may be expressed approximately as its transconductance g_m times the load resistance R_{LD}, so that gain varies directly with load resistance; in short, $A \cong g_m R_{LD}$.[2]

* *280 Twin Lane E., Wantagh, N. Y.*

[1] Usually this relationship is given as $A = \mu R_L/(r_p + R_L)$. This, however, assumes that R_g is large enough compared with R_L so that the parallel resistance of the two is essentially that of R_L. Although this is often true, for purposes of the present discussion it is not desirable to make this simplifying assumption.

[2] $A = \mu R_{LD}/(r_p + R_{LD})$. But in typical pentode circuits, r_p is much larger than R_{LD}, so that $A \cong \mu R_{LD}/r_p$. Since $g_m = \mu/r_p$, $A \cong g_m R_{LD}$.

www.americanradiohistory.com

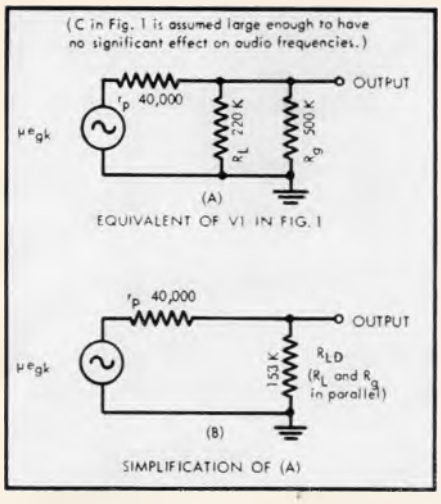


Fig. 2. Equivalent circuit of V_1 in Fig. 1.

From the above it is apparent that a radical change in value of a plate or grid resistor can significantly affect gain, although more so in the case of a pentode than a triode.

Impedance and Frequency Response

Let us first consider low-frequency response. In *Fig.* 3, (A) shows the equivalent circuit of *Fig.* 1 so far as low frequencies are concerned. It is now assumed that coupling capacitor C does have a significant effect at the low end. Since the fictitious signal generator in (A) has zero impedance (all impedances are shown external to it), R_L can be represented in parallel with r_p, as in (B). The series circuit of (B) can then be rearranged as in (C) without altering the electrical characteristics of the circuit.

In *Fig.* 3, (C) indicates that low-frequency response is determined, so far as the resistive element of the pertinent RC time constant is concerned, not by R_g alone but rather by R_g in series with the parallel combination of R_L and r_p. Particularly in the case of a pentode, where R_L and r_p in parallel are fairly high—values of 100,000 to 250,000 ohms can occur in practical circuits—the RC constant is appreciably increased due to R_L and r_p. Thus a value of C which may initially seem too low for adequate bass response in conjunction with R_g may on further inspection appear quite adequate. For example, consider *Fig.* 4. Response is 3 db down at the frequency where the reactances of C and R are equal; that is, $f = 1/2\pi RC$. The time constant CR_g would seem to indicate that response is 3 db down at 64 cps, which is certainly not compatible with high fidelity requirements. However, by taking into account the approximately 250,000 ohms additional resistance of r_p and R_L in parallel, the 3-db point is seen to occur at 32 cps, which is much more acceptable. A person tampering with this circuit in the mistaken belief that response is adequate only down to 64 cps (that is, the person may seek to improve bass response by increasing C above .01 μf) may be upsetting a nice balance between bass response and minimization of rumble frequencies. Or he may be lowering the stability margin of the audio component (say a power amplifier) with respect to motorboating or other low-frequency oscillation.

Turning now to high-frequency response, (A) in *Fig.* 5 shows the equivalent circuit of *Fig.* 1, but with a shunt capacitance C_s added. C_s consists of the input capacitance of V_2 in *Fig.* 1, the output capacitance of V_1, and miscellaneous stray capacitances (wiring, and so on). Coupling capacitor C is omitted because, except for adding slightly to stray wiring capacitance (about 1 to 5 $\mu\mu f$), it has no significant

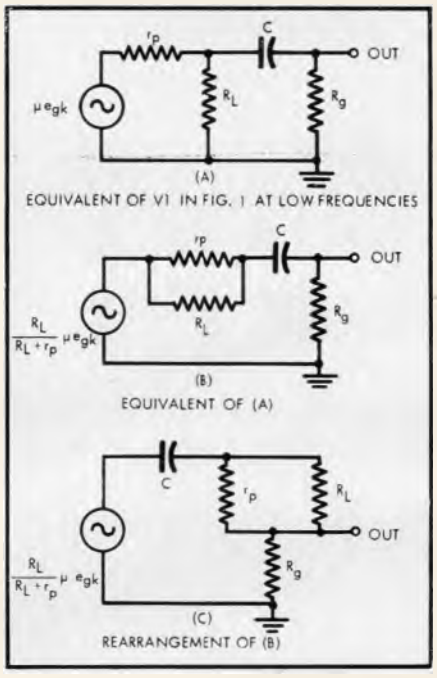


Fig. 3. Equivalent circuit of V_1 in Fig. 1 at low frequencies.

effect at high frequencies. As before stated, we are dealing with a zero-impedance fictitious signal generator, so that r_p, R_L, and R_g may be drawn in parallel, as in (B). (C) is a simplified version of (B), with R replacing the three parallel resistors.

In (C) we have a voltage divider that discriminates against high frequencies; or we may call it a low-pass filter. Response is 3 db down at the frequency where the reactance of C equals R (that is, $f = 1/2\pi RC$) and declines thereafter at a rate approaching 6 db per octave. Based on the values in *Fig.* 1, R has a value of about 31,000 ohms. C_s should be small enough so that response is not more than 3 db down at 30,000 cps, which in turn means 1 db down at 15,000 cps and thus consistent with high fidelity requirements. $C = 1/2\pi RF = 1/(2\pi \times 31{,}000 \times 30{,}000) = 170\ \mu\mu f$.

Is it likely that C_s will be as great as 170 $\mu\mu f$? Generally not. *Figure* 6 shows that C_s for a 12AX7 might consist of (1) grid-cathode capacitance of about 1.5 $\mu\mu f$; (2) the preceding tube's plate-cathode capacitance of about 2 $\mu\mu f$; (3) wiring and other stray capacitance assumed to be 3 $\mu\mu f$; (4) a large capacitance due to Miller Effect (discussed later in detail), which may be somewhat over 100 $\mu\mu f$ for a tube such as the 12AX7 under normal conditions. All told, there is a shunt capacitance of about 110 $\mu\mu f$, appreciably less than the 170 $\mu\mu f$ that would barely avoid trouble at the high end.

Yet this 110 $\mu\mu f$ of shunt capacitance could seriously affect treble response under different and quite possible conditions. Assume that R in (C) is not 31,000 ohms but 167,000 because the signal source is a pentode, as shown in *Fig.* 7. In this situation, the 110 $\mu\mu f$ of shunt capacitance causes response to be 3 db down at about 8500 cps, a substantial departure from high fidelity although possibly acceptable for some other audio uses.

Even in the case of triodes there is a frequently encountered situation which produces a high-frequency loss when the input capacitance of the following stage is on the order of 110 $\mu\mu f$. This occurs when a volume control appears in the circuit, as in *Fig.* 8, which is the same as *Fig.* 1 except that a 0.5-megohm pot replaces the fixed grid resistor. In *Fig.* 8, (B) shows the equivalent circuit when the arm of the pot is midway. As may be seen by tracing the development of (C) and (D), this proves equivalent to a 133,000-ohm resistor in series with the 110 $\mu\mu f$ shunt capacitance. Response is 3 db down at about 10,500 cps, and therefore inadequate. On the other hand, if the gain control is close to the high or low end, then, as shown in (A) and (B) of *Fig.* 9, response is 3 db down at frequencies well outside the audio range, respectively 28,000 and 60,000 cps. This sort of situation is not

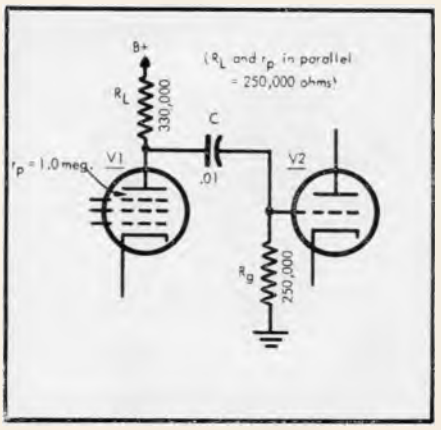


Fig. 4. Example of a circuit where low-frequency response is significantly affected by plate resistance and load resistor.

at all uncommon in control amplifiers, even in some of the best. The problem can be solved in substantial measure or altogether by using a volume control having a value of 0.25 megohm or less. A 0.25-megohm pot in *Fig.* 8 would result in response being 3 db down at about 20,000 cps when the arm is in mid-position, and about 1 db down at 10,000 cps, which is good enough for most requirements.

Miller Effect

Miller Effect is of sufficient importance in audio circuits to warrant a subsection for individual discussion. As already brought out, triodes generally have very appreciable input capacitance due to Miller Effect, which is often mentioned in the literature but seldom explained. If one truly understands how Miller Effect takes place, he is better equipped to find satisfactory solutions to the problems that it raises.

Figure 10 helps explain Miller Effect. The signal source is assumed to have an instantaneous value of −1 volt. Tube gain is assumed to be 60, so that the instantaneous a.c. voltage appearing at the plate, referred to ground, is +60 volts. Therefore a 61 volt potential appears across the capacitor. Signal current flows through all impedances connected between grid and ground, taking the various paths shown at (B) in *Fig.* 10, which is the equivalent circuit of (A). One path is through the grid resistor. Another path is through the grid-cathode and other stray capacitances. A third path is through the capacitance between grid and plate.

The physical grid-plate capacitance of a 12AX7, employed for illustration in *Fig.* 10, is of the order of 1.7 μμf. However, a capacitor accepts a charging current directly proportional to the voltage across the capacitor. Thus 61 volts across capacitor C_{gp} results in 61 times as much charging current as a 1-volt potential. In other words, the 1.7 μμf capacitor in *Fig.* 10 effectively becomes a 103.7 μμf capacitor. Accordingly, at high frequencies an appreciable amount of signal current must flow through the grid-plate capacitance; this is equivalent to a reduced impedance across the signal source, resulting in less of a voltage drop across this impedance. The apparent multiplication of grid-plate capacitance is called Miller Effect.

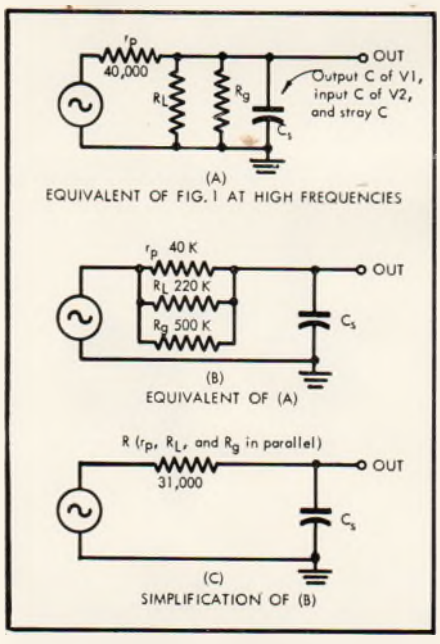


Fig. 5. Equivalent circuit of Fig. 1 at high frequencies.

Previous discussion has indicated that one way of preventing Miller Effect from causing losses within the audio

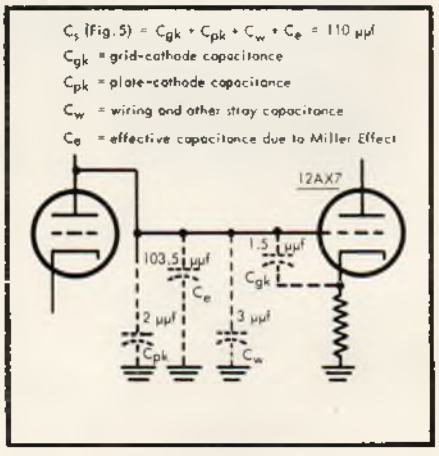


Fig. 6. Interstage coupling capacitance of a typical triode stage.

range is by reducing source resistance. To get directly to the matter, there are ways of reducing the effective capacitance itself. Effective capacitance, which we may term C_e, equals $C_{gp}(1+A)$. Thus effective capacitance varies almost directly with tube gain. By using a medium mu triode such as the 12AU7, which provides a gain of only about 10, effective capacitance is substantially lower than for a triode such as a 12AX7. Another method is to limit tube gain by means of feedback (discussed later) or by use of a small load resistor. The problem can be dismissed altogether so far as audio frequencies are concerned by using a pentode, which has extremely small grid-plate capacitance, .0035 μμf being typical. Although pentode gain may be as much as 300 or 400, the effective capacitance due to Miller Effect would be hardly more than 1 μμf.

Figure 11 shows a circuit that kills two birds with one stone, providing bass boost (for a tape recorder or magnetic pickup) and at the same time reducing effective input capacitance of a triode at high frequencies. Due to C and a relatively low value of R, of the order of a few hundred or few thousand ohms, gain is greatly reduced at high frequencies. Miller Effect is correspondingly decreased. On the other hand, this would not be the case if the equalization circuit were as in *Fig.* 12. Resistor R_1, which makes for a more stable circuit and permits a smaller value of C for the same bass equalization, isolates C and R from V_1, so that the high-frequency gain at the plate of V_1 is only slightly reduced and Miller Effect is almost fully operative. On the other hand, it is possible that in certain circuits, such as phono equalization, the high-frequency loss due to Miller Effect might be desired as part of a treble-cut characteristic. To take another case, the treble de-emphasis characteristic required for FM can be obtained entirely by means of Miller Effect, which permits a cherished saving of a component or two to a manufacturer; however, since tube gain and grid-plate capacitance are neither constant nor stable, this is a "lo-fi" expedient for it may shift the turnover frequency by half an octave or so.

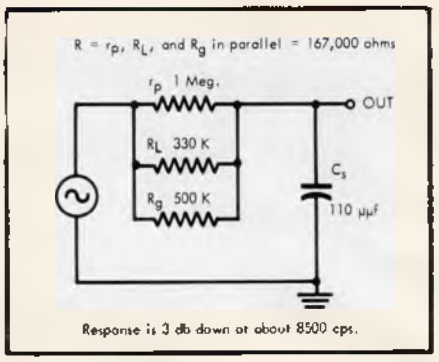


Fig. 7. Equivalent circuit of a typical pentode stage (V_1 of Fig. 4).

Impedance and Distortion

The load presented to the output of the tube governs its linearity of operation and therefore its distortion. In the case of triodes, high values of load impedance minimize distortion, whereas just the opposite is true for pentodes, which produce least distortion when the load is small. Referring to *Figs.* 1 and 2 it may be seen that the load depends not only upon the plate resistor but also upon the grid resistor. Sometimes a triode may be loaded down (relatively small load) only at high frequencies when a treble-cut circuit is associated with the stage. Two examples of this appear in *Figs.* 11 and 13. In *Fig.* 13, treble cut is produced by negative feedback and heavy loading. It may be seen that at high frequencies the load upon V_2 becomes merely that of the cathode resistor of V_1. In *Fig.* 11, a lesser circuit is used to produce treble attenuation, the load becoming essentially R at high frequencies.

Excessive distortion occurs if too large a signal is presented to the input of an amplifier stage. Sometimes the

Are you taking advantage of AMPEX DIRECT-TO-CUSTOMER SERVICE?

HERE IS HOW YOU BENEFIT:

- New application ideas, practical and tested
- Complete product and installation information
- Custom products tailored to your individual needs
- Personal contact with Ampex Research, Engineering and Production

AVAILABLE DIRECT FROM AMPEX

VIDEOTAPE RECORDERS
sold only direct

MODEL 300 sold only direct

MODEL 350

MODEL 601

Available only direct — Automatic programming systems, tape duplicators, and custom-engineered products.

AMPEX CORPORATION

854 CHARTER STREET, REDWOOD CITY, CALIFORNIA

professional products division

ATLANTA, TRINITY 4-0736 | CHICAGO, TERRACE 3-7050 | DALLAS, LAKESIDE 6-7741 | LOS ANGELES, OLIVE 3-1610 | NEW YORK, N. Y., PLAZA 3-9232 | SAN FRANCISCO, EMERSON 9-1481 | WASHINGTON, D. C., JUNIPER 5-8270

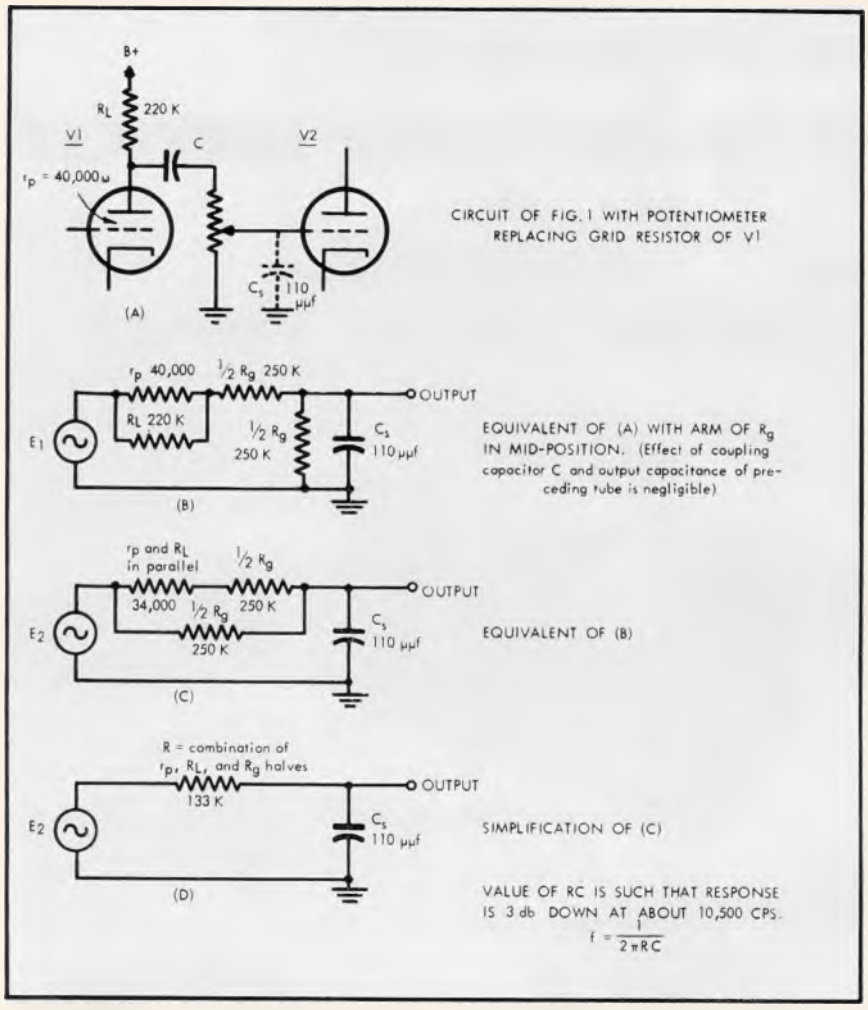


Fig. 8 Effect upon frequency response when arm of volume control is in mid-position.

reduction in gain of the preceding stage due to deliberate use of a relatively small load impedance is enough to bring the input signal within acceptable limits. An attempt by the amateur to increase gain may bring with this a significant rise in distortion (and possibly an unwelcome loss in treble response).

In the case of the cathode follower (more fully discussed later in connection with feedback), its signal handling ability can be seriously affected by the load at its output. The statement is often encountered that a cathode follower permits cable runs of several hundred feet. So far as frequency response is concerned, this is generally true. However, the resulting capacitive load of several thousand $\mu\mu f$, assuming about 25 $\mu\mu f$ per foot of cable, seriously reduces the ability of the cathode follower to handle large input signals. This ability varies directly with the impedance between cathode and ground, and the capacitive load reduces this impedance. Inasmuch as cathode followers are most usually found at the output of a piece of equipment, where the input signal to this stage is relatively large, distortion can be appreciably increased by a cable run much over 10 to 20 feet.

To illustrate, a typical cathode follower employs a 47,000-ohm cathode resistor. A capacitance of 300 $\mu\mu f$ would begin to reduce cathode-to-ground impedance significantly at 10,000 cps, for its reactance at this frequency is 47,000 ohms. At 25 $\mu\mu f$ per foot, 300 $\mu\mu f$ is equivalent to only 12 feet of cable. On the other hand, frequencies at 10,000 cps are ordinarily of much lower magnitude than at 1000 cps or so, wherefore the signal handling properties of the cathode follower need not be as great at 10,000 cps. Accordingly, cables of thirty or forty feet in length may be practical, although this is considerably short of the often advertised runs in excess of one hundred feet.

Negative Feedback and Gain

Negative feedback may be either of the voltage or current type. In the first case, feedback is proportional to output *voltage*, and in the second case feedback is due to the *current* in the output circuit.

(A) in *Fig.* 14 shows one of the simplest forms of voltage feedback, where part of the signal at the plate of a tube is fed back to its own grid. Inasmuch as the signal voltage at the plate of a tube is 180 deg. out of phase with that at the grid, this produces partial cancellation. What is sometimes called plate-to-plate feedback is shown at (B), although actually it is quite the same thing as at (A), namely plate-to-grid. In (B) feedback is applied from the plate of V_2 to its own grid through the coupling capacitor C; this saves an extra d.c. blocking capacitor, which would be required if the signal at the plate of V_2 were fed directly to the grid of that tube.

(C) shows probably the most popular negative voltage feedback configuration, where the signal at the plate of V_2 is applied to the cathode of V_1. Assume that the signal at the grid of V_1 is positive-going; this results in a negative signal at the plate of V_1 and grid of V_2, and a positive signal at the plate of V_2. In short, the polarity of the signal applied to the cathode of V_1 is the same as at its grid. To the uninitiated this may seem like positive rather than negative feedback. But bear in mind that current flow in a tube de-

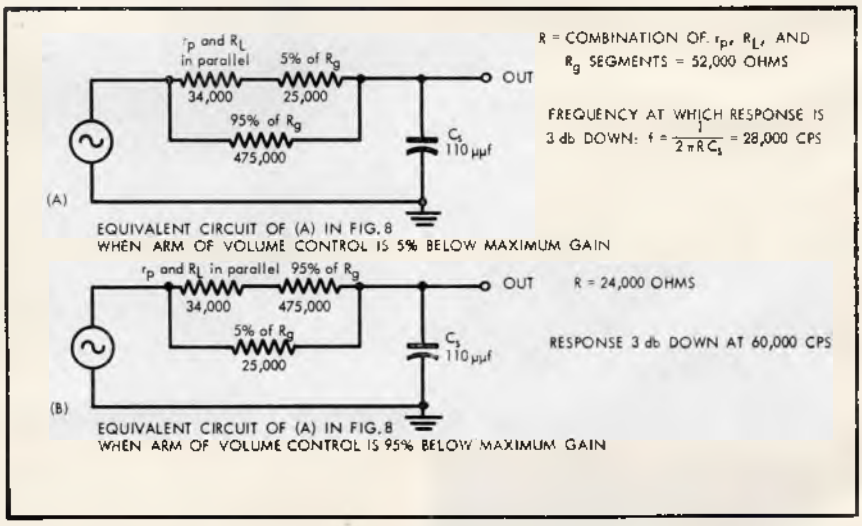
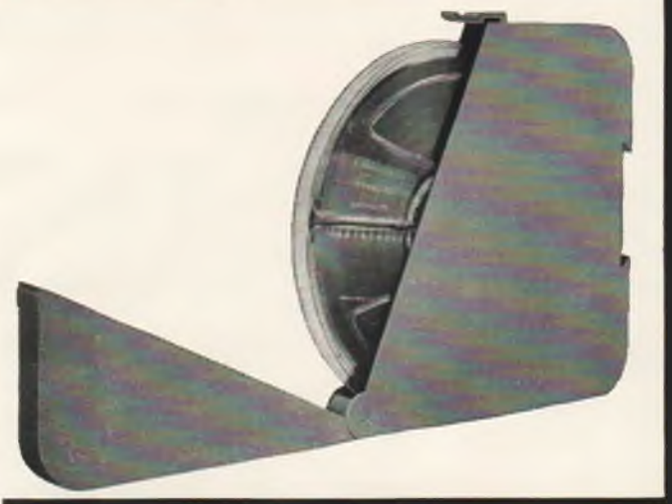


Fig. 9. Effect upon frequency response when arm of volume control is near extreme positions.



THE QUALITY RECORDING TAPE IN THE NEW PERMANENT PLASTIC CONTAINER

SONORAMIC

Here is an extraordinary new product designed to protect, preserve and facilitate storage of your Sonoramic Wide Latitude Recording Tape. It's the exclusive NEW Sonoramic *permanent plastic tape container.* Sonoramic's fine quality magnetic recording tape PLUS the new container makes this your best buy in recording tape.

Here's the story on the container:

- *Protects tape against dust and dirt.*
- *Made of high-impact, shatter-proof, polystyrene plastic in handsome decorator color.*
- *Opens at flick of finger pushing tape forward for easy access.*
- *Stacks neatly on shelf, bookcase, or table.*
- *Dovetail strip (available from company) lets you hang a row of tape containers on wall.*
- *Unique Sonoramic indexing system on pressure sensitive labels included free in every package. Permits you to keep tabs on all recordings.*
- *Tape time ruler on carton permits accurate measurement of elapsed and remaining time.*

Inside the container...

...is Sonoramic Wide Latitude Recording Tape, a superb new miracle of recording tape engineering. From the selection of raw materials, to coating, slitting and packaging—this tape reflects the care and precision it takes to make a quality product. Here's the story on the tape:

- *Distortion-free recordings guaranteed by exclusive time-temperature dispersing techniques.*
- *Broad-Plateau Bias assures maximum performance regardless of make of recorder, line voltage fluctuations, tube age, head condition.*
- *High resistance to abrasion, print-through and cupping.*
- *Life-time lubrication eliminates squeal, layer-to-layer adhesion, and deposits on heads.*

There are three tapes designed for all uses—all on 7" reels. These include: *Standard Play,* 1½ mil acetate, 1200 feet, meets rigid requirements for both professional and home use. *Long Play,* 1 mil mylar,* 1800 feet, a premium quality tape designed for maximum strength and immunity against heat, humidity and other weather conditions. *Extra Long Play,* ½ mil mylar,* 2400 feet, a high quality tape useful for extra recording time, and where tape tension is not excessive.

When you buy your next reel of tape remember these facts: not only do you get the excellent quality of Sonoramic Wide Latitude Recording Tape—but every reel comes in its own handsome permanent plastic container.

NOTE: To the first 50 people who write in requesting it—we'll be happy to send out a free Sonoramic tape container. Please remember: we can only do this with the first 50 requests: *Write to Dept. A102, Ferrodynamics Corporation, Lodi, New Jersey.*

Store on table...

...or on wall...

...or in bookcase.

**A DuPont trade mark.*

SONORAMIC IS A PRODUCT OF THE Ferrodynamics CORPORATION • LODI, NEW JERSEY

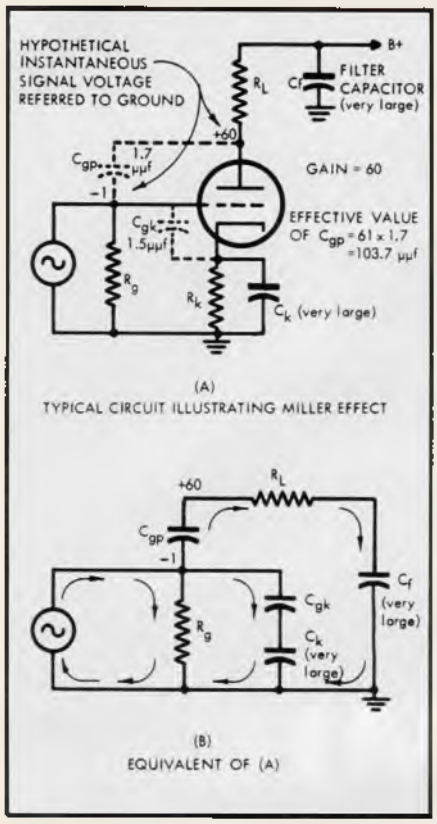


Fig. 10. Operation of Miller Effect.

pends upon the grid voltage *in relation to the cathode*. If the signal at the grid is positive-going, for example, application of a positive-going voltage to the cathode reduces the positive-going potential between grid and cathode, thereby limiting tube current. Thus the tendency for tube current to increase because of the positive-going signal at the grid is partially cancelled by the reduction in current due to the reduced grid-cathode potential.

Negative current feedback is obtained simply by omitting the usual cathode bypass capacitor, such as C_k in *Fig.* 1. As in the case of plate-to-cathode voltage feedback, the action depends upon the cathode swinging in the same direction as the grid, thus reducing the net voltage between the two, tube current, and gain of the stage. In this case, however, it is current flowing in the plate (output) circuit rather than output voltage that produces feedback. Assume the signal at the grid is positive-going with respect to ground. This increases tube current. Greater current flow through the unbypassed cathode resistor causes the cathode to go more positive with respect to ground. Thus the grid-cathode potential decreases somewhat and tube current is reduced, therefore reducing gain.

In the case of negative voltage feedback, gain may be found by the equation $A' = A/(1 + A\beta)$, where A is gain without feedback, A' is gain with feedback, and β is the percentage of output voltage fed back. To illustrate, consider (C) in *Fig.* 14. The feedback resistor R_f and cathode resistor R_k form a voltage divider, so that the percentage of output signal fed back is $R_k/(R_k + R_f)$. Assume that gain between the input to V_1 and output of V_2 is 900 and that R_f and R_k are proportioned so that 1 per cent of the output of V_2 is fed back to the cathode of V_1. Then $A' = 900/(1 + 900 \times .01) = 900/(1 + 9) = 90$. If we merely desired to know the "feedback factor," that is, the ratio between gain without feedback and with feedback, we would simply calculate: $F = 1 + AB = 1 + 900 \times .01 = 10 = 20$ db. In brief, there is 20 db loss of gain due to feedback under the conditions assumed for (C) in *Fig.* 14.

In the case of current feedback, gain may be found to a close degree of approximation by the formula

$$A' \cong \frac{A}{1 + A\left(\frac{R_k}{R_{LD}}\right)},$$

where A and A' are as previously defined, R_k is the cathode resistor, and R_{LD} is the load resistance (which is approximately R_L, the plate resistor, if this is small compared with the grid resistor R_g of the following stage; otherwise R_{LD} is the parallel value of R_L and R_g as discussed in the section on impedance and gain). In most cases this formula comes within less than 1 db of being exact. The more complex exact formula,

$$A' = \frac{A(R_{LD} + r_p)}{R_{LD} + r_p + R_k(\mu + 1)},$$

involves r_p, the plate resistance of the tube; since r_p as given in tube manuals is itself an approximation and not constant, the apparent exactness of the precise formula is illusory. The feedback factor may be found by computing A/A'.

If current feedback is frequency-discriminating, as in *Fig.* 15, because a relatively small bypass capacitor which reduces current feedback only at high frequencies, the gain at a given frequency may be found by substituting for R_k the parallel value of R_k and the reactance of C, namely $Z = \sqrt{R_k^2 + X_{cf}^2}$.

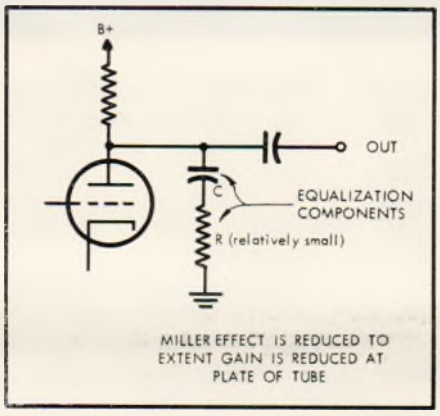


Fig. 11. Equalization circuit with collateral feature of minimizing Miller Effect.

Negative Feedback and Frequency Response

Apart from treble-boost circuits, which are outside the present discussion, negative voltage feedback can maintain high-frequency response in several ways. One is by reducing the output impedance of a stage; how this happens is explained later. Small output impedance, as previously discussed, causes a capacitive load to have less effect upon high-frequency response than when output impedance is large.

The most important manner in which negative voltage feedback maintains frequency response is by what may be called self-regulating action. Referring to (C) of *Fig.* 14, assume that for some reason the gain of V_1 or V_2 declines at frequency f. Consequently there is less output at the plate of V_2, which in turn results in less feedback at f, so that there is a compensating rise in gain at this particular frequency. The improvement in response is proportional to the feedback factor. For example, should a 3-db drop occur at 10,000 cps in the absence of feedback, then 20-db feedback (10:1 ratio) would result in only 0.3 db decline at this frequency.

Figure 16 shows an ingenious way in which negative voltage feedback is sometimes used to overcome high-frequency losses due to input capacitance. This figure represents the first stages of the playback section of a high-quality tape recorder with separate record and playback heads. The cable from playback head to tube has both an inner and an outer shield, the inner one going to the cathode and the outer one, in conventional manner, to ground. The head is assumed to have 2.5-Hy. inductance, a typical value for a high-impedance

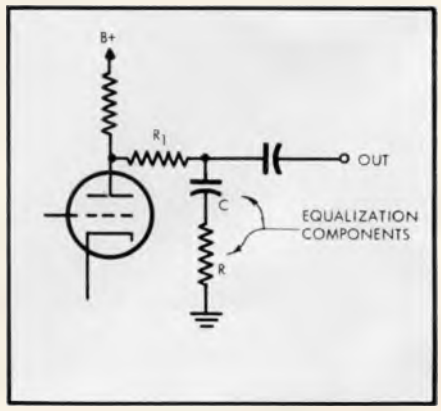


Fig. 12. Equalization circuit which fails to take advantage of opportunity to minimize Miller Effect.

Johansson Blocks, used for high-precision measurements, are accurate to within one millionth of an inch. Their surfaces are ground so perfectly flat that, when one is placed on top of the other, molecular attraction and atmospheric pressure wring them firmly together.

In high fidelity "JBL" is the symbol of highest precision. JBL loudspeakers are used most often to demonstrate the quality of other components. The tight electrical coupling and rigid piston assembly that give JBL cone speakers their distinctive, crisp, clean sound can only be achieved by manufacturing to the closest tolerances. Painstaking precision in forming diaphragms, winding voice coils, and machining phasing plugs gives JBL high frequency drivers their smooth, peak-free performance. The unexcelled efficiency and transient response of JBL transducers are directly related to the precision with which the units are made. Write for your free copy of the new JBL catalog and the name of the man in your community who can demonstrate the difference precision makes—your Authorized JBL Signature Audio Specialist.

"JBL" MEANS JAMES B. LANSING SOUND, INC.
3249 Casitas Avenue, Los Angeles 39, California

JBL

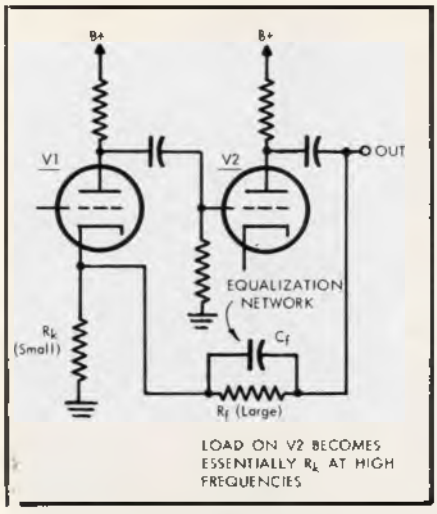


Fig. 13. Examples of heavy loading (of V_2) due to negative feedback.

head designed expressly for playback.[3] The connecting cable is assumed to be six feet long, with a capacitance of about 25 $\mu\mu f$ per foot between the inner conductor and inner shield and another 25 $\mu\mu f$ per foot between the two shields. Since these capacitances are in series, the total capacitance between the grid lead and ground is 75 $\mu\mu f$. Finally, it is assumed that the head has about 20 $\mu\mu f$ inter-winding capacitance, and that the input capacitance of V_1 is very small, only 5 $\mu\mu f$, due to the decrease in Miller Effect as the result of the equalization network, which greatly reduces gain at frequencies above 3000 cps.

What kind of frequency response does this set of circumstances permit at the input of V_1? The head inductance of 2.5 Hy. in conjunction with 100 $\mu\mu f$ input capacitance (75 + 20 + 5) is resonant at 10,000 cps, which would mean a rapid drop at a rate approaching 12 db per octave beyond this frequency. Such response is not nearly good enough for a high-quality recorder operating at 7.5 ips, and even worse at 15 ips.

Fortunately, here the situation is saved by the feedback voltage at the cathode of V_1 and therefore on the inner shield of the cable. It will be recalled from the discussion of Miller Effect that it is the voltage across a capacitor which causes it to accept the signal charging current. Since the feedback voltage on the inner shield is of the same polarity as on the grid (as previously explained), there is relatively little potential across capacitance C_1 at high frequencies, so that C_1 accepts considerably less charge and thus appears as if it were reduced to a value much less than 150 $\mu\mu f$. A tape recorder conforming to NARTB equalization has about 36 db of feedback at the high end, so that C_1 is reduced to about 1/60 of its physical value, namely to less than 2 $\mu\mu f$. Therefore C_1 in series with C_2 is effectively less than 2 $\mu\mu f$ instead of 75 $\mu\mu f$. The resonant frequency of the 2.5 Hy. inductance and about 27 $\mu\mu f$ input capacitance (2 + 20 + 5) is over 19,000 cps, and all is well so far as the input circuit is concerned.

Current feedback is often used to maintain high-frequency response by means of a suitable bypass capacitor, as shown in *Fig.* 15. At the frequency where the reactance of C equals that of R_k, there is an appreciable reduction in current feedback and hence a significant rise in gain. Current feedback can also be used to improve frequency response by decreasing the gain of a tube and thereby reducing input capacitance due to Miller Effect.

[3] Such a head is generally not suitable for recording purposes because the high inductance makes it relatively difficult to drive the required audio and bias currents through the head. Also, the winding capacitance tends to short out the bias current, further increasing the difficulty of supplying sufficient bias.

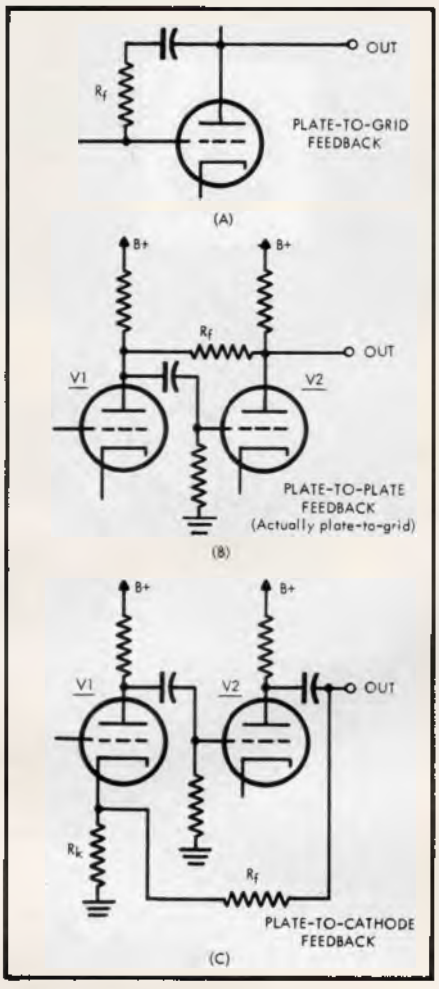


Fig. 14. Popular forms of negative voltage feedback.

Feedback and Distortion

Negative feedback may be said to reduce distortion in two ways: (1) by cancellation of distortion voltages generated in the tube; (2) by increasing the signal-handling capacity of the tube.

Assume that because of tube nonlinearity a frequency appears at the output of V_2 in (C) of *Fig.* 14 which was not fed into the input of V_1. Negative feedback applies this extraneous signal to the cathode of V_1, but in such phase as to partly cancel the unwanted frequency. For example, assume that an extraneous signal generated by V_1 is negative-going at the plate of that tube. The corresponding signal at the plate of V_2 and therefore the feedback voltage at the cathode of V_1 is positive-going. This causes the grid of V_1 to go negative with respect to cathode, which makes the plate of V_1 positive—opposite in phase to the extraneous voltage there and resulting in partial cancellation.

The reduction in distortion is proportional to the amount of feedback. Thus if there is 20 db feedback in the system (10:1), then 90 per cent of the unwanted signal would be eliminated. Accordingly, 5 per cent distortion, for example, would diminish to 0.5 per cent.

Negative current feedback operates in similar fashion. Any distortion frequency generated in the tube results in a corresponding current flow through the cathode resistor. Thus there appears between grid and cathode a voltage of such phase as to cancel partly that generated by the tube. For example, assume that the extraneous voltage is positive-going. This increases tube current and causes the cathode to go positive. Hence the grid becomes negative with respect to cathode, and in turn results in an offsetting decrease in tube current.

Negative feedback increases the signal-handling ability of a tube because it decreases the voltage between grid and cathode, which is really all that the tube cares about; the voltage between grid and ground is immaterial. In the case of plate-to-grid voltage feedback, the incoming signal is directly reduced by feed-

(Continued on page 86)

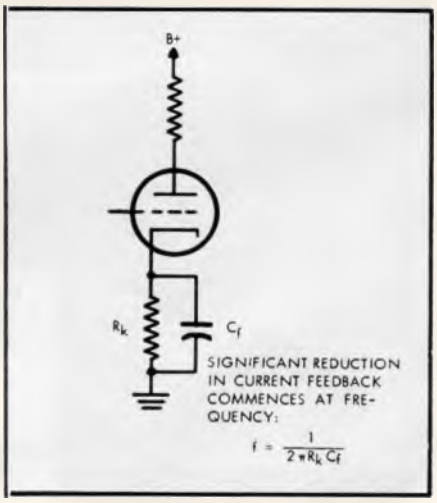


Fig. 15. Frequency-discriminating current feedback.

* New Transcription-Type Tone Arm Makes Collaro World's First True High Fidelity Changer

When you select your high fidelity system—an amplifier with low distortion and low noise level, a speaker capable of reproducing the entire audible range—you want to make certain you pick the right record player. Because that's where **the music begins.** That's why today's fine high fidelity systems require the **all new** Collaro—*the turntable that changes records*—featuring the revolutionary transcription-type tone arm.

The new arm is one-piece, counter-balanced and will take any standard cartridge. Resonances are below the audible level. Between the top and bottom of a stack of records there's a difference of less than 1 gram in the tracking weight as compared with 4 to 8 grams on conventional changers. This insures better performance for your precious records and longer life for your expensive styli.

It's worth noting that Collaro quality is so well recognized that leading American manufacturers of fine console units incorporate Collaro into their instruments in order to achieve the best possible performance in a record player.

In addition to the transcription-type arm, the Collaro Continental features:

Four speeds, manual switch that permits playing single record or portion of a record; jam proof mechanism, hold the arm in mid-cycle and it won't jam; automatic intermix, plays 7", 10" or 12" records in any order; automatic shut-off after last record has been played; wow and flutter specifications, ¼ (0.25%) RMS at 33⅓ RPM, superior to any changer in the world; muting switch and pop filter to eliminate extraneous noises; extra heavy duty 4-pole induction motor; heavy rim-weighted, balanced turntable for fly wheel action; removable heavy rubber turntable mat; pre-wiring for easy installation; attractive two tone color scheme to fit any decor; factory custom-testing for wow, flutter, stylus pressure and correct set-down position. Reflecting their custom English craftsmanship Collaro changers are tropicalized to operate under adverse weather and humidity conditions. The base, in blond or mahogany, is optional at slightly extra cost and the Collaro mounts easily and quickly on a pre-cut mounting board or base.

When you buy your Collaro, you're buying professional quality equipment at a record changer price. Collaro prices start at $37.50. The Continental, featured above, is $46.50. (Prices are slightly higher west of the Mississippi.)

ROCKBAR Corporation

FREE: Colorful new catalog, containing guide on building record library plus complete Collaro line.
WRITE TO DEPT. A-012
ROCKBAR CORPORATION
MAMARONECK, N. Y.

Rockbar is the American sales representative for Collaro Ltd. and other fine companies.

The Sad Tale of a Half-Watt Resistor

OR

What a ten-cent component can do to your hi-fi ambitions.

WALTHER RICHTER*

Recently an amplifier available in kit form had been assembled, and it was decided to check the actual performance against the specifications. This particular power amplifier is highly regarded by Hi-Fi enthusiasts, and had received quite favorable reviews and test reports. The amplifier has a rated output of 50 watts, and the distortion at this output is specified as less than one per cent.

An intermodulation analyzer was connected to the amplifier, and an attempt was made to drive it to full output. However, it showed that even with 40 watts output the intermodulation distortion exceeded the specifications. Various attempts were made, such as improving the balance between the plate currents of the output tubes by providing separate bias for them, all to no avail. As a matter of fact, in the course of a week's experimentation with the amplifier, the performance kept on deteriorating until at the end of this period the distortion was approximately nine per cent. The situation was indeed becoming desperate.

Up to this time the investigation had been confined to the measurement of distortion, since this was considered as the most important characteristic of the amplifier. Now it was decided to measure some of the other characteristics, in the hope that such investigations might throw a light on the deterioration of the performance. The first additional characteristic to be checked was the required input voltage for full output. The specifications stated that an input voltage of 1.5 volts is needed to obtain full power output. Lo and behold, instead of 1.5 volts, a signal of 3 volts was required to obtain full output. Now in an amplifier with a large amount of negative feedback, the gain from input to output is usually essentially determined by the feedback network, rather than by the actual gain of the amplifier. An examination of the diagram showed that feedback was obtained from the 16-ohm output terminal of the transformer through a series combination of a 1000-ohm and a 47-ohm resistor to the cathode of the input stage. To produce 50 watts in a load of 16 ohms requires 28.3 volts, and with a series combination of 1000 and 47 ohms this would feed back approximately 1.23 volts to the cathode of the input stage; the excess of 1.5 volt over 1.23 volt would then represent the actual input voltage required between cathode and grid of the amplifier.

The large discrepancy in the input requirements immediately threw suspicion on the feedback network. Measurement of the two resistors showed that the 1000-ohm resistor was well within tolerance limits, but that the 47-ohm resistor was around 100 ohms; replacing this resistor with a new 47-ohm resistor not only brought the input requirement down to the specified value, but brought the intermodulation distortion to approximately 0.3 per cent, therefore well within the specifications.

Not the Whole Story

The story could have ended here. But a little meditation showed that there was perhaps more to be learned from this incident. The change of the resistance value from 47 ohms to approximately double this value increased the feedback to about twice the original value; this was a perfectly logical explanation for the increased input requirements. However, as far as distortion is concerned, an increase in feedback should, if anything, decrease the distortion, rather than increase it (provided of course that the amplifier remains stable with the increased feedback, which it did). There was only one possible explanation, and one that is hard to swallow, namely that one of these two resistors had become nonlinear. Since it was the 47-ohm resistor which had changed its value, naturally suspicion centered on this resistor. The suspicious resistor was set up in a Wheatstone bridge circuit, as shown in *Fig.* 1. Note that the resistance placed

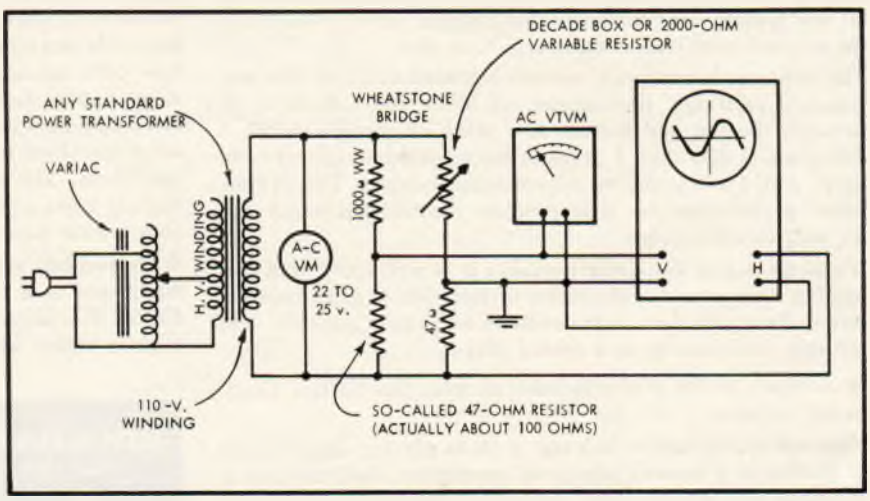


Fig. 1. Test circuit used to demonstrate non-linearity of the offending resistor.

* *8575 N. Hawthorne Rd., Milwaukee 17, Wis.*

NEW SONOTONE CA-12 12" CO-AXIAL LOUDSPEAKER

The price will be music to your ears, too!

40-14,000 cycles—elliptical cone tweeter—complete dividing network. And the price . . . $19.50. That's right, $19.50. Yet it out-performs speakers selling at three times the price. Interested? Listen to the CA-12 and be convinced.

Ask your dealer for a demonstration—or send coupon for full information.

Electronic Applications Division

SONOTONE® CORPORATION

LA-127, ELMSFORD, N. Y.

Sonotone Corporation LA-127
Electronic Applications Division
Elmsford, N. Y.

Name_____

Address_____

City_____ Zone_____ State_____

in series with it is exactly of the same value as that found in the amplifier circuit, and that the bridge voltage was made equal to the a.c. voltage which appears across these two resistors in the amplifier under full-load conditions. The unbalance of the bridge was observed on a cathode-ray oscilloscope as well as on a vacuum-tube a.c. voltmeter.

This being an a.c. bridge, exact balance is, of course, possible only when the resistive as well as the reactive components are in balance. However, with a frequency of 60 cps, and the relatively low resistance values in the bridge, stray capacitance and inductance have only a minor effect; if due to these influences a small reactive unbalance remains, it will show itself on the scope as an ellipse, and it can usually be balanced out by placing a variable capacitor across one of the four arms. But in this test, the unbalanced voltage could not be brought below approximately 80 millivolts, and the trace observed on the screen of the cathode-ray tube showed that the remaining unbalanced voltage was a 180-cps voltage, in other words a third harmonic, which could not be balanced out. This means that with a 60-cps sinusoidal current flowing through this so-called resistor, there appeared across it not only a 60-cps voltge of approximately 2 volts, as one would expect, but additionally a 180-cps voltage of approximately 80 millivolts, which is 4 per cent of the 60-cps voltage. A resistor with a built-in harmonic distortion of 4 per cent.

Just to make sure, that this startling result was not by any chance caused by a faulty method of analysis, the simple series combination of 1000 ohms and the suspicious resistor were connected once more to the intermodulation analyzer, interposing an amplifier of known and very low distortion between the analyzer and the series combination. The voltage applied to the two resistors in series was considered as input voltage, the voltage across the defective resistor was considered as output voltage. This simple network now showed an intermodulation distortion of 15 per cent. (Evidently between taking the resistor out of the circuit and completing these measurements, further deterioration had taken place.) In the April, 1948, issue of the *Proceedings of the IRE*, W. J. Warren and W. R. Hewlett published a paper entitled "An Analysis of the Intermodulation Method of Distortion Measurement". In this paper it is shown that if the distortion is due to a non-linearity of the transfer characteristic of a network or an amplifier, a well defined relation exists between harmonic and intermodulation distortion. The paper shows that if the non-linearity is caused by a third harmonic, the ratio between intermodulation distortion and harmonic distortion is approximately 3.8. The measurement with the Wheatstone bridge method indicated a harmonic distortion of 4 per cent, which would result in $4 \times 3.8 = 15.2$ per cent intermodulation distortion, according to this paper. With this degree of agreement between the results obtained by two entirely different methods, there can be no reasonable doubt about the non-linearity of the resistor.

Over-all Effects

For the high fidelity enthusiast the implications presented by this investigation are positively frightening. In his eternal quest for the elusive goal, perfection, he is forever replacing good components with better components. If the advertisements for the new Super-Triple-X amplifier state that it provides 99.44 per cent perfect reproduction, he cheerfully plunks down 250 dollars or so, and discards his previous amplifier, which had 1 per cent distortion and was therefore only 99 per cent perfect. Whether he personally can hear this difference, is probably of less importance than the fact that he can now brag about his new equipment, and feel superior to the poor boobs who haven't the new Super-Triple-X. So what, if a resistor goes bad in the Triple-X and the distortion goes up to 1, 2, or 3 per cent? You still can brag and feel superior about "having the best" (which naturally means the most expensive). This writer can, of course, not speak for others, but he knows definitely that he can not hear the difference between 1 and 2 per cent distortion, as a matter of fact, suspects that it would take 4 or 5 per cent before he would notice it, and a good deal more before it would become disagreeable. He considers himself quite fortunte, not to be cursed with a so-called "Golden Ear," but makes good use of his "Tin Ears" to enjoy thoroughly his library of 800 or so LP records (mostly classical), many of which undoubtedly have more than a modest 3 per cent distortion built right into them. So he can not help but feel a little bit sorry for those who actually *can* hear 1 per cent distortion, because this evidently not only puts severe limitations on the amount of program material available to them, but puts them at the mercy of every component in their system, from 10-cent resistors to 40-dollar output transformers, all of which must be in perfect condition. It is, however, highly probable and fortunate that most of us do not possess the kind of ears that detect with agony a deviation of 2, 3, or even 5 per cent from perfection, otherwise the enjoyment of recorded music would be almost an impossibility.

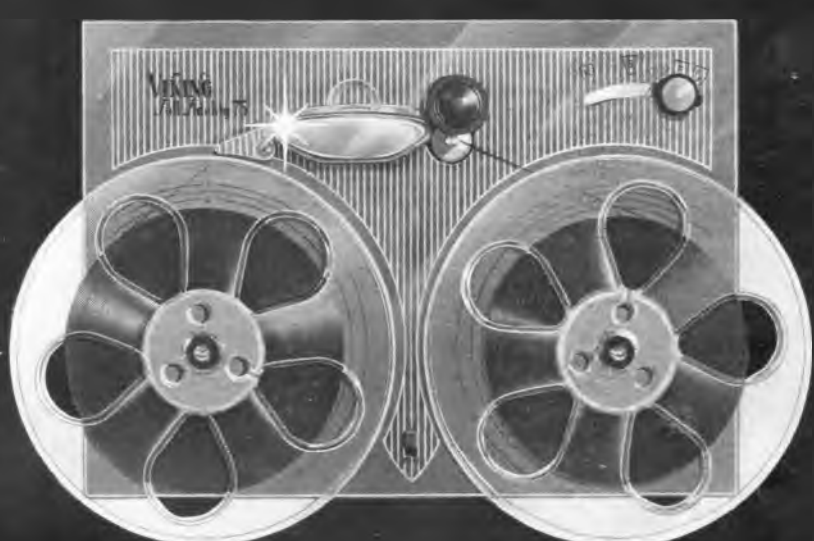
The investigation and measurements reported here were made in the laboratory of Mr. E. D. Nunn, President, Audiophile Records, Saukville, Wis., and in the writer's own laboratory. Mr. Nunn's interest and cooperation in securing this information is gratefully acknowledged. **Æ.**

Is this *loud enough?*

Viking

The World's Simplest Tape Deck
and the most effective

Rugged simplicity for enduring performance. The finest of bearings and the ultimate in machining tolerances in capstan and drive members — *where precision counts.*



The Model FF75SR
Monaural Erase/Record
and Stereo Play

The Model FF75ES
Stereo Erase/Record
and Playback

With Viking Tape Components you buy only what you need now. Convert later with complete flexibility. Monaural decks as low as $66. *A complete high-performance stereo recorder and player for less than $300.*

Buy Viking components from your regular dealer. For assistance in planning your tape system, write Viking's Customer Service Department.

The Recorder with the high "RP" Factor

Viking OF MINNEAPOLIS
9600 Aldrich Avenue South, Minneapolis 20, Minnesota

EXPORT DIVISION: 23 Warren Street, New York City 7, New York
Cable: SIMONTRICE, New York (All Codes)
IN CANADA: Alex L. Clark, Ltd., 3745 Bloor St. W., Toronto 18, Ontario

Loudness, Its Definition, Measurement and Calculation

HARVEY FLETCHER and W. A. MUNSON

Part II

FROM THE ARCHIVES OF BELL TELEPHONE LABORATORIES

By using the sound stage and the technique of measuring field pressures described by Sivian and White[5] and by using the technique for making loudness measurements described in Appendix A, the following measurements were made. An electrical voltage V_1 was placed across the two head receivers such that the loudness level produced was the same at each frequency. The observer listened to the tone in these head receivers and then after 1½ seconds silence listened to the tone from the loud speaker producing a free wave of the same frequency. The voltage level across the loud speaker necessary to produce a tone equally loud to the tone from the head receivers was obtained using the procedure described in Appendix A. The free wave intensity level β_1 corresponding to this voltage level was measured in the manner described in Sivian and White's paper. Threshold values both for the head receivers and the loudspeaker were also observed. In these tests eleven observers were used. The results obtained are given in Table II. In the second row values of $20 \log V_1$, the voltage level, are given. The intensity levels, β_1, of the free wave which sounded equally loud are given in the third row. In the fourth row the values of the constant C, the calibration we are seeking, are given. The voltage level added to this constant gives the equivalent free wave intensity level. In the fifth, sixth, and seventh rows, similar values are given which were determined at the threshold level. In the bottom row the differences in the constants determined at the two levels are given. The fact that the difference is no larger than the probable error is very significant. It means that throughout this wide range there is a linear relationship between the equivalent field intensity levels, β, and the voltage levels, $20 \log V$, so that the formula (*13*)

$$\beta = 20 \log V + C$$

can be applied to our receivers with considerable confidence.

The constant C determined at the high level was determined with greater accuracy than at the threshold. For this reason only the values for the higher level were used for the calibration curve. Also in these tests only four receivers were used while in the loudness tests eight receivers were used. The difference between the efficiency of the former four and the latter eight receivers was determined by measurements on an artificial ear. The figures given in Table II were corrected by this difference. The resulting calibration curve is that given in *Fig.* 1. It should be pointed out here that such a calibration curve on a single individual would show considerable deviations from this average curve. These deviations are real, that is, they are due to the sizes and shapes of the ear canals.

We can now express the data in Table I in terms of field intensity levels. To do this, the data in each double column were plotted and a smooth curve drawn through the observed points. The resulting curves give the relation between voltage levels of the pure tones for equality of loudness. From the calibration curve of the receivers these levels are converted to intensity levels by a simple shift in the axes of coordinates. Since the intensity level of the reference tone is by definition the "loudness level," these shifted curves will represent the loudness level of pure tones in terms of intensity levels. The resulting curves for the ten tones tested are given in *Figs.* 2A to 2J. Each point on these curves corresponds to a pair of values in Table I except for the threshold values. The results of separate determinations by the crew used in these loudness tests at different times are given by the circles. The points represented by (*) are the values adopted by Sivian and White. It will be seen that most of the threshold points are slightly above the zero we have chosen. This means that our zero corresponds to the thresholds of observers who are slightly more acute than the average.

From these curves the loudness-level contours can be drawn. The first set of loudness level contours are plotted with levels above reference threshold as ordinates. For example, the zero loudness level contour corresponds to points where the curves of *Figs.* 2A to 2J intersect the abscissa axis. The number of db above these points is plotted as the ordinate in the loudness level contours shown in *Fig.* 3. From a consideration of the nature of the hearing mechanism we believe that these curves should be smooth. These curves, therefore, represent the best set of smooth curves which

[5] L. J. Sivian and S. D. White, "Minimum audible sound fields," *Jour. Acous. Soc. Am.* 4, 288 (1933).

[6] The ordinates represent the intensity level in db of a free wave in air which, when listened to with both ears in the standard manner, is as loud as a tone of the same frequency heard from the two head receivers used in the tests when an e.m.f. of one volt is applied to the receiver terminals.

TABLE II

FIELD CALIBRATION OF TELEPHONE RECEIVERS

Frequency c.p.s.	60	120	240	480	960	1920	3850	5400	7800	10,500	15,000
Voltage level ($20 \log V_1$)	−13.0	−26.2	−38.5	−47.0	−48.2	−42.3	−36.3	−34.0	−39.1	−32.4	− 6.4
Intensity level (β_1)	+79.3	+71.0	+67.4	+63.8	+65.3	+64.0	+62.2	+65.5	+74.0	+78.6	+75.0
$C_1 = \beta_1 - 20 \log V_1$	92.3	97.2	105.9	110.8	113.5	106.3	98.5	99.5	113.1	111.0	81.4
Threshold voltage level ($20 \log V_0$)	−48.0	−61.8	−86.2	−105.4	−110.7	−109.0	−104.0	−97.1	−100.5	−102.0	−74.0
Threshold intensity level (β_0)	+49.3	+33.7	+19.7	+8.4	+5.4	−0.9	−4.2	+2.7	+10.6	+16.1	+22.0
$C_0 = \beta_0 - 20 \log V_0$	97.3	95.5	105.9	113.8	116.1	108.1	99.8	99.8	111.1	118.1	96.0
Diff. $= C_1 - C_0$	−5.0	1.7	0	−3.0	−2.6	−1.8	−1.3	−0.3	+2.0	−7.1	−14.6

NEW ALTEC speaker systems

...matchless design for faithful sound reproduction and exciting appearance

ALTEC LANSING speaker systems combine selected high and low frequency speakers designed to work together with a specific dividing network, all engineered by ALTEC for perfect mechanical compatibility. These components are set in phase computed bass reflex cabinets of extremely heavy construction, braced and blocked so no part of the enclosure can vibrate and absorb any speaker energy. Thick fibreglas panels provide the proper padding and absorption of back waves.

The expensive, hand finished solid hardwood exteriors have been designed with the finest taste to complement the decor of any room.

The result of ALTEC's painstaking design of both the outside and inside of their beautiful speaker systems is breathtaking excitement in sight and sound.

Have the pleasure of listening to an ALTEC speaker system at your dealer's. If your ear is in tune, you'll take ALTEC home.

830A LAGUNA SYSTEM

This is without qualification the finest residential speaker system in the world. Its comparatively low price can only be achieved through the use of a small number of outstanding components rather than a multiplicity of speakers of lesser quality. The Laguna has a guaranteed frequency response from 30 to 22,000 cycles without any peaks, false bass, treble rise or other misleading frequency accentuations. Internally this corner system consists of a matched pair of massive 15" 803A bass speakers, and 802 high frequency driver mounted on the 511B horn and five hundred cycle 500D dividing network.

Available in walnut, blonde, or mahogany hardwood cabinets (Shipped completely assembled). Price: $585.00

831A CAPISTRANO SYSTEM

Incorporating one 15" 803A bass speaker, an 800E dividing network and an 802 driver with the 811B horn the Capistrano has a guaranteed range from 35 to 22,000 cycles. The graceful, delicate styling of the enclosure is as outstanding visually as the performance is outstanding audibly. The Capistrano is equally appealing to the decorator and the audiophile.

Available in walnut, blonde, or mahogany hardwood cabinets (Shipped completely assembled). Price: $381.00

Other complete ALTEC speaker systems available from $120.00.

ALTEC LANSING CORPORATION

Write for free catalogue

ALTEC LANSING CORPORATION, Dept. A12-A
1515 So. Manchester Avenue, Anaheim, Calif.
161 Sixth Avenue, New York, N.Y.

TUNERS, PREAMPLIFIERS, AMPLIFIERS, SPEAKERS, SPEAKER SYSTEMS, ENCLOSURES

12-6

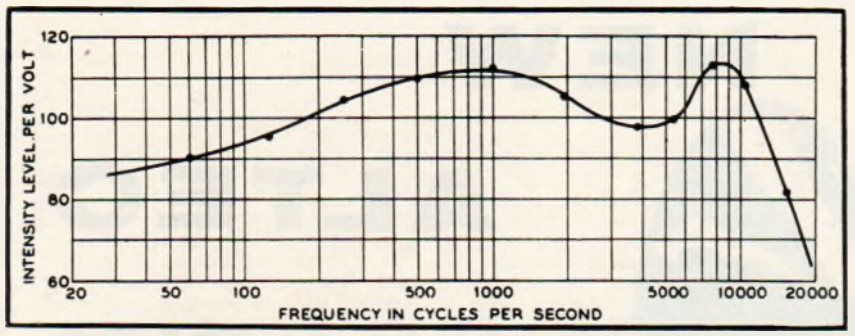


Fig. 1. Field calibration of loudness balance receivers.[6] (Calibration made at L = 60 db)

we could draw through the observed points. After the smoothing process, the curves in *Figs.* 2A to 2J were then adjusted to correspond. The curves shown in these figures are such adjusted curves.

In *Fig.* 4 a similar set of loudness level contours is shown using intensity levels as ordinates. There are good reasons[5] for believing that the peculiar shape of these contours for frequencies above 1000-cps is due to diffraction around the head of the observer as he faces the source of sound. It was for this reason that the smoothing process was done with the curves plotted with the level above threshold as the ordinate.

From these loudness level contours, the curves shown in *Figs.* 5A and 5B were obtained. They show the loudness level *vs.* intensity level with frequency as a parameter. They are convenient to use for calculation purposes.

It is interesting to note that through a large part of the practical range for tones of frequencies from 300 cps to 4000 cps the loudness level is approximately equal to the intensity level. From these curves, it is possible to obtain any value of L_k in terms of β_k and f_k.

On *Fig.* 4 the 120-db loudness level contour has been marked "Feeling." The data published by R. R. Riesz[7] on the threshold of feeling indicate that this contour is very close to the feeling point throughout the frequency range where data have been taken.

DETERMINATION OF THE LOUDNESS FUNCTION G

In the section "Formulation of the Empirical Theory for Calculating the Loudness of a Steady Complex Tone," the fundamental equation for calculating the loudness level of a complex tone was derived, namely,

$$G(1000,\ L) = \sum_{k=1}^{k=n} b_k G(1000,\ L_k). \quad (10)$$

If the type of complex tone can be chosen so that b_k is unity and also so that the values of L_k for each component are equal, then the fundamental equation for calculating loudness becomes

$$G(L) = nG(L_k), \quad (14)$$

where n is the number of components. Since we are always dealing in this section with $G(1000,\ L)$ or $G(1000,\ L_k)$, the *1000* is left out in the above nomenclature. If experimental measurements of L corresponding to values of L_k are taken for a tone fulfilling the above conditions throughout the audible range, the function G can be determined. If we accept the theory that, when two simple tones widely separated in frequency act upon the ear, the nerve terminals stimulated by each are at different portions of the basilar membrane, then we would expect the interference of the loudness of one upon that of the other would be negligible. Consequently, for such a combination b is unity. Measurements were made upon two such tones, the two components being equally loud, the first having frequencies of 1000 and 2000 cps and the second, frequencies of 125 and 1000 cps. The observed points are shown along the second curve from the top of *Fig.* 6. The abscissae give the loudness level L_k of each component and the ordinates the loudness level L of the two components combined. The equation $G(y) = 2G(x)$ should represent these data. Similar measurements were made with a complex tone having ten components, all equally loud. The method of generating such tones is described in Appendix C. The results are shown by the points along the top curve of *Fig.* 6. The equation $G(y) = 10G(x)$ should represent these data except at high levels where b_k is not unity.

There is probably a complete separation between stimulated patches of nerve endings when the first component is introduced into one ear and the second component into the other ear. In this case the same or different frequencies can be used. Since it is easier to make loudness balances when the same kind of sound is used, measurements were made (1) with 125-cps tones (2) with 1000-cps tones and (3) with 4000-cps tones. The results are shown on *Fig.* 7. In this curve the ordinates give the loudness levels when one ear

[5] Loc. cit.

[7] R. R. Riesz, "The relationship between loudness and the minimum perceptible increment of intensity," *J. Acous. Soc. Am.* 4, 211 (1933).

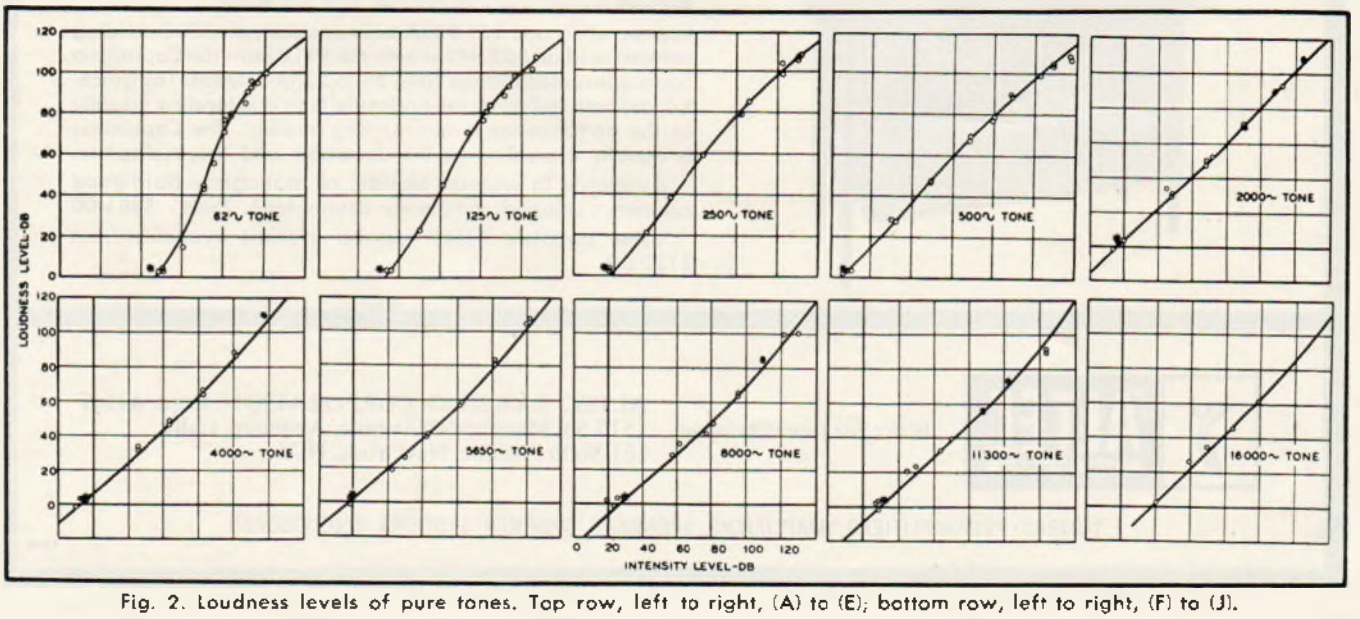


Fig. 2. Loudness levels of pure tones. Top row, left to right, (A) to (E); bottom row, left to right, (F) to (J).

LIVE SOUND

is the closest thing to a Weathers speaker

Listening is your dynamic proof! With any Weathers Speaker System you'll hear the full range of sound audible to the human ear... sound re-created at any volume, any frequency, to "natural perfection". Audiophile or beginner, a Weathers Speaker is your *finest source* to professional sound within your own home. This achievement is made possible by Weathers exclusive sonic principles: "radial damping" backwave control, exclusive multiple octave crossover, and a new cone-edge treatment resulting in the incredible smooth middle register. Weathers enclosures are constructed of selected, *solid* woods, all surfaces beautifully finished. Listen and compare—the closest comparison is "live" sound.

Weathers INDUSTRIES

DIV. OF ADVANCE INDUSTRIES, INC.

65 E. GLOUCESTER PIKE, BARRINGTON, NEW JERSEY

Export: Joseph Plasencia, Inc., 401 Broadway, New York, N. Y.

The BARRINGTON – a powerful, 12-speaker system, fills an auditorium, yet precisely controlled at 1/10 watt of audio power for small room volume. Offers a fidelity and smoothness of the full range of sound heretofore possible only under controlled laboratory conditions.

The MONTE CARLO – a 6-speaker system, graceful and elegant in design... versatile in application. Like all Weathers speakers, Monte Carlo is a finely integrated system offering distortion-free, uninhibited, full range response of every sound audible to human ear.

The DECORATOR – modern, slim-lined two-speaker system – ONLY 8¾ inches in depth. A luxury speaker at budget price for full-range response with perfect fidelity. Additional Decorator provides three-dimensional sound with unapproachable quality.

The FIESTA – a beautiful highly compact two-speaker system. Smallness in size makes no compromise on full-range response with true fidelity at every frequency. Ideal where space is at a premium. Ideal for multiple speaker installations for stereophonic sound.

www.americanradiohistory.com

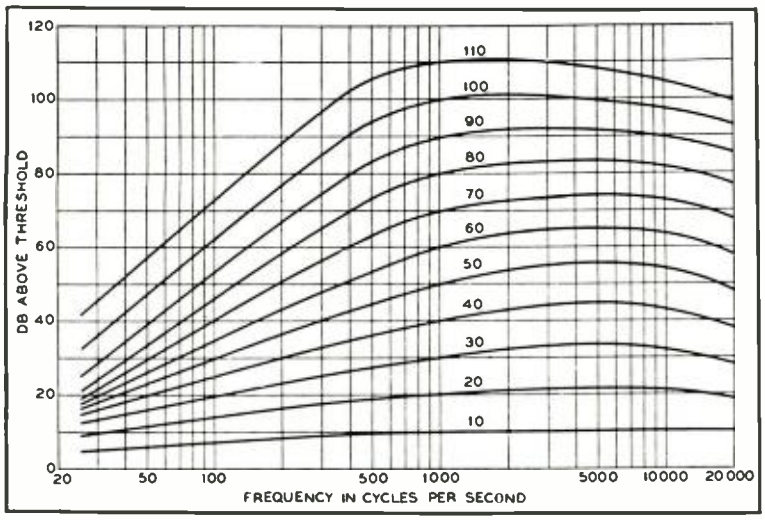


Fig. 3. Loudness level contours.

is used while the abscissae give the corresponding loudness levels for the same intensity level of the tone when both ears are used for listening. If binaural *vs.* monaural loudness data actually fit into this scheme of calculation these points should be represented by

$$G(y) = \tfrac{1}{2}G(x).$$

Any one of these curves which was accurately determined would be sufficient to completely determine the function G.

For example, consider the curve for two tones. It is evident that it is only necessary to deal with relative values of G so that we can choose one value arbitrarily. The value of $G(0)$ was chosen equal to unity. Therefore,

$G(0) = 1.$

$G(y_0) = 2G(0) = 2$

where y_0 corresponds to $x = 0$,

$G(y_1) = 2G(x_1) = 2G(y_0) = 4$

where y_1 corresponds to $x_1 = y_0$,

$G(y_2) = 2G(x_2) = 2G(y_1) = 8$

where y_2 corresponds to $x_2 = y_1$,

$G(y_k) = 2G(x_k) = 2G(y_{k-1}) = 2^{k+1}$

where y_k corresponds to $x_k = y_{k-1}$.

In this way a set of values for G can be obtained. A smooth curve connecting all such calculated points will enable one to find any value of $G(x)$ for a given value of x. In a similar way sets of values can be obtained from the other two experimental curves. Instead of using any one of the curves alone the values of G were chosen to best fit all three sets of data, taking into account the fact that the observed points for the 10-tone data might be low at the higher levels where b would be less than unity. The values for the function which were finally adopted are given in Table III. From these values the three solid curves of *Figs.* 6 and 7 were calculated by the equations

$G(y) = 10G(x),$

$G(y) = 2G(x),$

$G(y) = \tfrac{1}{2}G(x).$

The fit of the three sets of data is sufficiently good, we think, to justify the point of view taken in developing the formula. The calculated points for the 10-component tones agree with the observed ones when the proper value of b_k is introduced into the formula. In this connection it is important to emphasize that in calculating the loudness level of a complex tone under the condition of listening with one ear instead of two, a factor of ½ must be placed in front of the summation of Eq. (*10*). This will be explained in greater detail later. The values of G for negative values of L were chosen after considering all the data on the threshold values of the complex tones studied. These data will be given with the other loudness data on complex tones. It is interesting to note here that the threshold data show that 10 pure tones, which are below the threshold when sounded separately, will combine to give a tone which can be heard. When the components are all in the high pitch range and all equally loud, each component may be from 6 to 8 db below the threshold and the combination will still be audible. When they are all in the low pitch range they may be only 2 or 3 db below the threshold. The closeness of packing of the components also influences the threshold. For example, if the ten components are all within a 100-cps band each one may be down 10 db. It will be shown that the formula proposed above can be made to take care of these variations in the threshold.

There is still another method which might be used for determining this loudness function $G(L)$, provided one's judgment as to the magnitude of an auditory sensation can be relied upon. If a person were asked to judge when the loudness of a sound was reduced to one half it might be expected that he would base his judgment on the experience of the decrease in loudness when going from the condition of listening with both ears to that of listening with one ear. Or, if the magnitude of the sensation is the number of nerve discharges reaching the brain per second, then when this has decreased to one half, he might be able to say that the loudness has decreased one half.

In any case, if it is assumed that an observer can judge when the magnitude of the auditory sensation, that is, the loudness, is reduced to one half, then the value of the loudness function G can be computed from such measurements.

Several different research workers have made such measurements. The measurements are somewhat in conflict at the present time so that they did not in any

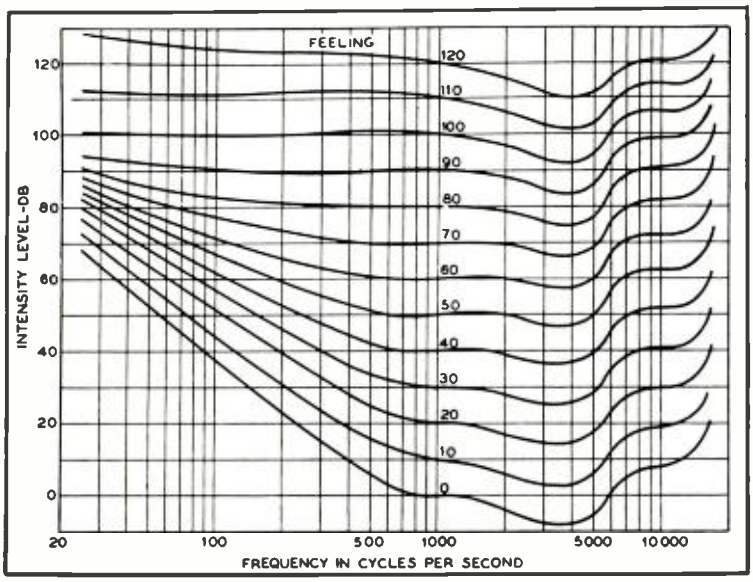
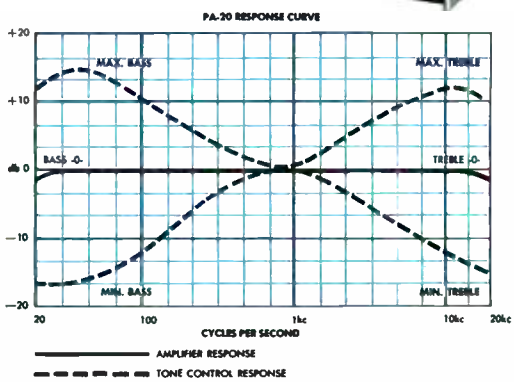


Fig. 4. Loudness level contours.

www.americanradiohistory.com

NEW

G-E pa-20



New features for finest amplifier performance

With frequency response from 20 through 20,000 cycles, General Electric's new 20-watt Amplifier-Preamplifier brings you the smooth, clean response you demand in your High Fidelity sound system.

Check these features: (1) Phono input hum level below −55 db at full output; (2) overall distortion level of less than one percent at full output; (3) phono input sensitivity of five to six millivolts at full output; (4) accurate phono equalization, within 1¾ db.

To achieve a very sharp low-frequency cutoff of 12 db per octave below 10 cycles, the new PA-20 incorporates an unusual L-C tuned circuit in its rumble filter. Rumble and sub-audio frequencies are filtered out with no appreciable effect on bass response.

So versatile that it fulfills every home Hi-Fi need, the PA-20 offers five separate inputs, three outputs and seven different controls. Its modern leather-grain finish, extra size control knobs and gold brushed escutcheon are a handsome complement to its outstanding audio performance.

Ask for a demonstration of the new General Electric PA-20 at your Hi-Fi dealer's soon. Also be sure to hear the new G-E VR II magnetic cartridge.

Specialty Electronic Components Dept.
Section HFA12, West Genesee Street
Auburn, N. Y.

Please send me complete specifications on the new G-E PA-20.

Name_____

Address_____

City_____ **Zone**_____ **State**_____

GENERAL ELECTRIC

www.americanradiohistory.com

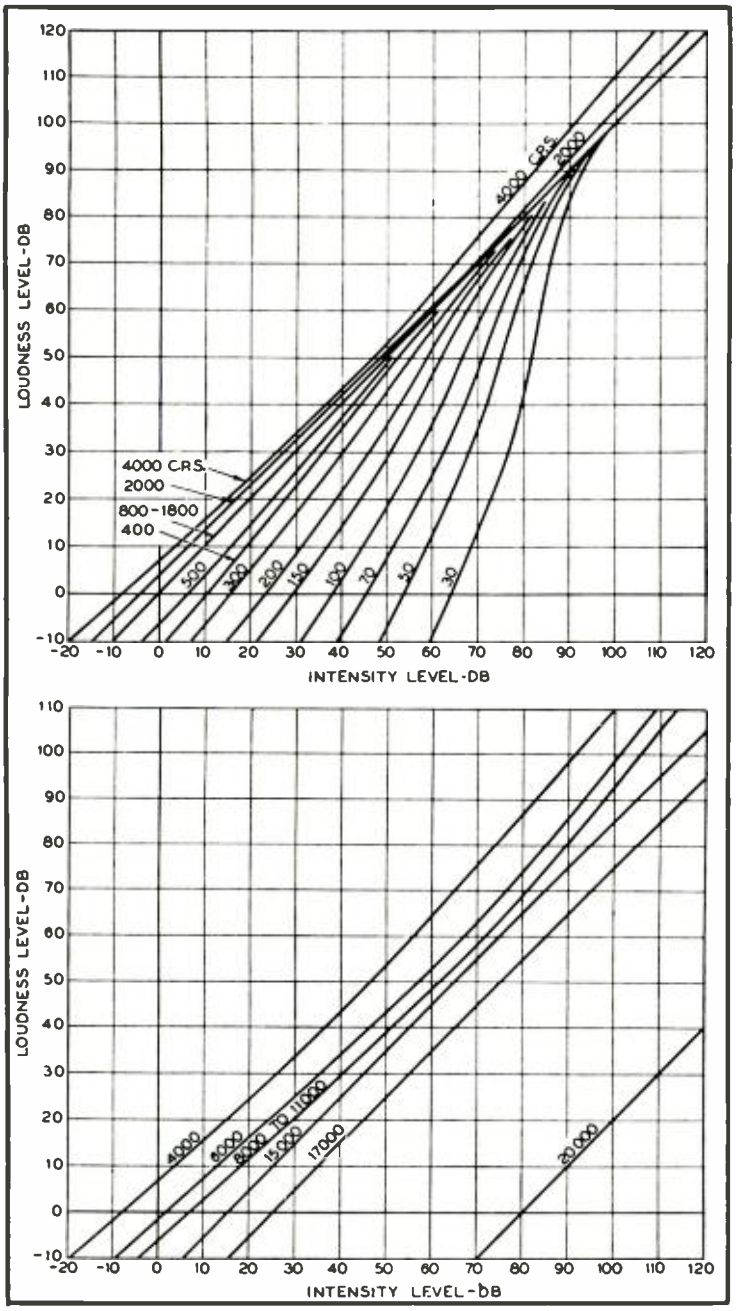


Fig. 5. (A and B)—Loudness levels of pure tones.

way influence the choice of the loudness function. Rather we used the loudness function given in Table III to calculate what such observations should give. A comparison of the calculated and observed results is given below. In Table IV is shown a comparison of calculated and observed results of data taken by Ham and Parkinson.[8] The observed values were taken from Tables 1a, 1b, 2a, 2b, 3a and 3b of their paper. The calculation is very simple. From the number of decibels above threshold S the loudness level L is determined from the curves of *Fig.* 3. The fractional reduction is just fractional reduction in the loudness function for the corresponding values of L. The agreement between observed and calculated results is remarkably good. However, the agreement with the data of Laird, Taylor and Wille is very poor, as is shown by Table V. The calculation was made only for the 1024-cps tone. The observed data were taken from Table VII of the paper by Laird, Taylor and Wille.[9] As shown in Table V the calculation of the level for one fourth reduction in loudness agrees better with the observed data corresponding to one half reduction in loudness.

Firestone and Geiger reported some preliminary values which were in closer agreement with those obtained by Parkinson and Ham, but their completed paper has not yet been published.[10] Because of the lack of agreement of observed data of this sort we conclude that it could not be used for influencing the choice of the values of the loudness function adopted and shown in Table III. It is to be hoped that more data of this type will be taken until there is a better agreement between observed results of different observers. It should be emphasized here that changes of the level above threshold corresponding to any fixed increase or decrease in loudness will, according to the theory outlined in this paper, depend upon the frequency of the tone when using pure tones, or upon its structure when using complex tones.

DETERMINATION OF THE FORMULA FOR CALCULATING b_k

Having now determined the function G for all values of L or L_k we can proceed to find methods of calculating b_k. Its value is evidently dependent upon the frequency and intensity of all the other components present as well as upon the component being considered. For practical computations, simplifying assumptions can be made. In most cases the reduction of b_k from unity is principally due to the adjacent component on the side of the lower pitch. This is due to the fact that a tone masks another tone of higher pitch very much more than one of lower pitch. For example, in most cases a tone which is 100 cps higher than the masking tone would be masked when it is reduced 25 db below the level of the masking tone, whereas a tone 100 cps lower in frequency will be masked only when it is reduced from 40 to 60 db below the level of the masking tone. It will therefore be assumed that the neighboring component on the side of lower pitch which causes the greatest masking will account for all the reduction in b_k. Designating this component with the subscript m, meaning the masking component, then we have b_k expressed as a function of the following variables.

$$b_k = B(f_k, f_m, S_k, S_m). \qquad (15)$$

[8] L. B. Ham and J. S. Parkinson, "Loudness and intensity relations," *J. Acous. Soc. Am.* 3, 511 (1932).

[9] Laird, Taylor and Wille, "The apparent reduction in loudness," *J. Acous. Soc. Am.* 3, 393 (1932).

[10] This paper is now available. P. H. Geiger and F. A. Firestone, "The estimation of fractional loudness," *J. Acous. Soc. Am.* 5, 25 (1933).

www.americanradiohistory.com

99.75 net

NEW 12" PRECISION TURNTABLE

OUTSTANDING FEATURES

Four speeds, each with +3% speed adjustment. Built-in illuminated strobe disk for all speeds. Built-in level bubble and leveling screws. Precision 4-pole motor, extra-compliant belt-drive and idler system plus exclusive Thorens Roto-Drive principle, provide complete vibration isolation, absolutely constant speed. Provision for easily changing arms without leaving unsightly permanent marks:—just replace low-cost arm mounting board, available for 12" or 16" arms in various finishes. Easy to mount, the TD-124 requires only 2¾" clearance below mounting board. Furnished with attached line cord, shielded cable and solder plate.

Gyro-like Roto-Drive gives new Thorens TD-124 absolute speed uniformity. Heavier than 16-inch turntables, yet it starts, stops in less than 2/3 turn!

How to get the heaviest possible turntable for smooth, absolutely quiet operation without sacrificing fast starts and stops.

That's the problem Thorens engineers faced when they set out to build the best four-speed, 12-inch, hi-fi turntable money can buy. You'll be amazed at the simplicity of their solution.

The new TD-124 really has two turntables in one: (1) a heavy 10-lb. rim-concentrated, cast-iron flywheel (outweighs 16" aluminum turntables) (2) a light aluminum cover, or turntable proper. An exclusive, Thorens-originated clutch couples or decouples the light aluminum table to the heavy flywheel for instant starts and stops. What's more, the Thorens double turntable system gives you the weight of a cast-iron table (3 times as heavy as aluminum) without danger of attracting any pickup magnet. And with this unique construction, your pickup gets magnetic shielding from motor or transformer hum fields by the iron turntable.

Ask your hi-fi dealer to show you the Thorens TD-124. Better yet, arrange to hear one of those critical, slow piano records on the TD-124. If you don't know who your dealer is, write Thorens Company, Dept. A127, New Hyde Park, N. Y. 7.9

THORENS ★ FULL YEAR GUARANTEE ★ SWISS MADE PRODUCTS

THORENS SWISS MADE PRODUCTS

HI-FI COMPONENTS · LIGHTERS · SPRING-POWERED SHAVERS · MUSIC BOXES

www.americanradiohistory.com

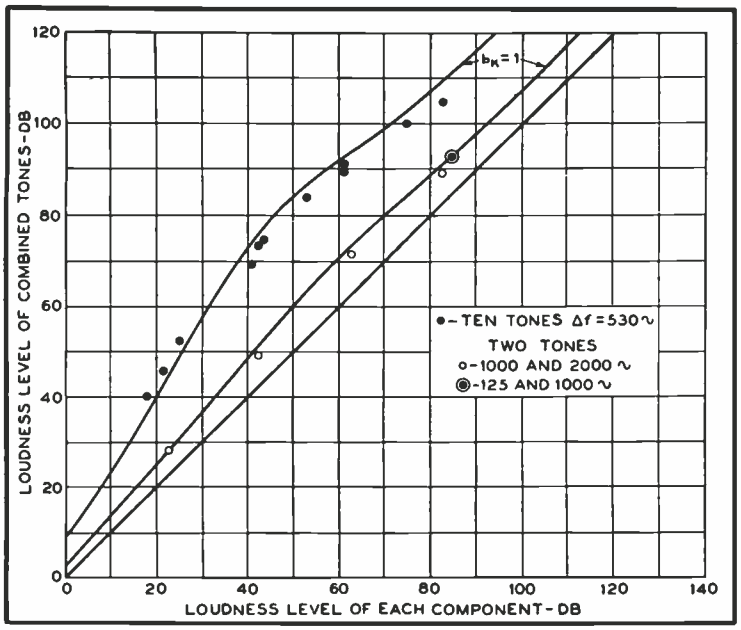


Fig. 6. Complex tones having components widely separated in frequency.

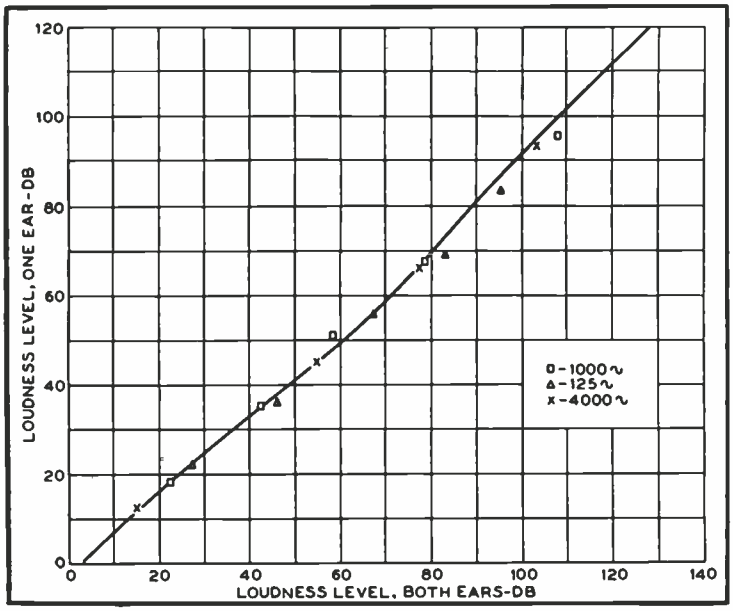


Fig. 7. Relation between loudness levels listening with one ear and with both ears.

where f is the frequency and S is the level above threshold. For the case when the level of the kth component is T db below the level of the masking component, where T is just sufficient for the component to be masked, then the value of b would be equal to zero. Also, it is reasonable to assume that when the masking component is at a level somewhat less than T db below the kth component, the latter will have a value of b_k which is unity. It is thus seen that the fundamental of a series of tones will always have a value of b_k equal to unity.

For the case when the masking component and the kth component have the same loudness, the function representing b_k will be considerably simplified, particularly if it were also found to be independent of f_k and only dependent upon the difference between f_k and f_m. From the theory of hearing one would expect that this would be approximately true for the following reasons:

The distance in millimeters between the positions of maximum response on the basilar membrane for the two components is more nearly proportional to differences in pitch than to differences in frequency. However, the peaks are sharpest in the high-frequency regions where the distances on the basilar membrane for a given Δf are smallest. Also, in the low frequency region where the distances for a given Δf are largest, these peaks are broadest. These two factors tend to make the interference between two components having a fixed difference in frequency approximately the same regardless of their position on the frequency scale. However, it would be extraordinary if these two factors just balanced. To test this point three complex tones having ten components with a common Δf of 50 cps were tested for loudness. The first had frequencies of 50–100–150 · · · 500, the second 1400–1450 · · · 1900, and the third 3400–3450 · · · 3900. The results of these tests are shown in *Fig.* 8. The abscissae give the loudness level of each component and the ordinates the measured loudness level of the combined tone. Similar results were obtained with a complex tone hav-

(*Continued on page 83*)

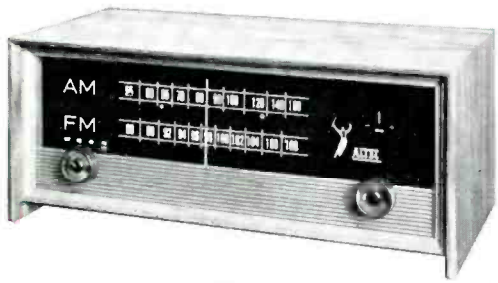
TABLE I — VALUES OF $G(L_k)$

L	0	1	2	3	4	5	6	7	8	9
−10	0.015	0.025	0.04	0.06	0.09	0.14	0.22	0.32	0.45	0.70
0	1.00	1.40	1.90	2.51	3.40	4.43	5.70	7.08	9.00	11.2
10	13.9	17.2	21.4	26.6	32.6	39.3	47.5	57.5	69.5	82.5
20	97.5	113	131	151	173	197	222	252	287	324
30	360	405	455	505	555	615	675	740	810	890
40	975	1060	1155	1250	1360	1500	1640	1780	1920	2070
50	2200	2350	2510	2680	2880	3080	3310	3560	3820	4070
60	4350	4640	4950	5250	5560	5870	6240	6620	7020	7440
70	7950	8510	9130	9850	10600	11400	12400	13500	14600	15800
80	17100	18400	19800	21400	23100	25000	27200	29600	32200	35000
90	38000	41500	45000	49000	53000	57000	62000	67500	74000	81000
100	88000	97000	106000	116000	126000	138000	150000	164000	180000	197000
110	215000	235000	260000	288000	316000	346000	380000	418000	460000	506000
120	556000	609000	668000	732000	800000	875000	956000	1047000	1150000	1266000

www.americanradiohistory.com

THE ALTEC

306A AM-FM TUNER



*"...the most sensitive tuner ever tested"**

The ALTEC LANSING 306A features an exceptionally large six gang tuning condenser which is fully shielded and mounted directly to the chassis for perfect grounding, a dry rectifier for long stable life, complete isolation between transformers and power mains and a chassis layout which reduces coupling between circuits to a minimum that easily meets F.C.C. radiation requirements. The FM section features a Foster-Seeley (Armstrong) detector, a "cascode" low noise RF stage, a triode low noise mixer stage, AFC and *two* limiter stages.

The AM section features three IF transformers with optimized coupling for flat pass band and maximum noise rejection. This use of specially designed and over-coupled IF transformers provides maximum band width with extremely sharp skirt attenuation for maximum fidelity.

These features, careful chassis layout and intensive testing and alignment account for the superior performance of this tuner. Examine the 306A closely. Compare its performance critically. You will see why it is considered the world's finest tuner for sensitivity, selectivity, stability and long life. Like all ALTEC products its performance specifications are guaranteed. Price: (less cabinet), $198.00. Walnut, Blonde or Mahogany Cabinet, $18.00. * *According to one of nation's leading testing laboratories.*

THE ALTEC 305A AM TUNER

The 305A has been designed specifically for use in those areas where FM reception is not available or for use with the 306A for stereo broadcast reception. It provides the maximum possible quality from AM broadcasting through the utilization of a special circuit which provides the greatest possible band width. Many AM tuners have both broad and narrow band selection but the broad band position invariably has so little skirt attenuation that it is virtually unusable. The 305A uses ALTEC developed and produced IF transformers of an unusual design which permits them to be over-coupled to provide extremely sharp skirt attenuation. This sharp attenuation provides the greatest usable band width for maximum fidelity, and strong noise rejection for quiet operation and freedom from station interaction. Price: (less cabinet), $99.00. Walnut, Blonde or Mahogany Cabinet, $18.00.

ALTEC LANSING CORPORATION

Write for free catalogue
ALTEC LANSING CORPORATION, Dept. A12
1515 So. Manchester Avenue, Anaheim, Calif.
161 Sixth Avenue, New York 13, N.Y.

12-7

www.americanradiohistory.com

Equipment Review

Dyna Preamplifier and Dynakit III 60-watt power amplifier—Fairchild 412-1 turntable and 280-A transcription arm—General Electric VR-II variable reluctance pickup—The Garrard Line

DYNACO, INC.

Slightly over a year ago we reviewed the original Dynakit II power amplifier (Sept. 1956) with its unusual—for then—50-watt output. Now there are many 50-watt amplifiers on the market, and some of still higher power, and it is somewhat of a surprise to note how many of them employ the same circuit as that of the Dynakits. The newest model, the Dynakit III, is rated at 60 watts and incorporates a few features that were not part of the earlier model. While the circuit is essentially the same, the output tubes are KT-88's, which accounts largely for the increased output. In addition, a filter choke has been added, improving the signal-to-noise ratio, and a 11.2-ohm resistor has been added from the cathodes of the output tubes to ground—an improvement towards more output linearity that has already been recommended as a suggested change for earlier owners of Dynakit II.

The new unit is the same size as its predecessor—9 by 9 by 6¾ in.—and is of similar appearance, as shown in *Fig.* 1. Rated output is obtained from an input of 1.6 volts, and the model tested (which was assembled in slightly less than two hours) reached 68 watts at 2 per cent IM distortion. Output impedances of 4, 8, and 16 ohms are available, and the unit provides power for Dynakit and Heathkit preamplifiers directly, or for most others if proper connections are made to the power socket.

The Dyna Preamp is an interesting design, conventional in some respects, unusual in others. The tone control action is obtained from a feedback circuit with somewhat less interaction than is usual for the average preamp. One useful feature is the "Special" input which may be wired by the builder to be equalized for microphone or tape head, or it may be employed as an additional RIAA phono position, depending on the user's requirements. In the latter connection, it is possible to leave two pickups plugged in at all times, with front-panel switching—accommodating, for example, a changer and a turntable at the same time. Another very desirable feature is the rectifier-filter circuit which permits the use of a 6.3-volt a.c. source to provide some 11.5 volts of d.c. for heater supply. It should be noted that when this arrangement is used, the ground connection normally present in the power amplifier should be removed, since the ground on the heater circuit is best obtained from the potentiometer in the preamp. The Dynakit III is normally wired with the heater winding free from ground, and if it is to be used with any other preamplifier the center tap should be grounded. Similarly, if the Dyna preamp is used with any other power amplifier, the ground on the heater circuit of the other power amplifier should be lifted. *Figure* 2 shows the external appearance of the Dyna preamp, while *Fig.* 3 shows the internal arrangement. The use of pre-assembled etched-wiring panels reduces construction to a relatively simple operation. In spite, however, of the ease of construction, it is likely that most users would be very well satisfied with the Dyna models. **M-18**

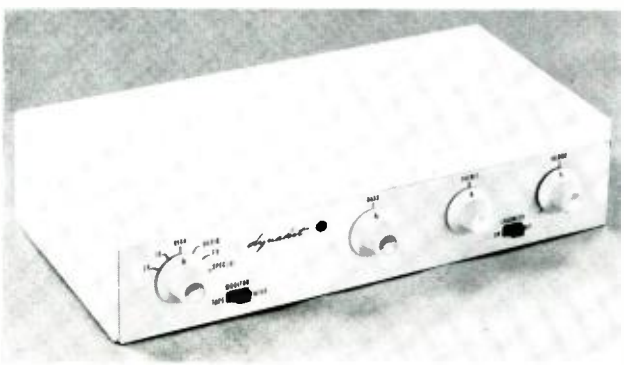
Fig. 1. From a box of parts to a 60-watt amplifier in about two hours, the new Dynakit III is a model any kit builder will enjoy.

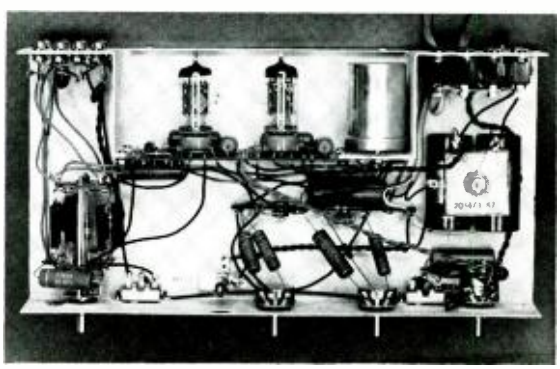
FAIRCHILD

In general it may be said that the simplest form of any particular device might well be the best, since there are likely to be fewer parts and consequently less chance of trouble. Thus the simplest form of a phonograph turntable could well be the platter with a suitable bearing, a driving motor, and a belt drive between them. This permits the motor to be mounted as flexibly as possible, and removes any actual mechanical contact between motor and turntable, since the belt would undoubtedly be made of some material which would not transmit vibrations.

Such a device is the Fairchild 412-1 turntable—a single-speed model for those whose principal interest in records centers

Fig. 2 (left). The Dyna preamplifier kit ends up as a neat and attractive unit with excellent performance. Note left slide switch which connects monitor circuit to tape recorder without need for changing plugs. Fig. 3 (right). Inside view of Dyna preamp. Tubes are completely enclosed and shielded when cover is in place.





www.americanradiohistory.com

Burton Browne Advertising

NEW **Jensen DUAX***

HIGH FIDELITY LOUDSPEAKERS

You'll spend less for more performance . . . get traditional Jensen quality!

Making the utmost of the hi-fi possibilities of two coordinated cones driven by one voice coil, Jensen's new DUAX speakers bring you a lot more performance at a lot less than you'd expect to pay. No one makes a better speaker at anywhere near the price.

Both acoustic elements operate together up to a "mechanical cross-over" at 4000 cps; above this the small cone operates with special effectiveness. Frequency range, 40-13,000 cps, with low end enclosure dependent, but working fine just about anywhere you put it. One pound new high efficiency DP-Alnico-5 magnet. Twelve inch DX-120, net $25.50; fifteen inch DX-150, only $35.50.

Free condensed Catalog 165-B tells about the complete new Jensen line. Write for it now.

*T. M. Reg.

KTX-2 "STEP-UP" KIT

Start with a DUAX, up-grade later to a true 2-way system with compression horn tweeter for 2000-15,000 cps. Easy to add, costs only $32.50 net.

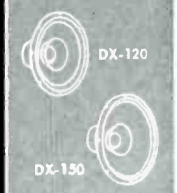
Jensen MANUFACTURING COMPANY

6601 South Laramie Ave., Chicago 38, Illinois

Division of The Muter Co.

In Canada: J. R. Longstaffe Co., Ltd., Toronto
In Mexico: Radios Y Television, S.A., Mexico D.F.

UNAX* SINGLE ELEMENT



DUAX* 2-ELEMENT SYSTEMS

COAXIAL 3-ELEMENT SYSTEMS

COAXIAL 2-WAY SYSTEMS

TRIAXIAL* and **TRIAX*** 3-WAY SYSTEMS

THE WORLD'S MOST COMPLETE HIGH FIDELITY LOUDSPEAKER LINE

*T. M. Reg.

www.americanradiohistory.com

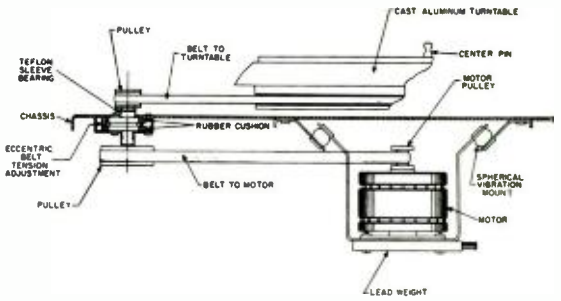


Fig. 4 (left). The Fairchild 412-1 turntable mounted in a hardwood cabinet which accommodates also the 280 transcription arm. Entire unit is large, but a belt drive from motor to idler and another belt drive from idler to turntable holds rumble to a minimum. Fig. 5 (above). Cross-sectional view of the 412-1 turntable showing relative position of the various elements.

around the LP. However, for those who need the other speeds, the Electronic Drive unit may be employed. Basically, therefore, the turntable unit consists of the platter, a motor, and a belt—although, actually, to obtain suitable speed reduction there is an intermediate idler, with two belt drives. One belt drives the idler from the motor, and the other drives the turntable from the idler. *Figure* 4 shows the complete unit, together with the transcription arm, and *Fig.* 5 shows the mechanical arrangement in cross section.

The driving motor—a hysteresis-synchronous model—is mounted in a flexible cradle with highly compliant suspension which eliminates transmission of vibration (and audible noise) to the chassis. The idler is mounted to the chassis with rubber cushions, and is equipped with Teflon sleeve bearings, the whole idler assembly being mounted in an eccentric which permits adjustment of belt tension. The recognized speed constancy of the hysteresis-synchronous type of motor ensures extreme speed accuracy at the turntable proper—the production models being held to an absolute speed accuracy of closer than 0.3 per cent.

The turntable platter is a heavy aluminum casting, dynamically balanced, and its hardened steel shaft is carried in lapped well provided with lubrication grooves, the thrust being taken on a hardened steel ball riding on a Nylon seat. Rumble was so low as to be extremely difficult to measure, since even the unmodulated grooves on most test records show some "rumble" when the reproducing equipment finally becomes good enough. Suffice that rumble is entirely *inaudible* with any records we played at well above normal listening level.

For those who need other speeds, the Electronic Drive unit may be added at any time. This unit simply provides other frequencies of supply voltage by means of an oscillator—60 cps being normal for the 33⅓-rpm speed, and thus equivalent to normal line supply frequency. For 16⅔ rpm, the oscillator supplies 30-cps drive voltage; for 45 rpm the supply frequency is 81 cps; and for 78 rpm the frequency is 141 cps. Since the absolute speed of the hysteresis-synchronous motor is dependent on the frequency of the supply voltage any speed desired can be obtained by changing the frequency of the oscillator. This makes an especially desirable unit for use in areas where 60 cps is not the normal line frequency or where the frequency is not carefully controlled. The Electronic Drive unit can also be used from practically any voltage source—a.c. from 85 to 135 volts at from 40 to 400 cps; d.c., with any type of inverter, which does not need to be frequency-controlled; or batteries, with an ordinary vibrator-inverter. The ED unit is normally used with four fixed output frequencies, all of which have vernier adjustments, but the output frequencies could be tailored by any user having special requirements with relatively little trouble.

The turntable unit requires a clearance of 6⅞ in. below the mounting board, and the hardwood base shown in *Fig.* 4 is 21¼ by 14½ by 7½ in., actually not much larger than the turntable unit itself. The top board is mounted with acoustic isolation to minimize the effects of external vibration.

The 280A transcription arm is an improved model of the earlier Fairchild arm, and has a minimum of bearing friction—both vertically and horizontally—low vertical mass, and a detent which holds the arm fixed in the rest position without any additional arms or holding devices. The cartridge is carried on a removable slide to which electrical contact is made by a pair of springs which short out the leads when the cartridge slide is removed. Arm resonance has been held to a minimum, with no effect whatever being noticed above 12 cps. The arm is an attractive unit, and well complements the high quality of the turntable. **M-19**

GENERAL ELECTRIC

The new GE cartridge—VR-II—is likely to continue the long tradition its predecessor has maintained, that of being a very good pickup at a very low price. The overall frequency range has been increased to provide better response above 10,000 cps; compliance has been increased; and tracking in a typical transcription-type arm is satisfactory at a stylus force of only 4 grams. *Figure* 6 shows the dual-stylus model 4G-series—the suffix numbers –050 indicating two sapphires, –052 indicating a 1-mil diamond and a 3-mil sapphire, while –053 indicates two diamonds.

With a load resistance of 6200 ohms the cartridge has a roll-off which corresponds with the RIAA curve, and the output at a stylus velocity 10 cm/sec has a nominal value of 22 millivolts. Compliance is rated at 1.7×10^{-6} cm/dyne, which—while not especially high—indicates that the pickup should be sturdy and require a minimum of "kid glove" treatment. Suitable tracking force for the pickup—using as an indication the minimum intermodulation distortion point—appears to be between 3.5 and 4.5 grams, and the cartridge operates satisfactorily at a 6-gram force in good-quality record changers.

Susceptibility to pickup of hum from nearby fluorescent lamps or to static pops resulting from build-up of static charges on the record surface has been reduced appreciably by the use of an electrostatic shield which is designed to be grounded to the "low" terminal of the pickup when it is installed in the head.

The body of the cartridge is not as wide as in the previous models, which makes it possible to install the VR-II in some of the narrower arms used in many of the "packaged" hi-fi sets. Thus better quality can be available to a wider group of potential users than heretofore—a feature

Fig. 6. General Electric's new VR-II cartridge, available in a number of types and stylus arrangements.

www.americanradiohistory.com

what could be more exciting to a high fidelity enthusiast?

new GLASER-STEERS GS Seventy Seven*

the fully automatic record changer with turntable quality performance

At last — what every audiophile has been waiting for — the convenience of a fully automatic record changer with the performance quality of a transcription turntable.

The new GS-77 provides a quality of performance unsurpassed by turntables up to double the price. Flutter and wow are virtually non-existent. Rumble has, for all practical purposes, been eliminated. And as for automatic conveniences — it is, without doubt, the most advanced record changer of our time.

There is more originality in the GS-77 than in all other changers combined! See for yourself.

'SPEEDMINDER'...*the amazing GS-77 feature that automatically selects correct turntable speed, and gives you record and stylus protection no other changer can equal.

You simply set the indicator to ***'SPEEDMINDER'*** and automation takes over . . .

- with the standard groove stylus in play position, the changer automatically plays at 78 rpm.
- with the microgroove stylus in position, the changer automatically intermixes and plays 33 and 45 rpm records without regard to speed, size, or sequence.

TURNTABLE PAUSES during change cycles and doesn't resume motion until next record has come into play position and stylus is in lead-in groove. Eliminates record surface wear caused by grinding action of record dropping on moving disc—a common draw-back in other changers. And the change cycle lasts only 5 seconds — fastest in the field.

* Trademark

***Every feature† spells**—Greater Convenience and Better Performance* — The ARM is shock suspended and damped, effecting complete acoustical isolation from deck plate and motor and practically eliminating resonance. An accessible vernier control adjusts stylus pressure to match any cartridge requirements. Once adjusted, the variation of stylus pressure between the first and tenth record on the table does not exceed 1 gram. Transcription arm convenience includes: finger lift for manual play, as well as indicator to facilitate location of stylus in groove. The MOTOR is 4-pole induction, dynamically balanced, hum shielded and shock mounted — all to assure accurate, constant speed, and smooth operation.

The IDLER and other rotating parts are precisely centered and mounted on low friction bearings. Idler automatically disengages in 'off' position. Prevents flat spots and wow. MUTING SWITCH and R/C filter network squelch all annoying sounds.

The GS-77 is absolutely jam-proof — built for years of trouble-free performance. A single knob controls all automatic and manual operations. The changer is pre-wired for easy installation, and is dimensioned to replace most changers.

less cartridge and base — ONLY **$59.50**

Styling of the new GS-77 is gracefully simple — enhanced by its ebony and brushed gold finish and oyster white turntable mat. For a thrilling experience — see it — hear it at your high fidelity dealer. Descriptive literature available on request. Dept. A-12.

† Patents Pending

GLASER-STEERS CORP. 20 Main Street, Belleville 9, N. J.
In Canada: Glaser-Steers of Canada, Ltd., Trenton, Ontario.
Export Div.: M. Simons & Son, Co., New York 7, N. Y.

www.americanradiohistory.com

Fig. 7. Garrard Model T "Mark II" 4-speed manual record player—neat and compact.

Fig. 8. The Garrard "Professional" model 301 transcription turntable—a three-speed unit of exceptionally quiet performance.

Fig. 9. The RC88 record changer—four speeds, automatic or manual operation.

which will be of special interest to the audio service man who is called on to make improvements in sets of this type. It is quite likely, therefore, that the VR-II will carry on the tradition of being the "work horse" of the magnetic pickups. M-20

THE GARRARD LINE

It has long been the custom of this department to review equipment of the type that the average reader considers "standard" in that it rarely seems to change appreciably from year to year. This description applies particularly well to the Garrard line of record players and changers—as well as the 301 transcription turntable—because such minor improvements as may be introduced into the various units are not sufficient to warrant a new model designation. While the Model T "Mark II" was reviewed in July of this year, and the new TPS-10 arm was described in the October issue, the remainder of the line has not been discussed since the introduction of the RC88, RC98, and RC121 models over a year ago.

Figure 7 shows the Model T, which is a manual record player with four speeds. The pickup shell is the same as those used on the three changers, which simplifies the problem of the user who may have a changer in his home but who occasionally uses the smaller manual unit as a "portable", for example. The motor starts when the arm is moved fully to the right, and shuts off automatically at the end of the record. An arm rest is provided, and the entire unit is quite compact.

The RC88—which might be described as the common garden variety since these are the Garrard models most often encountered—is shown in *Fig. 9*. This model uses the pusher platform type of record change for 10"- and 12" records, and a center-drop spindle for the 7" 45's. One interesting and useful feature is the spring mounting used for all of the changers as well as for the Model T. To make installation, the mountings are attached to the base plate and simply pressed into the holes on

Fig. 10. Model RC121 is more compact because of the center-drop spindle, can fit into many existing phonographs.

the motor board, levelling screws being accessible from the top so that even when the motor board itself is not level the changer can be made so readily.

Model RC98 is essentially the same as the 88 with the addition of a vernier speed adjustment which covers the range of about ±4 per cent, permitting those who wish to play records with a piano or other instrument to match the pitch properly. The underside of the 98 is shown in *Fig. 11*, and it is identical with the 88 except for the vernier speed control housing shown at the left.

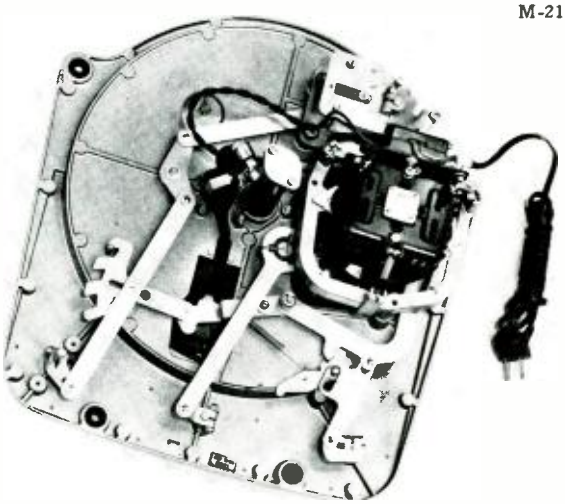
Model RC121, shown in *Fig. 10*, uses the simpler center-drop spindle for both types of records. This results in a smaller base plate that can usually be accommodated in the space available in existing phonographs when a change to a better quality of turntable is desired or when the user feels that he wants the 16⅔ rpm speed. Like all the other models, no belts are used between motor shaft and idlers, but a more conventional turret drive is employed to effect the speed changes.

Figure 8 shows the top view of the Model 301 transcription turntable, which has already established an enviable reputation for itself. Using the same basic drive principles, the transcription model is naturally constructed with every possible thought being given to the reduction of rumble. The underside view of this model shows the "battleship" type of construction, with the motor being supported in a cradle by means of rubber-damped springs, and the vernier speed control isolated from the motor by springs to minimize any transmission of motor vibration—and there is very little from this dynamically balanced motor—to the chassis. An interlock prevents changing speeds when the motor is running, and the ON-OFF switch control is separate from the SPEED SELECTOR to eliminate the possibility of turning the unit on to a wrong speed—a disaster in professional applications.

As the leader in the Garrard line, the 301 well deserves its excellent reputation.

M-21

Fig. 11 (below). Underside view of the deluxe RC98. The vernier speed control—which changes the electrical circuits of the motor itself—is in the perforated housing at the left. The RC88 is essentially identical except for this control. Fig. 12 (right). Underside of the 301 transcription turntable. Note the extremely rugged construction with thorough isolation of motor from chassis.



www.americanradiohistory.com

FOR THE **PRESTIGE** OF OWNING THE BEST . . .

BOZAK *Quality Loudspeakers*

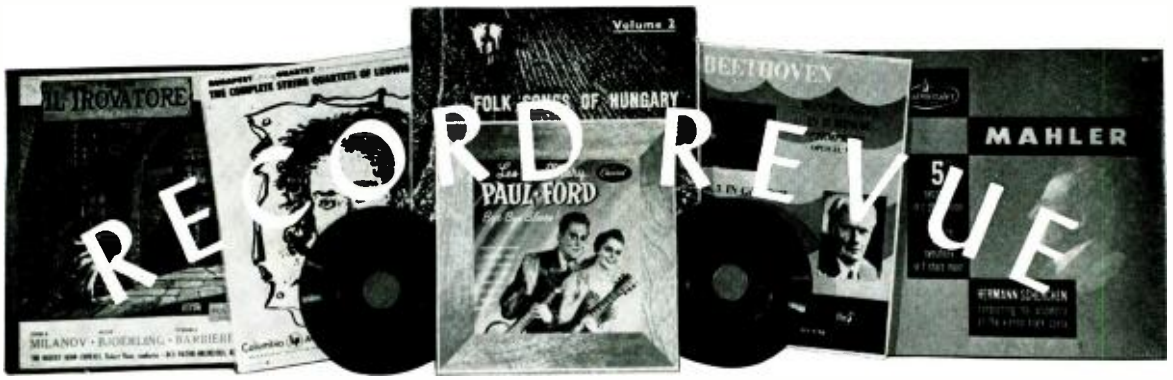
The Very Best in Sound

THE R. T. BOZAK SALES COMPANY

DARIEN • CONNECTICUT

EXPORTS: ELECTRONICS MANUFACTURERS' EXPORT COMPANY • PLAINVIEW • NEW YORK

www.americanradiohistory.com



EDWARD TATNALL CANBY*

1. WORDS, AMAZIN' WORDS

Shakespeare: Hamlet—the Baylor Theatre Production, 1957. Baylor Univ., Waco, Texas. **Word Record W-6002-3 (3)**
(With script, ill. booklet.)

Wonders will never cease! Here is an ultra-Hamlet to knock you for a loop. Blurb on the cover says "The first deadly NEW Hamlet in 355 years . . . *three actors playing each major role*"—and, by golly, that is literally true.

There are three simultaneous Hamlets here, and three queens, three kings, three Poloniuses, Ophelias, Laerteses, Horatios. Even the play-within-the-play has triple everything. The cast is enormous. Each triple character appears as a unit, all three, and the trio act and speak throughout as a team. When four or five characters are onstage the babble of voices is like Times Square in the rush hour. It takes six people to play a love scene!

The play was staged in a theatre with swivel seats surrounded by stages on all sides; the show goes on all around and the audience pivots. Music comes from strange drums, from the inside of pianos, wood blocks, sections of iron pipe. Costumes and sets are timeless and modern. The script—Shakespeare—is rearranged and adapted.

And yet, in spite of all this (or because of it), the production, even on records, is really convincing.

Yes, there is a good deal of conventional stage stuff left, perhaps more than the players are aware. Too much chanting and moaning, as actors love to do in tragedies, too much fateful thumping of drums. The speaking accents are often forced, as Shakespeare usually is today. (Some, however, are delightfully Texan, including one of the three Hamlets.) On casual listening you might class this as just another acting uproar, a lot of stage-struck fanatics making pretentious noise. There is that aspect to it—as to much serious-minded playmaking these days. Dreadfully dedicated.

Yet if you will sit down and follow the printed script (to keep yourself straight as to how many of whom is who) you will find this an exciting and moving show, as it has seldom been for us ordinary non-drama souls. The thing works.

For, when you get down to it, this is simply Shakespeare done in our own terms, as we do things. We like to divide and analyze people and things into facets. On the stage, we divvy up characters into aspects, separate them. And in opera too, same idea. Saint Theresa I and II in "Four Saints in Three Acts" of Thomson, Dr. Jekyll and Mr. Hyde. The two sisters with the same name in Kurt Weil's "Seven Deadly Sins"; just two aspects of the same gal. You'll even remember such things in the movies, too.

We're crazy for symbolism. We want our actors to *represent* things, to be symbolical, rather than to be whole people. So—three Hamlets, each a facet of the whole man. Three who act as one person, speak one character's lines, who appear always together.

You will find that it all makes remarkably good sense, this facetizing of a character into aspects. You quickly become used to three voices for Hamlet, three for Polonius, and you soon get to know them individually, as contrasting aspects of the persons involved.

That it does make sense, of course, is due to some very expert tailoring of the actual speech patterns, dividing one text among three voices. The three actors speak sometimes together, sometimes singly, often in overlapping phrases, with chorus-like repetitions, fading out, fading in—and here is one of the oddest things about the whole production, particularly interesting to an audio man:—

The broken-up lines, for three people, use extensive echo and pre-echo, almost exactly as we hear them in faulty LP grooves and in tape print-through—and as we hear them every day deliberately produced, by tape feedback, for everything from cigarette commercials to tapsichord music. What could be more familiar, what more of the essence of *now*, than this echo-chorus! Here, it is used "live", purely vocally. A line is pre-echoed, faintly, before it is said aloud; or it is repeated, echo-style, dying away into the background as another voice picks up the foreground. Sheer audio mixing technique, without audio.

I assure you that the effect of this three-dimensional speech rhythm is fascinating. The new dramatic approach, the new intensity that it allows in the lines, is unforgettable. With this sort of speech counterpoint, who wants to go back to mere single sentences spoken by a single voice? Old fashioned, out of date.

Yes, I think I go along with the Baylor people. Youthful or no, this really is a NEW Hamlet, maybe the newest in 355 years, at that. I recommend it.

Poetry Readings in the Cellar. Cellar Jazz Quintet; Kenneth Rexwroth, Lawrence Ferlinghetti. **Fantasy 7002**

Maybe you saw the piece in Life mag about the San Francisco poets and the slightly "loony" renaissance of poetry and other arts in that lively city. Here is the sound you saw in the pictures, and it'll make your hair curl.

Kenneth Rexroth is a born rouser of fever-pitch emotions and he knows it. Dogmatic, sharp, fanatical, his rasping voice at first may make you smile a bit, at these odd-ball poets; but as the record continues and the violence grows ever more, you will stop smiling and begin to churn. When the side ends, chances are you will be furiously angry. I was. Say no more—judge it for yourself, but expect a very potent sort of shock treatment.

The other poet, Ferlinghetti, is a more pleasant personality and his intentions are to entertain as well as to satirize—his double-takes are acid, but mostly pretty sharp too. I didn't mind him a bit, nor did the Cellar audience. The Cellar is a night club, by the way.

The jazz improvisations are a good idea and, in fact, the whole business of combining this sort of music-making with poetry is an excellent and constructive experiment, worth trying many times again.

Cervantes (trans. Starkie): Don Quixote. Excerpts read by Walter Starkie. **Mentor 12-A 1**

This slightly forbidding-looking title covers one of the funniest and most unexpected "literary" records I've hit yet—Don Quixote wearing the Irish green.

Cervantes, of course, was Spanish. His famous satirical stories of the idealistic Don who chased windmills, assisted by his prosaic but faithful "squah" (squire), Sancho Panza—the Don tall and gawky, Sancho short and fat on a donkey—were a studied jibe at the prosaic modern world of the 16th century as compared to the flowering of gallantry and knighthood of the past. Hideous new pistols, gunpowder, these were the modern horrors that had killed the spirit of chivalry—or so the Don thinks. Cervantes leaves you wondering, as the Don's chivalry shatters the windmills and unhorses the knight himself!

All that was Spanish; but Walter Starkie, a long-time expert in Spanish culture, is from Dublin University. Mix a bit of the Irish with anything else and what do you get? That's what you have here. It is a beautifully done translation and a very exciting and utterly hilarious reading—straight out of Ireland. This man is a born reader-actor. He has a high, wiry voice and a positively fabulous mike personality, if unlike any you could have imagined. He is violently enthusiastic, he gets carried away by his own excitement and you will be swept along too.

But best of all is the Irishness. In the parts concerning the Don himself it is not so much in the speech as in the gusto, the lilt, the glitter of excitement and drama. Give an Irishman a stage, . . . The Sancho Panza episodes are something else, for there Mr. Starkie simply converts the good Sancho into a sheer 100 per cent Irish countryman, speech and all, and the same for his wife. Most of one whole record side, thus, is an argument between Sancho and Mrs. Sancho as to whether (when success comes and Sancho is made a Govern'r) Mrs. S. and progeny shall become grrand aristocracy. She holds out for the simple virtues; he fights for the grandiloquences, and the ensuing battle of words is about as Spanish as a Shamrock. Such a flow of eloquence!—and you'll soon forget that it all comes from one little Irish professor, expert in Spanish culture.

P.S. You won't find a better way to discover why old Cervantes is famous for his Don Quixote. Self-evident, in these Irish terms.

The Living Talmud—The Wisdom of the Fathers and its Classical Commentaries. Judah Goldin. **Mentor 12-A 2**

This could be meaningless for non-Jewish listeners, but it is far from it. On the contrary, though a bit more is taken for granted than most of us can understand (terms unexplained, for instance), the general exposition of the shape and significance of the great

* *780 Greenwich St., New York 14, N. Y.*

www.americanradiohistory.com

Linda Carillon Berry plays Old-Time favorites at her Player Piano. AFLP 1846

Exotic, tantalizing music from the mysterious and fascinating Middle East. Vol. 2 AFLP 1834

Memories of Bourbon Street and Famous Door from 1950–1955. Spontaneity Supreme! AFLP 1860

Christmas in Hi-Fi...

AUDIO FIDELITY RECORDS

TOTAL FREQUENCY RANGE RECORDINGS

The perfect gift for the high fidelity enthusiast any time of the year! These are not just records . . . each is a tremendous emotional experience!

*reg. app.

$5.95 each 12 inch LP

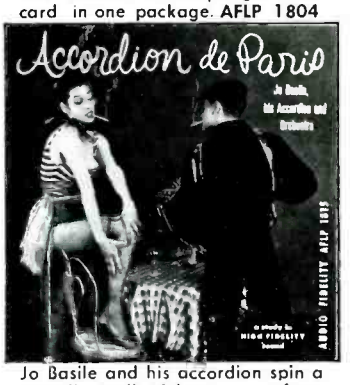
Listenable Latin tempos played by Pedro Garcia and the Del Prado Orchestra. AFLP 1841

Moon-drenched Cha Cha rhythms Pedro Garcia and the Del Prado Orchestra. AFLP 1837

Melodic handbells ring in the Yuletide season. A unique gift and card in one package. AFLP 1804

Traditional music of the Bullfight Ring. All new selections. Complete with four-color book. AFLP 1835

Sinuous, exotic Tango melodies Pedro Garcia and the Del Prado Orchestra. AFLP 1838



Jo Basile and his accordion spin a melodic spell of love . . . of romance . . . of Paris! AFLP 1815

Enchanting melodies of Rome as played by Jo Basile, his accordion and orchestra. AFLP 1822.

AUDIO FIDELITY, Inc., 770 Eleventh Ave., New York

www.americanradiohistory.com

pioneer

TWEETERS

help to give you real

PRESENCE!

with frequency range extending up to 16,000 cps

PT-1

(CONE TYPE)

Popular type tweeter. Covers 3,000 to 16,000 cps without peaks or dips. Driven impedance, 8 or 16 ohms; power input, 20 watts.

PT-1C

(CONE TYPE WITH SIMPLE NETWORK)

A simple dividing network that is matched to the optimum crossover frequency is built in the unit. Covers 1,000 to 16,000 cps; power input, 15 watts; impedance, 8 or 16 ohms.

PT-2

(HORN TWEETER)

PT-2 is the horn type tweeter designed for use in two or three way system. The moving coil is wound with aluminum wire in order to improve the response. Frequency range, 2,200 to 16,000 cps; power input, 20 watts above 4,000 cps; impedance, 8 or 16 ohms.

PT-3

(RECTANGULAR HORN TWEETER)

By adoption of a rectangular horn, the dispersion characteristics are extremely good. Frequency range, 1,700 to 16,000 cps; power input, 20 watts above 2,800 cps; impedance, 8 or 16 ohms.

Write for catalog to:

5 Otowacho 6-chome, Bunkyo-ku, Tokyo

FUKUIN ELECTRIC

collection of commentary on basic pronouncements of classic Hebrew wisdom is most interesting. For the first time, I suspect, this will bring to some of us a sense of the immense importance and living force of this curious tradition—where for thousands of years, scholars have pored over the meaning of every phrase of the ancient fathers' maxims—and pored over each word and phrase of the later interpretations, slowly adding more and more to the mass.

The selected passages are from Judah Goldin's own new translation. They are given together with a very interesting look at the Hebrew language, as of biblical times and as of a thousand years later in the times of the commentary—especially interesting in view of the present-day rebirth of Hebrew as a still-growing language. The reverse side has the same passages read in the original Hebrew, and though I did not understand more than a couple of words here and there (from singing various Hebrew musical works), I listened to the very end and found the language beautiful to hear, just as sound.

Dr. Watson, Meet Sherlock Holmes; The Final Problem. (A. Conan Doyle). Sir John Gielgud, Sir Ralph Richardson, Orson Welles, et al. **London LL 1568.**

Capital good entertainment . . . and yet, somehow not as capital as I had expected. If you are like me, the very first words of these dramatizations will conjure up dozens and dozens of Sherlock Holmes shows, extending as serials back into the dim distant past as far as you can remember—for who hasn't heard (or seen) Holmes and Watson on the radio, TV, stage, or films? This will sound like a new episode in an endless series. Be sure to listen again next week, same time same station . . . but, of course, it isn't a serial; it's a record.

Here we have an all-star cast, two main actors with Sirs on their handles, plus the inevitable villain, Orson Welles. Good, and yet I found the whole thing rather ponderous, almost a bit sententious, the audible staging a trace on the amateur side. Could it be that our own eternal Holmes on the radio moved faster, more lightly, with more excitement and an easier sense of detective drama? I think so.

This version is terribly British and oddly dated. The emphasis is not so much on the plot—which is ageless—as on the British amenities, the well-bred British restraint and sense for what is good taste and proper manners. Especially in a tight spot. Never raise the voice, what-ho, always display the perfect *sang-froid!* Just listen to Holmes and Moriarty (villain) arguing ever so politely on the brink of a ghastly cataract, into which Holmes shortly will be deposited!

Not that this isn't in the original. It is, and it is both very British and very Victorian. Our blood-and-thunder stuff today is pitched on a screaming emotional plane, in comparison. When our characters are in desperate straits, they show it; they yell, or spit gravel words, or shoot their way out. Not Holmes—not Dr. Watson!

Now this can be made dramatic today, as it always has been. I miss the drama in this recording. Perhaps it is because these actors take the Holmes-Watson characters so literally (and so much for granted) that their dramatic force is lost on us. We don't take that sort of thing for granted any more.

And as for Holmes' famous violin, he (Campoli) plays one silly little piece, unctuously, so many times over and over that I could have wrung the idiot's neck. My dear Holmes, not *that*—again?

No, this isn't first rate Holmesiana.

2. CLASSIC

Stravinsky: Firebird Suite.
Tchaikowsky: Romeo and Juliet. N. Y. Philharmonic, Bernstein.
Columbia ML 5182.

Leonard Bernstein is now co-conductor of this famous orchestra and as such he is more or less bound to perform the major works of the standard repertory, though his strong point is always the modern, in its every aspect. These two playings have fine recorded sound and a very respectable and well thought out pair of interpretations.

It's odd that Bernstein plugs the old-fashioned, Romantic aspect of the Firebird music, rather than the modern side of it—as does old Pierre Monteux in his RCA reading. Perhaps it is that Monteux, who was around for the premiere, still feels the revolutionary impact of Firebird, (as of 1910), whereas Bernstein, of a later generation, hears it primarily as an old-fashioned, youthful piece by a major modern composer. Interesting.

As for Romeo and Juliet, the ultra-poetic 1870 music just isn't for our day and our orchestras; with the best will, they simply cannot put into it the passionate excitement, the marvellous sense for poignant detail that, for instance, Willem Mengelberg got out of the score many years ago. To be fair to Bernstein, his version sounds less forced, more natural, more genuine than any modern one I've lately heard. It's good, and won't likely be better played anywhere else.

Schubert: Rosamunde; Serenade, Op. 135; Psalm #23, Op. 132. Diana Eustrati, alto, Berlin Motet Choir, Berlin Philharmonic, Fritz Lehmann. **Decca DXB 144 (2)**

Here is another complete version of the various pieces that made up the rather extensive incidental music to the play, Rosamunde, plus the earlier overture that was thrown in, the Magic Harp, and two lovely choral pieces for women's voices and piano.

This Rosamunde is big and Brahms-like and, thus, both highly expressive and somewhat anachronistic. Schubert was not Brahms and not a late-Romantic composer, though undeniably his music was on the way, in many respects, towards that heavier, thicker kind of Romantic expression. Thus in this version the tempi tend to be rather heavy, the more serious passages taken with tremendous portentousness; the sighs and pantings are done to a turn and there is much high-Romantic swelling and dying away; the orchestra sounds enormous.

Now this contrasts nicely with the Westminster version of "Rosamunde" (XWN 18483)—which also includes the superb vocal numbers—in that the Westminster version under the American Dean Dixon is rather on the formal, precise side, with a certain stiffness to it, and no big-Romantic sweep at all. Yet the Dixon reading, done by Viennese performers, is closer to the right feeling for this early-Romantic music, even if not as musically set forth as this one.

Romantic or no, the chorus and solo parts in this new Decca version are lovely. The Berlin Motet Choir is splendidly plastic and expressive, both in the "Rosamunde" numbers and in the two exquisite choruses for women's voices and piano. Diana Eustrati is the excellent alto solo in the recording.

Note that most versions of the "Rosamunde Incidental Music" include only the orchestral sections, leaving out the vocal numbers, which are decidedly not to be missed and perhaps the best music in the collection.

Beethoven: Piano Sonata #17 ("The Tempest"*) Chopin: Three Etudes; Mazurka Op. 17, #4; Scherzo Op. 39. Dorothy Eustis, pf. **Alta 1001**

This disc is put forth first of all as a technical feat of piano recording, pressed on Microfusion and recorded without dynamic range limitation. As such it will please hi-fi fans and those interested in recording problems, for it is in fact remarkably free from distortions and does appear to cover the whole dynamic range without too much loss in the soft parts. I would say that the potentially superior faithfulness of Microfusion pressing is fairly well put into practice.

As to the miking—it is not especially effective; for my ear the piano is too far away, somewhat thin, the sound a bit amateurish, like many a recording made in the home. Probably it is in fact a faithful job—it's just that we are now accustomed to hepped-up piano sound and, in fact, require it for the recorded medium. I am not one to favor literal realism when recorded trickery can get the musical power over better.

www.americanradiohistory.com

Miss Eustis is an excellent pianist—thanks be. Too many such technical experiments involve poor musical performance! No complaint, except for one odd instrumental mannerism: in the recitative-like passages in the Beethoven, of a sort very common in his music (the Ninth Symphony, for instance), she pedals the notes together into a big blur, which is disturbing to anyone who associates recitative, as Beethoven surely did, with the declaiming of sung works by a solo voice. A minor item, if interesting.

Schumann: Dichterliebe, Op. 48. Brahms: Six Songs. Dietrich Fischer-Dieskau, bar. Jörg Demus, pf. **Decca DL 9930**

The German Lied is a world to itself, with its own peculiar laws of intepretation—as peculiar, shall we say, as our own jazz and popular music. These are middle and late Romantic songs, and they are of the sort that can be interpreted with an enormously wide variation in the actual, physical sounds produced—for there is no set key, no fixed pitch (they can be transposed at will), and no special voice designated. Yet the boundaries of this great freedom are surprisingly strict, when you come down to it.

Fischer-Dieskau is the prize *lied* singer of the German younger generation and he shows it well enough. Yet his singing is curiously unlike that of older Germans in the tradition, both male and female. He sings with the intense diction that is a part of this kind of music—practically spitting at you—and is so often missed by American, French or English singers. He "emotes," acts, as one definitely must in German song. (But not in American or English folk song, to cite an opposite example.) But his whole delivery and approach has a more formal aspect to it, an almost classical fervor, that is utterly unlike, say, Lotte Lehmann.

Another oddity is that, in this day of mike technique and the even-voiced crooner Fischer-Dieskau is much given to loud and soft extremes of volume in his singing. No doubt this has grown the German engineers a few gray hairs, but they have managed to capture his peaks and his valleys without distress and so all is well—except that you will not find this good background music; it requires constant and careful listening!

But then—so does all singing of the sort. The German *lied* was never meant to be crooned to low conversation.

Excellent piano cooperation from the young Demus, who hits the Fisher-Dieskau stride to perfection.

Brahms: Sonatas #2, Op. 100; #3, Op. 108. Mischa Elman, vl., Jos. Seiger, pf. **London LL 1630**

Here is a highly worthwhile record for all of us who relish a certain continuity with the past in this fine day of lighting-speed change. Mischa Elman is a great violinist of another day and another musical era, hardly after that of Brahms himself: Elman made his debut in 1904. He brings to these works a flavor, a technique, a brace of mannerisms, that though they may startle some of us young'uns, though they are not those of a youthful player, still have an authenticity that comes forth in the listening and makes Brahms a bigger man than he might otherwise seem to the modern age.

Even the recording is a bit old-fashioned—the prominent violin and the slightly pushed-back piano "accompaniment," just as the music would have been recorded in Elman's heyday! We are treated to a real close-up of him and he comes off remarkably well for a veteran of more than fifty years on the concert stage. Only a slight "shortness of breath" in his bow arm, an occasional inaccuracy, betray this long experience; most of the music is strongly and well played. But the style—it is full of those once-beloved slides, slithers, hesitations, now schewed by the model violinist as old fashioned but played wholly naturally and out of habit here. Good, for these things come out of Brahms' own time and suit the music. But there is also a not-so good lack of long line, a way of pushing each note at the expense of the whole melody, which doesn't help Brahms much, even if it was rather

PILOT

and only

PILOT

offers you peak performance in high fidelity at low cost

TUNERS

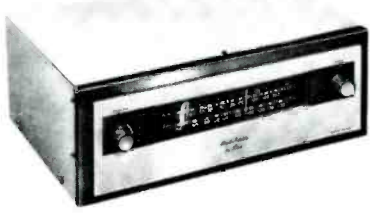
Traditional Pilot engineering and quality assure optimum performance. All Pilot tuners feature *Beacon* tuning for precise station selection. All Pilot tuners are also fully shielded to conform with FCC radiation specifications.

FA-550 FM-AM

Has tuned RF stage and dual cascade limiter-discriminator FM circuit for maximum sensitivity; — perfect quieting even with fringe signals; AFC with disabling switch; 10 KC filter for AM; flywheel tuning; built-in FM and AM antennas. Features preamp-audio control with five input channels; hum-free DC on tube heaters; tape head and phono inputs with separate equalization; bass and treble controls; separate cathode follower outputs for tape recorder and power amplifier. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 14½"w x 10¼"d.

$159.50 Complete

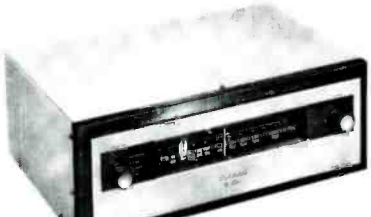


FA-540 FM-AM

Has tuned RF stage for high sensitivity — perfect quieting even with fringe signals; AFC with disabling switch 10KC filter for AM; cathode follower output; phono and auxiliary inputs; flywheel tuning; built-in FM and AM antennas. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 13"w x 8¾"d.

$109.50 Complete



FM-530 FM Only

Has tuned RF stage for high sensitivity — perfect quieting even with fringe signals; AFC with disabling switch; cathode follower output; phono and auxiliary inputs; flywheel tuning; built-in antenna. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 13"w x 8¼"d.

$89.50 Complete

Make your own performance test of these tuners at your Pilot dealer.
For complete specifications, write to Dept. AV-10

Prices slightly higher west of Rockies.

Pilot RADIO CORP., 37-06 36th St., Long Island City 1, N. Y.

Over 38 years leadership in electronics.

www.americanradiohistory.com

typical of his day. In this instance, today's long-phrased, organ-like violin playing is better for the Brahms melodies. Elam is all breath, all quiver, all for the long-haired moment.

As a matter of fact, it should be quickly added that, in this music for two equal partners, the pianist, Joseph Sieger (or is it Seiger, as on the cover?) does a perfectly tremendous job. If it weren't for his strong, passionate piano, Elman would indeed sound tired and elderly. Sieger is one of the best Brahms pianists I've heard and it is a shame that he is placed even slightly in the background in this recording, in favor of the bigger name. Pianists who tackle Brahms would do well to listen to his leadership here, in this increasingly difficult music.

Marcel Dupré Plays Mozart and Bach. Covaillé-Coll organ, Saint-Sulpice, Paris. **Overtone 14**

Here's a splendid example of a vanishing breed of organ and of organ player, for that matter. We hear of three types of pipe organ today; the "Mighty Wurlitzer" theatre organ, the so-called Classic or Baroque organ, small, with sharp, shrill tone colors after the great organ builders of the 17th century, and finally, the huge, monstrous noise-maker organ of 19th century France, ancestor of most of our local organs large and small—those that haven't yet been rebuilt to the Baroque style.

This is the French organ at its best. Its worst, in a thousand muddy, blurred examples, is pretty bad and you can blame most organ roaring and ranting upon the French school, indirectly. But good French organ—that's another matter.

Marcel Dupré, of the old school, plays this 1862 organ with real grace and musical sense, always tailoring his tempo to the echo so that confusion is avoided, using some lovely stops of a sort we wouldn't have thought available on this type of reverberant monster. He plays some splendid music, too, a pair of very late and movingly expressive Mozart pieces, incongrously composed for a mechanical organ, plus one of the biggest and broadest of Bach Preludes and Fugues, the "St. Anne" in E Flat.

If you like this, there's another, all Bach (Overtone 13). Overtone Records, 139 Shelton Ave., New Haven 11, Conn.

Pierre Cochereau in an Organ Recital at Symphony Hall, Boston. (King of Instruments, Vol XII.) **Aeolian Skinner**

The first of this notable series from a major organ company was the description and explanation of organ tone by the late G. Donald Harrison, illustrated with organ excerpts; the succeeding volumes were of more interest to professional organists than to the general music listener. This one would be the same, except for one very interesting facet—M. Cochereau, a brilliant young French organist, here *improvises* an entire symphony on the spot, from three themes given him just before the recording.

Now this is an impressive accomplishment, though I suggest not as impressive as most of us might think. Improvising, for those who have practiced it, is not so very mysterious nor does it require superhuman powers. That is, unless you improvise as Bach or Beethoven did, tremendous works or highly organized structure. We ought to remember that improvising in the jazz or popular idiom is with us right and left. You can't play jazz at all without some ability to go it on your own, within a given stated framework. Ask any high school jazz player or popular beginner.

Moreover, an organ is a wonderful tool with which to make impressive noises. You can roar and rant, shimmer and shake, bellow forth great pedal points and glittering jewel-traceries and it can be mostly bluff. The organ's reverberation covers a lot of sins for the casual ear and if you get stuck, you can always hold onto what you have—the organ never runs out of breath!

The Cochereau symphony, in four movements, is thus a brilliant job and convincing, especially as to rhythm and color—he keeps the ball rolling very nicely. But it is diffuse and thin, it doesn't go far beyond the safe things that can be done effectively. Why should it?

Why? Only because this particular improvisation is down for posterity, if posterity happens to have 60-cps a.c. and a record player. And so, like recorded jazz, it's in a way to being permanent music.

But where jazz improvisation is tied down to a solid framework of background harmony or melody and so can soar, this piece is on the loose—and it is loose, though in no case ineptly so. As I say, it's merely a bit diffuse, full of tone colors and rhythms signifying not a great deal. Pleasantly impressive listening and the great Symphony Hall organ never sounded better.

3. GADGETIZING

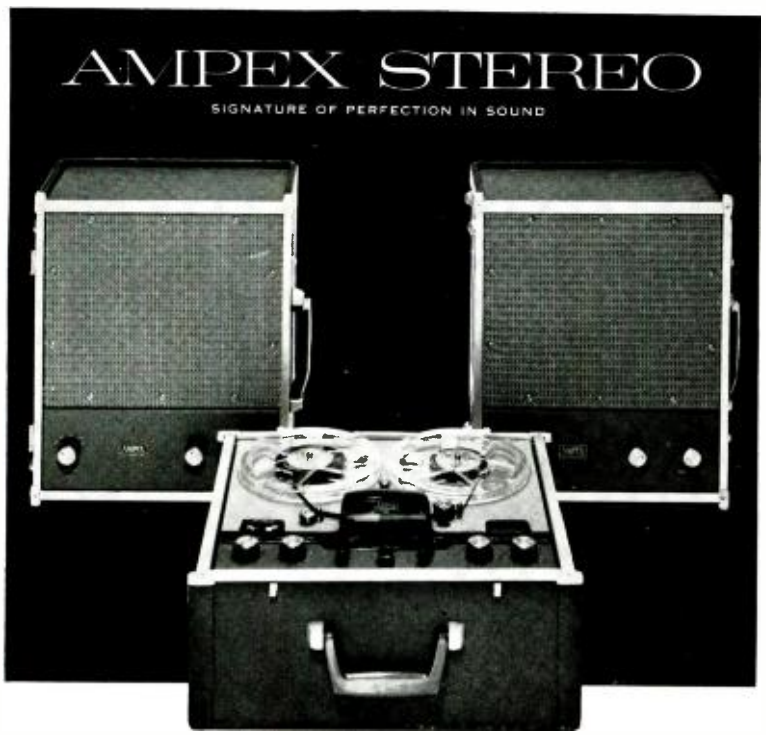
Why Hi-Fi? A Narrative Adventure Through High Fidelity. Barbara Cameron, Steve Palmer. . . . **Consultant CR 102**

This was a gimmick disc passed out at the Hi-Fi shows this year and might not warrant a mention, except that in ways it isn't half bad, considering.

Considering that the whole presentation fairly reeks with opportunism, as of the Shows, and considering that the disc itself is atrociously pressed—my copy is both off-center and badly warped. It wows unmercifully. Good tracking test for your pickup, anyhow.

We hear an informal discussion among three people, the explaining engineer and his two pupil-friends, a man and a girl, guests for the evening in his hi-fi living room. Considering how stilted and dogmatic such recorded explanations often are, these three speak with rare informality. They talk like human beings, most of the time—though sometimes the script gets too cute to be carried off.

There are frequent musical examples, well intended but not very well chosen for effect. The record wow messes them up in my copy. Even so, their intended points do get over. A tweeter tweets, a woofer woofs, bad needles



An audio system is like a chain. For optimum performance, all the links must be equally strong . . . there can be no compromise with "weak-link" components in the system.

It was on this premise that the Ampex A122-SP Portoble Stereophonic System was designed. Each link in the choin — from recording ond playback heads to speaker — was forged to the same exacting standards and precision tolerances which guide the manufacture of world-famous Ampex professional recording and playback equipment.

Heads — Facing surfaces of head gaps lapped to an optical flatness so precise they reflect a single light band (1/3 micron) on flatness gage. This, plus initial surface polish of 6-8 micro-inches, insures sustained frequency response with negligible change in characteristics over many thousands of hours of operation — many times longer than with ordinary heads.

Amplifier-Speakers — Ampex-designed, Ampex-built as an integral part of system . . . yet may be used separately with other units of your system (has front-panel input switching for Tape, Tuner, TV, or Phono). Amplifier sensitivity 0.25 v for maximum power output; 20-20,000 cps ± ½ db output with well under 1% harmonic distortion. Speaker features unusually high total gap energy, converts a maximum of output power into sound energy, with smooth, peak-free response.

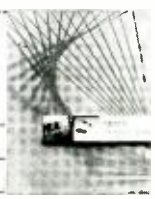
Complete Specifications — Write today for free new full-color brochure containing complete specification sheet and description of full line of unmounted units, consoles, modular table-tops and portables.

AMPEX AUDIO, INC.
1036 KIFER ROAD,
SUNNYVALE, CALIFORNIA
Please send free color brochure to:

NAME

ADDRESS

CITY



www.americanradiohistory.com

distort and good ones don't, ancient phonographs screech and new hi-fi sounds blare.

You won't find deep or thorough explanations here and matters of controversy or opinion are carefully avoided. But basic ideas are got over, the difference between component and one-piece hi-fi is made quite clear (no preference expressed, of course) and in the end the listener will have soaked up a beginning, at least, of the hi-fi point of view.

As I say, not bad under the circumstances and you can safely give this to your Aunt Minnie for Xmas if she's not too intellectual.

(Note: I can't figure out who the third character might be. Credits on the jacket seem to give only two names, as above.)

Sounds of Steam Railroading.
O. Winston Link Railway Prods.
(58 E. 34th St. New York 16, N.Y.

I don't have the classic in this field, Cook's famous Rail Dynamics, to compare with this one, but I must commend the promoters of this specialty for a good job, in their special lingo.

That is—if you don't mind listening to trains and trains and more trains, if it thrills you rather than inducing yawns, then this is you disc. Hi-fi quality—yes. Let's take that for granted, with hydrofeed latheing of high quality original tapes. Moreover, the author takes photographs as well, usually simultaneously with the recordings, and they're good ones.

Special feature, aside from good sound, is long-term continuity. Each episode is continued for as long as there is anything to hear; trains that roar past small-town crossings are preceded by minutes of local audible scenery, people talking and laughing, children and dogs, crickets. Sets the mood beautifully. This is a technique first exploited on discs by Cook and to great advantage—it is as good here.

The R.R. is the last steam outfit in operation in this country, the Norfolk and Western. If you've got steam enginitis, better rush right down there and get your tape recorder to work. Or buy this.

N.B. Next issue, Mr. Link, let's have a real booklet of those superb pictures of yours. Worth extra cash.

The American Scene. A Concert of American Band Music. Band of Her Majesty's Welsh Guards. Vox VX 25.280

What's this—a bit o' competition? Not quite, since the Welsh outfit plays our music while the Highland Scots play their own.

Aside from the slight oddity of a Welsh band playing an all-American program, this one comes off very nicely, though the program isn't my dish of Postum. It tends towards some fairly fancy stuff, ranging from semi-historical evocations (Kentucky 1800) to a definite touch of the Rhumba and the Polka, of all things. (Of all things for her Majesty's Guards to play. . . .)

Band lovers will find it interesting to sense the definite but not so easily pinned down difference in playing style between these furriners and our own bands at home, in our music. A certain more fruity, mellow quality, perhaps; a sweetness and softness in contrast to our perky precision and snap . . . well, let's leave it to the U.S. bandsmen to figure that one out.

Prokofieff: Peter and the Wolf.
Saint-Saëns: Carnival of the Animals, Garry Moore, narrator; Philharmonic Symph. of London, Rodzinski; Vienna State Opera Orch., Scherchen. Assorted animal sounds. Westminster XWN 18525

This double concoction may amuse you for awhile and the musical part is well played in both works, but as an ensemble job, via tape editing, it tends towards the incongruous and tasteless, what with animal recordings, verses and Garry Moore.

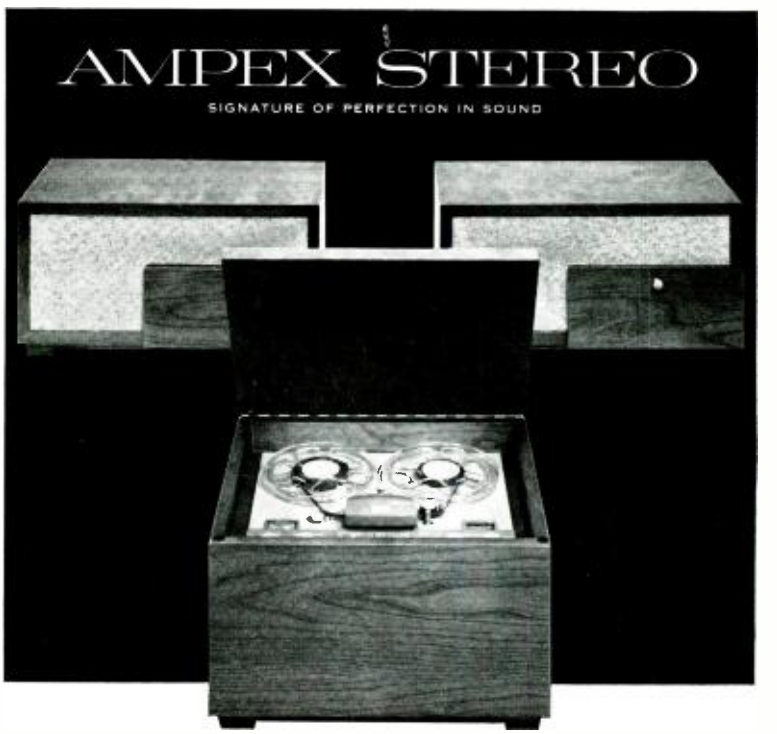
Mr. Moore's contribution is a goodly dose of his dry, slightly bored personality, very modern, quite the expected and, as far as my ear is concerned, not very sympathetic to either work. "Peter" has come a long way from its earlier recorded versions, beginning with the quavery, once-upon-a-time tones of Richard Hale with the Boston Symphony in the Thirties, through Basil Rathbone, Brandon De Wilde, and Arthur Godfrey. Everybody, it seems, gets to "Peter" sooner or later. This one is pretty blasé. "Look out," says Garry in matter-of-fact tones as the wolf grabs for the little bird, where other readers have always shouted "LOOK OUT!!." It's all that way—just a bit on the tired side.

M. Saint-Saëns' little Carnival is very imaginatively played by the Viennese orchestra under Scherchen and by the two pianists, Josef and Grete Dichler. But the final assembly of the other elements makes a pretty sad hodge-podge of the affair.

This time, Garry is assisted, first, by actual animal sounds recorded at the zoo and, second, by a set of inane verses, openly influenced by the famous lines of Ogden Nash (which probably weren't available) and not worth a line of them. If you ever thought Nash was corny, just try these for size. Not only corny but mostly irrelevant and in the way.

Anybody ought to know, too, that it is highly unwise to match up musical imitations of natural sounds with the sounds themselves. It either kills the music—or makes the sounds themselves seem unreal. That's what happens here, mostly. What a hideous hose-like squeal a real elephant makes—and how odious to put this brutal noise before the stately and imaginative elephant music in the Saint-Saëns! It is lucky that a few of these sounds are reasonably unobtrusive or the record would be a real bust. The birds and the donkeys actually blend with the musical imitations well enough not to hurt. (Must have taken a whale of a lot of work to get the effect.)

The Saint-Saëns musical satire—Berlioz, Mendelssohn, Offenbach themes grotesquely and wonderfully distorted—'s of course entirely put aside in this zoo-ish preoccupation. I'm sure even kids would be more interested if a record were done pointing out these genuine aspects of the piece and by-passing the real, live animals. They belong in the zoo, please, not the concert hall. **Æ**



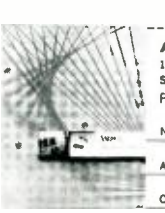
Recorder-Stereophonic Reproducer — Two-speed, precision-built tape transport, capable of playing over 4 hours from a single 7" reel of tape; sustained frequency response 30-16,000 cps (7½ ips), with dynamic range over 55 db; Flutter and wow under 0.25% rms at 7½ ips; Precision timing accuracy affords perfection of pitch held to tolerances of less than ⅓ of a half tone at highest frequencies.

Amplifier-Speakers — Electronically and acoustically matched for optimum reproduction of stereo and monaural sound. These units deliver more undistorted sound per watt than the great majority of 12" and 15" speakers ovoilable today. Environmental inverse feedback from speaker voice coil circuit to cathode of first amplifier stage affords improved damping, lower distortion. Tilt-out push-button control panel for selecting input (Tape, TV, Tuner, or Phono); bass, treble and volume controls.

Complete Specifications—Information on the units shown above, plus consoles, portables, and unmounted units, available in free new full-color brochure.

Here is a stereo system you'll be as proud to show as you will to operate. The Ampex A121-SC Modular home music system was designed to satisfy not only the needs of the audio perfectionist, but also the increasing desire for a system that is as pleasing to the eyes as it is to the ears.

The A121-SC is an *integrated* system, and though any of the individual units can be incorporated smoothly into your own system, the combination of the three provides a level of performance not possible to achieve by any other means.



AMPEX AUDIO, INC.
1036 KIFER ROAD,
SUNNYVALE, CALIFORNIA
Please send free color brochure to:

NAME

ADDRESS

CITY

www.americanradiohistory.com

for
LOWEST
hum...noise...
microphonics
in a high-μ dual triode . . . .

the
Amperex®
ECC83 A PLUG-IN
REPLACEMENT FOR THE **12AX7**

MICROPHONICS:

Negligible in amplifiers requiring an input voltage of at least 50 mv for an output of 5 watts. No special precautions against microphonics necessary even though the tube is mounted in the near vicinity of a loudspeaker with 5% acoustical efficiency.

HUM AND NOISE LEVEL:

Better than —60 db relative to 50 mv when the grid circuit impedance is no greater than 0.5 megohms (at 60 cps), the center tap of the heater is grounded and the cathode resistor is by-passed by a capacitor of at least 100 mfd.

OTHER **Amperex TUBES** FOR HIGH-FIDELITY AUDIO APPLICATIONS:

EL84/6BQ5	9-pin power pentode; 17 W PP
6CA7/EL34	High-power pentode; 100 W PP
EF86/6267	Low-noise high-μ pentode
ECC81/12AT7	Low-noise medium-μ dual triode
ECC82/12AU7	Low-noise low-μ dual triode
ECC85/6AQ8	High-μ dual triode for FM tuners
GZ34/5AR4	Cathode-type rectifier; 250 ma.
EZ80/6V4	9-pin rectifier; cathode; 90 ma.
EZ81/6CA4	9-pin rectifier; cathode; 150 ma.

At All Leading Electronic Parts Distributors

Amperex
ELECTRONIC CORP.
230 Duffy Ave., Hicksville, Long Island, N.Y.

AUDIO ETC.

Edward Tatnall Canby

Three-Way Stereo—The Center Carrier II

EVER OPTIMISTIC, I originally had planned to get to the gist of the argument involved in this series before the end of the last installment; but space didn't allow us to progress from Two-way to Three and I left you all high and dry (I hope), just crazy to know how I was going to explain the phenomenon of three apparent tracks from two real ones, as per much recent stereo reproduction.

Having in the November issue gone into the ways of two-track stereo—farsighted and nearsighted—and into the Number One Stereo Plague, doubling of the image, I hereby continue with the tricks of the ear that can make you think you are hearing three tracks out of two speakers.

The Monaural Middle

I mentioned that there were several ways to use the three-channel type of recording. Here is what seems to me to be the idea behind Mercury's excellent and, indeed, unique two-channel commercial stereo tapes, that do not quite sound like anybody else's I've heard so far. Specifically, they sound like three-channel tapes, with much close-up "fi" yet astonishingly little doubling, where you would most expect it in ordinary two-channel recording.

Am I suggesting that with a three-channel original, you can make a two-channel tape sound *literally* like a three-channel one? I am. As I figure it out, you actually hear that third channel, along with the other two. What's more, it is specifically heard in the middle, not at the sides. The side speakers act as joint carriers for the middle channel.

Look at it this way. Suppose you were to play a single (monaural) channel through two speaker systems, spaced apart on either side of you. What would be the effect?

Common enough. You can get it by playing any stereo tape with the machine in the SINGLE or MONAURAL position, where one track is fed to both speakers. You hear the sound precisely in the middle, centered exactly between the two speakers. (That is, if your speakers are phased correctly. If the phasing is reversed, you hear severe doubling, the sound comes from the two speakers individually, and there is a sharp division in the middle. Assume, however, correct phasing.)

One track through two speakers (rightly phased) and you do *not* hear doubling. All the sound is in the middle. In fact, it has a curious way of pushing forward, almost out in front of the two speakers.

This is one of the odd effects you may have noticed in switching a good two-track stereo tape from stereo to the monaural position with one of the tracks in both speakers. On "monaural," the sound seems to narrow, and to move in and forward; it concentrates in a smaller space, straight between the speakers; it seems to come closer, to be deader and more confined. Switch over to stereo playing, and your sound suddenly widens, broadens, and jumps away, further back. The whole perspective is bigger.

A good stereo sound doesn't jump too far—the middle isn't broken, though it is stretched out, so to speak. A poor stereo splits straight down the center and the sound leaps aside into the two speakers, leaving a hole.

Switch back to "monaural," and it leaps forward again into the center.

Now—and perhaps you already see my reasoning—why not use this monaural centering effect along with the stereo sidewise spreading? Why not use "monaural" and "stereo" simultaneously? Why not put two stereo tracks on the outside and a *third track in the center, monaural-style?* All you have to do is to feed a single ("monaural") track equally to both speakers and you'll hear it reproduced exactly in the middle.

What single track? Well, of course, the middle track in a three-track stereo master. If you fed it *alone* to your two speakers, dividing it in half, you would hear the sound directly between them. The same thing will happen if you feed it along with the other two channels, mixing it into each of the side channels. A sort of carrier system.

Now you may doubt this at first. How can you mix two recordings into one channel? But just think a moment. The best feature of sound vibration is that it can carry any number of "separate" messages, separate wave forms, and the ear can sort them out and hear them simultaneously. There's every reason to anticipate, then, that your ears can hear a left channel, a right channel and a third channel recorded in both, without any interference at all. No different than hearing a multi-mike pickup in standard reproduction.

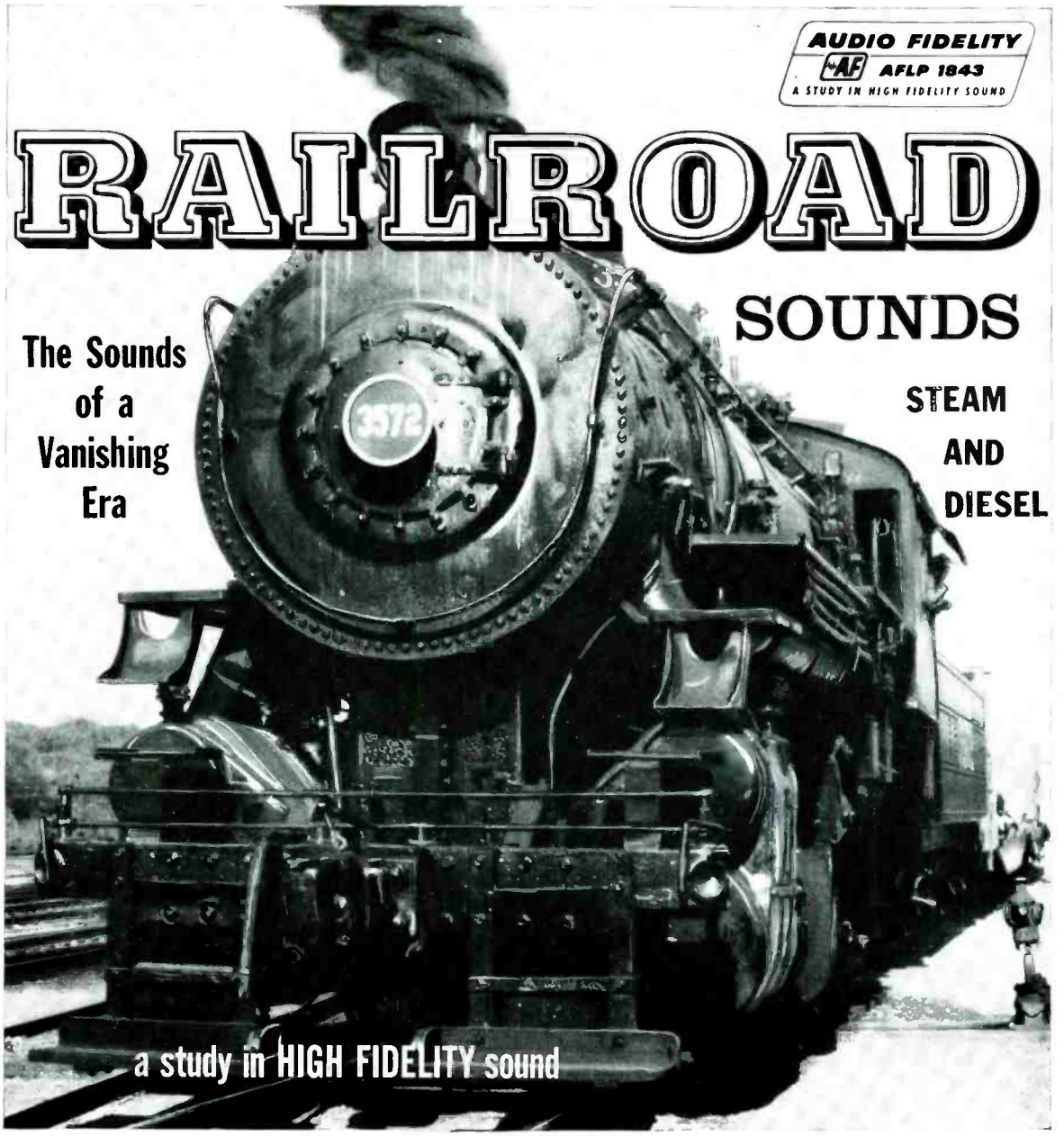
And we can lay out the theoretical "Mercury" carrier technique, as I figure it to operate. Three stereo tracks, A, B, C. Divide the middle track, B, feeding it equally to the outside tracks as though it were a "monaural" signal going to two loudspeakers. Release the result of this in a two-track stereo recording.

When you play it at home—

Track A is heard through the left speaker to the left of your listening position.

Track C is heard through the right

www.americanradiohistory.com

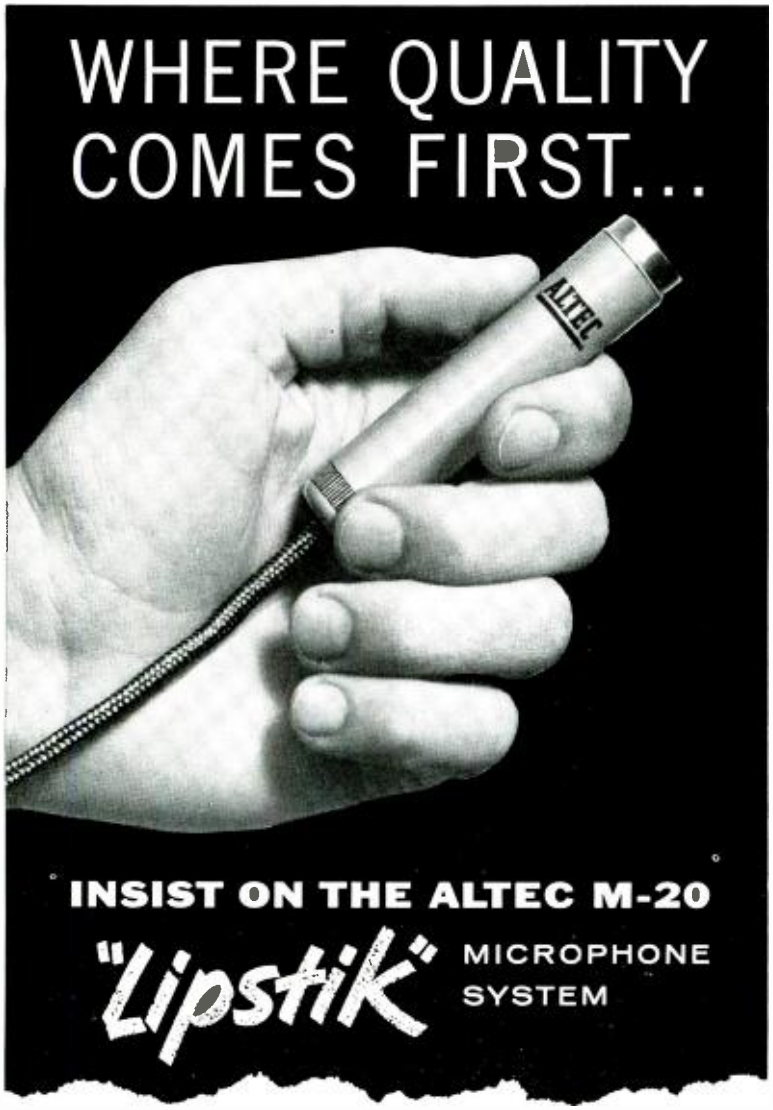


Steam engines . . . Diesel engines . . . huge black monsters shuddering under loads of coal and compressed steam . . . lumbering masses of iron and steel that make the ground tremble as they churn around curves . . . giants whose wailing whistles and deep-throated horns echo through silent country-sides . . . these are the sounds of a vanishing era . . . sounds that become dimmer and dimmer as the sounds of a new and greater power age grow louder with every passing day. Here, captured with earth-shaking dynamism, in magnificent high fidelity, are the romantic, nostalgic sounds of the railroad . . . truly sounds of a vanishing era!

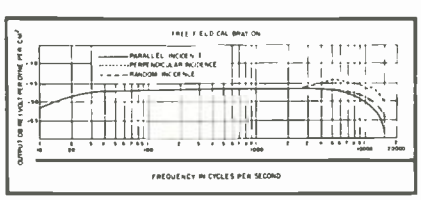
AF AUDIO FIDELITY INC.
770 ELEVENTH AVENUE · NEW YORK 19, N. Y. · CIRCLE 7-5533

AFLP 1843 — $5.95

www.americanradiohistory.com



IN CRITICAL HIGH FIDELITY recording and broadcast installations where highest quality is a "must," there is no substitute for the Altec Lansing M-20 microphone system. Only the M-20 "Lipstik" microphone combines highest fidelity with the compact size of a lady's lipstick. The proved quality of this system is also indicated by its wide acceptance for laboratory acoustical measurements, and for medical and scientific uses which demand the highest quality microphone on the market.



- 10 to 15,000 cps frequency response
- 3⅛" long; 0.6" diameter
- microphone, base, cable and connector weigh only 5 ounces
- printed circuit between tube socket and microphone cord to minimize wiring and facilitate tube replacement
- omnidirectional; ideal for television broadcast, interviews
- M-20 system includes mircophone holder, pocket clip, and power supply

A SOUND REPUTATION SECOND TO NONE

ALTEC LANSING CORPORATION

Distributed by Ctayton

Dept. AJ12
1515 S. Manchester Blvd., Anaheim, Calif.
161 Sixth Ave., New York 13, N.Y.

speaker, to the right of your listening position.

Track B is heard "monaurally" through both speakers and *therefore centers itself exactly between the speakers—where it belongs.*

That means that you really are hearing three separate, distinct stereo tracks, in their proper relation, via two channels.

This, if I am right, is what Mercury is now doing in its Living Presence stereo tapes, from three-channel originals. There are other three-track users and I don't imply that they aren't doing similar things. I single out Mercury here because, it seems to me, Mercury is now exploiting this particular "carrier" technique to its full implication, taking advantage of the third track quite literally, as though it actually were available in the home. Funny thing is—it is.

Thus you will note that the Mercury tapes are made surprisingly close to the big orchestra, with a sharper, drier sound than in the "farsighted" type of two-channel tape. Instruments all the way across the orchestra seem to be close-up, in the hi-fi manner, and yet there is not the expected doubling at the sides. The reason must be that the middle-area close-up sounds come from that third track, in the middle, and are now heard in the middle via the "monaural" use of both speakers.

If the third track is heard selectively by you just where you want it in space, does it matter how it gets there? I guarantee you, it *is* there! The proof of this pudding is in the hearing.

The Blimp-like Virtuoso

It remains to point out another and quite different use for the center channel in three-channel master recording. Again, this one overlaps the other, but we can afford to look at it as a separate principle.

One of the biggest problems in stereo is the big-name solo performer with orchestra. Why? You ask. Just put him on the stage and let him play; if your tape is good, he'll be just where he ought to be in a real concert, on the stage in front of the orchestra, somewhere near the center.

True, there are plenty of soloists who do, indeed, appear quite naturally in stereo in a simple and effective stage-relationship with the orchestra as a whole. One of the finest I've heard is the pianist in Rolf Liebermann's Concerto for Jazz Band and Symphony Orchestra, on RCA Victor ECS 3. He plays over to the left side of the stage, in the orchestra, and you won't ever find a more natural and realistic piano.

But he's not a big name artist.

It's all very well to put a piano, or a solo violin or a trumpet solo, right on the stage with an orchestra, and it works to perfection. But what'll you do if you are RCA and you have Arthur Rubinstein on your hands with *his* famous piano, or Jascha Heifetz with his indomitable fiddle? You can't just put them down with the mere orchestral players. They must be BIG.

Why? Well, simply because we've been making them sound big and out of proportion for all of thirty years now (since electrical amplification made it possible) and it's no time for a sudden change.

Our ears are so thoroughly accustomed to hearing every big-name solo player vastly enlarged, huge against his accompanying orchestra, that it is unthinkable (or almost unthinkable) to relegate him once more back to a "normal" concert hall stage volume. Solo mike is a term that is ultra-familiar to all recording celebrities. (People who haven't ever been to concerts are often horrified to find how puny a solo

www.americanradiohistory.com

PLEASE SEND

CHRISTMAS GIFT SUBSCRIPTIONS

FOR AUDIO TO

First Fold

Third Fold

Second Fold

BUSINESS REPLY ENVELOPE

No Postage Stamp Necessary If Mailed In The United States

—POSTAGE WILL BE PAID BY—

AUDIO

P. O. BOX 629

MINEOLA, N. Y.

FIRST CLASS
Permit No. 142
Mineola, N. Y.

SEND TO . . . . . .

ADDRESS . . . . . .

CITY . . . . . STATE . . . . . (Zone)

☐ 2 Years, ☐ 1 Year

Gift card from . . . . . .

SEND TO . . . . . .

ADDRESS . . . . . .

CITY . . . . . STATE . . . . . (Zone)

☐ 2 Years, ☐ 1 Year

Gift card from . . . . . .

www.americanradiohistory.com

Christmas Gift Order Form

Please enter gift subscriptions to AUDIO and send notice thereof on gift cards to the following persons:

(PLEASE PRINT)

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

SUBSCRIPTION RATES

TWO YEARS (Domestic)	$ 7.00
ONE YEAR (Domestic)	$ 4.00
TWO YEARS (Foreign)	$10.00
ONE YEAR (Foreign)	$ 5.00

Domestic rates apply to U.S., its Possessions, A.P.O. and F.P.O. addresses, Canada, and Mexico. All others payable at Foreign Rates.

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

SEND TO ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ 2 Years, ☐ 1 Year

Gift card from ....

MY NAME (please print) ....

ADDRESS ....

CITY .... STATE ....
(Zone)

☐ Enter my subscription in my name ☐ 2 Years, ☐ 1 Year

☐ Extend my subscription ☐ 2 Years, ☐ 1 Year

I ENCLOSE $.......... in full payment

NO ENVELOPE NEEDED
Just Fold, Seal and Mail

Direct Mail Envelope Co., Inc. (The Jumbo Direct-O-Mailer) New York 11, N. Y.

www.americanradiohistory.com

violin sounds when it plays naturally against a live orchestra without amplification.)

And so, for an outfit like RCA Victor or, indeed, for any outfit with big soloists to record, there is a real problem—how to blow up a soloist to the conventional huge size in a stereo recording.

Yep, give him a solo mike and feed it into both stereo channels. That's how it can be done in two-channel recording and that is how it has been done. Feed a bit more on one side than the other and you'll put him slightly to one side or the other—if you are lucky.

If you aren't lucky, and/or if the home listener's set-up is punk, you'll get doubling, and doubling on a big scale, too! I don't know how many concerti I've already heard in which there are two soloists most of the time, one of "him" on each side.

With two-track stereo recording, you must figure out the tricky balance at the recording session and get it right, then—or never. But how about that third channel? Why not put your soloist, from his single close-up solo mike, right on the third channel, in the center? Then, when you come to editing and dickering, you can alter him as you wish—and choose your balance from an infinite variety of possible mixings. That is what RCA does with solo players these days, among other things. An excellent idea.

In the final mixing, for two-channel commercial tape, the third channel can be added to one or both of the main stereo channels in any proportion you may wish. You can fuss as long as you want, to get the best possible blend.

Now of course this middle solo channel inevitably will have a good deal of the general sound on it. How much depends on the engineers. An ultra-close solo mike doesn't really get much of any background sound. The background level is far below that of the soloist, at close range, and so, in effect, it is not heard. On the other hand, if you back away a bit with your mike you'll get proportionately less solo volume and more of the general sound. Also, the soloist will be less close, nearer to the general over-all sound. Move still further and you no longer have a solo mike—the middle mike joins the outside pair for an equal three-way coverage.

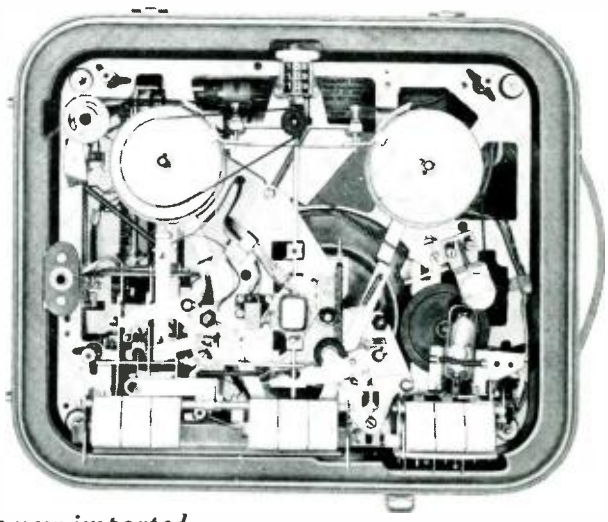
Thus, you see, the "RCA" technique (my own speculation, of course) can merge into the "Mercury" technique (again, so named by myself for convenience). There is every degree of in-between compromise you may wish; the middle channel can contribute all solo, all-background, or anything between.

In terms of listening, you may place your third-track soloist anywhere from an inch away to a distance equal to that of the rest of the music. And you may control middle-track volume, too, all the way from zero to extra-loud. Take the two together, straight three-track and two-tracks-with-solo, and you have a remarkably flexible arrangement. It's not surprising that three-track stereo recording is going ahead fast.

I'll have to observe, to end, that my own musical taste is against the loud, close-up solo in stereo—but I'll probably change. I'll get used to it, as we all have long since become accustomed to big, blown-up solos in standard recording.

As of now, I find stereo a bit too realistic for these mammoth soloists of monaural tradition! For my ears, now, they seem like immense floating monsters, musical giants, that hover out somewhere in front of the obviously more distant orches-

THIS IS THE WAY
A GREAT TAPE RECORDER
IS
BUILT



the new imported

NORELCO® 'CONTINENTAL'

the world's most advanced all-in-one portable

TAPE RECORDER

- engineered by Philips of the Netherlands, world pioneers in electronic design
- precision-crafted by Dutch master technicians
- styled by the Continent's top designers
- three speeds (7½, 3¾, and 1⅞ ips) . . . twin tracks . . . pushbutton-controlled
- special narrow-gap (0.0002 in.) magnetic head for extended frequency response
- built-in wide-range Norelco speaker
- lightweight . . . easily portable . . . rugged
- can also be played through external hi-fi system

For the name and address of your nearest Norelco dealer, write to

NORTH AMERICAN PHILIPS CO., INC.
High Fidelity Products Division
230 DUFFY AVENUE
HICKSVILLE, L. I., N. Y.

Norelco

www.americanradiohistory.com

KLH *Presents...*

THE MODEL FOUR

A complete-range loudspeaker system of distinctly superior performance

The superiority of the KLH Model Four stems from an exhaustive effort to bring as close to perfection as possible every factor affecting loudspeaker performance.

The KLH Model Four is a two-way loudspeaker system housed in a 13½H x 25W x 12"D cabinet. The low-frequency section is the same acoustic suspension mechanism used in the KLH Models Two and Three. Its very low distortion and smooth extended low-frequency response result in a quality of reproduction which is unique among loudspeaker systems.

The high-frequency section uses a small diameter direct radiator designed to operate as a piston throughout most of its range. Its wide dispersion and exceptionally smooth extended frequency response immediately distinguish it as one of the very few available high-frequency reproducers which fill every part of the room with sound free from any harshness.

Unequaled smoothness throughout the mid range is achieved by use of specially developed loudspeaker cones and by exceedingly careful attention to the design of a cross-over network which integrates the low- and high-frequency speakers into a complete-range system of such smoothness that the presence of two different speakers is undetectable.

A new standard of quality control in the manufacture of loudspeakers was introduced into the industry by KLH with the production of its Models One, Two, and Three. The same scrupulous care is applied to the production of the Model Four, thus assuring the uniformly high quality of every Model Four that leaves the KLH factory.

Although the development of the Model Four involved extensive engineering measurements, a truly fine loudspeaker system cannot be adequately described in terms of numbers, graphs, or other technical data. An appreciation of the magnificent performance of the Model Four can really be developed only by careful listening. When you do listen to the Model Four, you will notice that its superiority as an instrument for reproducing music becomes especially evident when it is compared, at the same volume level, with any other loudspeaker system.

At selected dealers. $209.00 to $231.00.
Slightly higher in West and Far South.

RESEARCH AND DEVELOPMENT CORPORATION

30 CROSS STREET · CAMBRIDGE · MASSACHUSETTS

tra, great musical blimps suspended in space between me and the stage. They are tangible—they can almost be touched. I prefer to imagine Mr. Heifetz and his big fiddle anchored on solid ground, where he belongs.

I think the trouble is that in standard-type listening we tend to imagine ourselves down on stage, in the midst of the music, the soloist right beside us, at his solo mike. But in stereo there is too much of a real sense of space to allow this. And so we find ourselves back in the hall—and the big, close-to soloist simply follows us right out into the air, where as I say, he hovers before us like a great blimp.

Be that as it may, we'll have to concede the enormous usefulness of three-track recording from the engineering and editing viewpoint, and if it brings us three separate channels for the price of two, we ought to be able to take a few blimps and stereo pink elephants along the way.

FOAM

One of the interesting developments in new materials these days is in hardened plastic or rubbery (latex) foam, which can be had in various almost weightless types of rigid or flexible material, with extremely useful qualities of springiness, air penetrability and, at the same time, rigidity. With such attractive features and especially with its weightlessness, foam inevitably has found its way into loudspeaker design, where it obviously offered a fine field for exploitation.

It was some years ago that Paul A. DeMars attached a large square of rigid foam to the front of a speaker and thereby produced a new type of air piston that pushed a lot of area, yet weighed almost nothing. That was one line of thinking, given weightless rigid-type foam.

Another approach makes use of more springy light foam as a means of surrounding and supporting the cone of a speaker. With foam, it could be guessed, the cone could move more freely in its piston-like direction, yet be held in the proper support position. If things worked out rightly, you would have a very compliant system with reduced likelihood of the irritating break-ups in the cone that are a pesty trouble in cone movement. The foam should have plenty of its own compliance, in responding gracefully yet firmly to cone excursion, and at the same time it ought to damp out those running break-up vibrations that tend to be reflected back by the usual curled-trough cone edge. All in all, this surely looked like a fine idea and something to try—all that was needed was a vast amount of specific research by loudspeaker experts, into the size, shape, and most important, the texture and formulation of material.

The results of this sort of research are now becoming evident. I now note two lines of speakers involving this principle, one British and one our own, and I assume that, patents allowing, there will be other applications of the general principle.

Wharfedale

I haven't heard the British version, but I note that on current Wharfedale speakers of the several sizes there has been a wee, tiny change in the complex designation, model for model. Thus the speaker that used to be the Super 12/CS/AL is now called the Super 12 FS/AL. An F for a C, and the difference is a big one—for the old code meant "Cloth surround, aluminum voice coil" and the new indicates "foam suspension . . ." Wharfedale has

www.americanradiohistory.com

converted from cloth to foam, and thereby hangs a small tale.

Cloth surrounds, it seems, are an excellent system for producing a compliant, low-resonance loudspeaker but they are not at all easy to manufacture. In fact, they are strictly a craft article, made individually, piece by piece.

G. A. Briggs, Wharfedale's big speaker man, told me some years ago that his famous cloth surrounds were a big headache because they were all cut by hand and the cutting was so expert that he had only a couple of old men left who could do it right. The entire Wharfedale's line, I gathered, was dependent on the work hours of these elderly master craftsmen!

Well, it looks as though the craftsmen had finally reached the end of the line. CS is now FS, the superb hand-made cloth surround is now replaced by the equally superb but presumably manufacturable foam surround. Probably just came along in the nick of time. Clearly, the reason we have never had cloth-surround speakers in any large way in the United States is simply that they are by nature unadaptable to quick and efficient mass production.

Racon

In this country, Racon went to work some time ago on the possibilities of foam materials for a new type of woofer that would have not heavy but relatively light moving parts—for better transients, better response to the damping capacities of the new amplifiers. The first finished results of the Racon development were written up technically in AUDIO a while back (May, 1956) and now there is a complete line of "Hi-C" woofer and full-range speakers from Racon built on the Racon refinement of the foam idea. I've had one of the big speakers in my apartment in New York competing unsuccessfully with a streetful of huge Diesel trucks, that out-produce it in heavy bass almost any morning. Considering the disparity in size, the Racon did positively nobly. The Diesels resonate at all sorts of heavy frequencies and my windows and Venetian blinds shake themselves to pieces with them. Racon resonates at a neat 24 cps in the 15-inch models, yet the moving structure is light and quick-acting (deliberately so, in contrast to many heavy, massive woofers) and the transients come through correspondingly clean and sharp-edged.

Racon didn't stop with a mere foam edge to the cone. There are also rigid foam structural supports on the back of the cone itself which impede break-up vibrations yet add almost no weight at all. Foam is marvellous stuff! And, it appears, the foam surround also acts rather curiously as a viscous damping agent—not the foam itself so much as the air which manages to work its way through it, from pore to pore. Viscous air, held back and made "thick" by the slowing-down effect of the semi-permeable foam material.

Racon's Hi-C speakers come in Twelves and Fifteens in all the usual combinations. In the larger size there are two "three-way" systems with dual cone plus a separate tweeter, one dual-cone full-range model minus tweeter and a straight woofer job. The twelve include a similar range, one of each type.

The tweeter in this line, by the way, is a cross between a compression-horn type and a direct radiator, with a stiff paper diaphragm in front of a compression chamber. Interesting idea. It sounded good to me, though my listening, in New York City, was too much impeded by extraneous low-fi

New **ALTEC** *1568A and 1569A Power Amplifiers*

RELIABILITY

STABILITY

SIMPLE OPERATION

The new compact ALTEC LANSING 1568A and 1569A power amplifiers provide dependable economical operation for paging, music distribution and sound reinforcement systems requiring low distortion, wide frequency range and complete operational stability with any type of load.

The frequency response is within 5 db of mid range value from 1 cycle per second to 100 KC.

Outstanding features designed for fast, inexpensive installation, ease of operation and service include a hinged front panel on which are mounted the power switch, fuse, pilot light and a continuously variable gain control; circuitry which is completely accessible for servicing when the front panel is open; input and output terminals provided in the form of barrier-type terminal blocks mounted on the rear of the chassis; and pre-wired 3-conductor power cord terminating in a 3-pin connector.

Unlike most professional amplifiers, these new ALTEC units are designed to withstand "hot switching" and other punishment which might be given them in the hands of untrained operators.

Adding to their adaptability, the 1568A and 1569A also feature a 70 volt distribution system to permit connection to a large number of speakers, each to operate at its own power level as required.

A unique device to protect horn loaded drivers in systems without dividing networks is provided by means of strapping which can introduce selected steps of low frequency attenuation.

Compare the unusual features of the 1568A and 1569A at your dealer's. You'll insist on nothing less for your installation.

Specifications

1568A: *Gain:* 65 db; *Power Output:* 40 watts at less than 2% thd 40 to 20,000 cps; *Frequency Response:* ±1 db, 5-30,000 cps; ±4 db, 1-100,000 cps; *Input Impedance:* 70,000 ohm or 30/50, 125/150, 250/300, 500/600 ohms with 4665 Plug-in Transformer; *Load Impedance:* 4, 8, 16 ohm + 70 volt ungrounded.

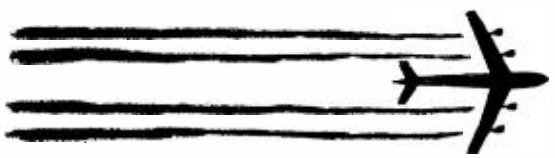
1569A: *Gain:* 68 db; *Power Output:* 80 watts at less than 2% thd 60 to 20,000 cps, 80 watts at less than 5% thd 40 to 20,000 cps; *Frequency Response:* ±1 db, 5-30,000; ±5 db, 1-100,000 cps; *Input Impedance:* 70,000 ohm or 30/50, 125/150, 250/300, 500/600 ohms with 4665 Plug-in Transformer; *Load Impedance:* 4, 8, 16 ohm + 70 volt ungrounded.

ALTEC LANSING CORPORATION, Dept. AJ12
1515 S. Manchester Avenue, Anaheim, Calif.
161 Sixth Avenue, New York 13, N.Y.

ALTEC LANSING CORPORATION

12-17A

www.americanradiohistory.com



The cartridge of tomorrow is HERE!

To ride in America's first jet airliner, you'll have to wait until 1959—but the cartridge of tomorrow can be yours today! The sensational new ESL C-60 electrodynamic cartridge, as advanced as tomorrow's jet and musical as a rare Stradivarius, is now at your audio dealer's.

Hear it, and you'll be astonished at the C-60's dramatic superiority of reproduction quality. You'll be astonished, too, at its ruggedness in any record changer or arm. With a voltage output five times the minimum specified for the world-famed ESL Concert Series cartridge, the ESL C-60 will easily drive all modern preamplifiers.

Like all fine ESL cartridges, the C-60 can greatly increase the life of your records and styli. Write for free information on the cartridge that's years ahead: the ESL C-60. Better yet, make it yours today. Only $39.50.

COMPARE THESE MINIMUM PERFORMANCE DATA:

- Frequency response flat within 1 db 18 cps to 20,000 cps (Elektra 35 test record)
- Response extends beyond 30,000 cps
- Minimum output 5 mv at 5 cm/sec
- Minimum compliance 6.8 x 10⁻⁶ cm/dyne
- Dynamic mass 1 mg
- IM distortion almost immeasurably small
- Vertical stylus force 2-6 gms
- Output impedance 40 ohms at all audio frequencies
- No transformer nor transistor amplifier ordinarily required
- Performance unaffected by load resistance

FOR LISTENING AT ITS BEST

Electro-Sonic Laboratories, Inc.

Dept. A • 35-54 Thirty-sixth Street • Long Island City 6, N.Y.

interference from the city itself for me to come up with any very positive conclusions. The tweeter clearly didn't seem to have the "horny" edge that I ordinarily find objectionable in many horn-type tweeters.

ENDS AND ODDS

Recently I ran a trick program in my New York broadcast series in which I discussed the new electronic "tapesichord" music, then proceeded to make up a tape piece of my own, patching and copying all sorts of odds and ends that were lying around on loose bits of tape, using simple feed-back of the Ampex output into an input channel to get tape echo, whistling, screeching, coughing—I even patched in a bit of Canby talking backwards and double speed. It was fun and I called the Opus the Canby Home Tape Concerto for Odds and Ends. Quite a dizzy piece.

Well, I got reactions, both aurally and via the mail. I quote you a handful. Most of the hearers got the point—that I was being funny—and also enjoyed the serious point I was making behind it all, that however zany this stuff is, it does have potentialities and it will, in all likelihood, develop into a useful and important "serious" musical technique. It has already, in many ways, of course. But boy, can taped music be corny, especially when that old feed-back echo gets working.

"Your program on tape recorded effects was hilarious. My husband and I certainly enjoyed it. Mrs. Ralph Stotz."

That sort of answer made me feel that maybe my fun was other people's fun too. But another lady had a different reaction. She was so violently moved by my Tape Concerto that she wrote not one, but two postcards, mailed in the same mail.

1. "Can anything be worse that the horrid sounds we have been subjected to in the last half hour—1 to 1:30 o'clock!"

2. "HORROR. Please don't do it again!!!"

She shall be nameless, and I trust she got over her agitation in time to get some Sunday lunch in. Sometimes I wonder whether I make sense. I do, evidently, to one sturdy old lady, who has written me dozens of times and each letter more wonderful than the last—she is German born and has never quite got herself straight on the English language and, more especially, its punctuation. Her name is Gussie, and here is Gussie's reaction:

"Even with the competition of two excelent, varieties, from 10:30 to 1, a, head, of yours, you sometimes win out on atraction.

"Blasting away the irresistible, and clearing up the music fog.

"It was hard for me, later, to keep, separated the facts, which of, you, said, what, even you, all three, used different composers to illustrate.

" 'Time, Period, Gramar, Personalities'. In other words, Music Alive. Not only, a heavenly entitety, an unexplainable charm. This was a Creation of your own, out of those music blends, an unforgetable experience, brought down to Earth."

Now a letter like that makes you feel good! I love to think of myself as blasting away, irresistible, clearing up the music-fog. Also, the audio-fog. And as for an unforgettable experience brought down to Earth, that's the way any composer wants to feel about his brainchild—even a tapesichord composer. Music blends and tape blends. She really has a way with our language, this Gussie, and I'll be glad to bring more of my creations down to Earth any day for her, if she'll just keep on writing.

www.americanradiohistory.com

NEW LITERATURE

• **Belden Manufacturing Company,** Chicago 80, Ill., in a new electronic wire and cable catalog, announces the development of a new lightweight hi-fi pickup-arm cable. It consists of 32-guage stranded copper conductors, vinyl insulated, with two conductors cabled. Belden trade number is 8430 and the cable is color-coded with black and red. **M-11**

• **H. H. Scott, Inc.,** 111 Powdermill Road, Maynard, Mass., has just released a new hi-fi catalog which pictures and describes the complete line of Scott components. Included are three amplifiers, five tuners, a turntable, and two power amplifiers. Along with technical information there are photographs showing Scott hi-fi equipment installed in the home. Requests for a free copy should specify Catalog P. **M-12**

• **Lafayette Radio,** 165-08 Liberty Ave., Jamaica 33, N. Y., is now mailing its 180-page general catalog No. 305 for 1958. In addition to a complete listing of the newest high-fidelity items of major manufacturers, a full line of Lafayette's own amplifiers, tuners, speakers, enclosures, turntables, pickup arms, and custom hi-fi systems, in a wide range of prices, is presented. Also, a large assortment of electronic parts, public-address components and systems, ham equipment, tools, books, microscopes, binoculars, cameras, and drafting equipment is offered. Catering primarily to the economy-minded hobbyist and industrial buyer, the new 1958 Lafayette catalog will be mailed free upon request. **M-13**

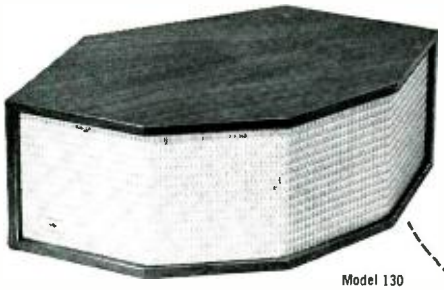
• **Bel Canto Magnetic Recorded Tape,** 2919 S. La Cienega Blvd., Culver City, Calif., will mail free a catalog listing of stereophonic recorded tapes. One of the most interesting collections of stereo tape to cross this desk, the Bel Canto collection is widely diversified, including such items as "Memories of France" by the Paris Theatre Orchestra, music from the original score of "Around the World in Eighty Days," and "Polovetsian Dances" by the Hamburg Philharmonia Orchestra. **M-14**

• **Waveforms, Inc.,** 333 Sixth Ave., New York 14, N. Y., has available a descriptive sheet containing complete technical data on the company's new Type 401A general purpose audio oscillator. Among the instrument's features are a range of 10 cps to 100 kc, 0.25 per cent distortion for all conditions, high output, and a flexible attenuator system. A newly-developed oscillator circuit permits remarkably low distortion and freedom from switching and tuning transients. A copy of the descriptive sheet will be mailed upon request. **M-15**

• **Audax Division, Rek-O-Kut, Inc.,** 38-19 108th St., Corona 68, N. Y. has recently published a revised edition of "Electronic Phono Facts," a 21-page booklet which answers hundreds of questions about high-fidelity sound reproduction. Written by Maximilian Weil, whose patents cover many of the audio industry's basic developments, the brochure covers such varied subjects as stylus alignment, turntables, tone arms, and care of records. Requests for copies must be accompanied by twenty-five cents to cover cost of mailing. **M-16**

• **United Catalog Publishers, Inc.,** 60 Madison Ave., Hempstead, N. Y., announces publication of the new 1958 edition of the Radio-Electronic Master catalog. Containing 1584 pages, it is the largest catalog ever published for the electronic industry. More than 150,000 items of 350 manufacturers are included. The massive Master catalog may be obtained from electronic parts distributors. **M-17**

JansZen* Electrostatic

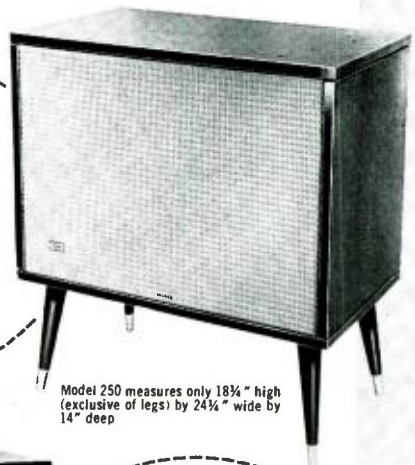


Model 130

New listening pleasure awaits you when you hear music over the JansZen Electrostatic. Transient response reaches a perfection hitherto unknown, record scratch is reduced because it excites no audible resonances and clarity and realism are maintained at all listening levels.

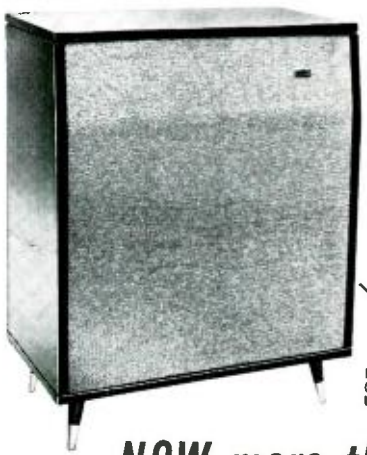
JansZen* DYNAMIC

The JansZen Dynamic sets new standards in cone woofers. Unique design concepts, combined with new materials has resulted in a woofer system which can be used singly or in pairs with the JansZen Electrostatic.



Model 250 measures only 18¾" high (exclusive of legs) by 24¾" wide by 14" deep

The Z-200 System



A complete range loudspeaker system using the incomparable JansZen Electrostatic mid and high range speaker (Model 130U) with the new JansZen Dynamic. Here is a loudspeaker of nearly perfect naturalness incorporating the latest advances in the art of music reproduction. Its design simplicity makes it suitable for use with either traditional or contemporary décor.

Model Z-200 measures only 32" high (including 4" legs) by 24¾" wide by 14" deep

NOW more than ever...

Hear the Music, not the Speaker

*Designed by Arthur A. Janszen

Write for literature and the name of your nearest dealer

Products of NESHAMINY ELECTRONIC CORP., Neshaminy, Pa.

Export Division: 25 Warren Street, N.Y.C. 7 • Cable Simontrice, N.Y.

www.americanradiohistory.com

CHARLES A. ROBERTSON*

Miles Davis and the Modern Jazz Giants
Prestige 16-3

One measure of the historical importance of a jazzman is the value collectors place on alternate takes of his sessions. When separate masters were made for distribution to several pressing plants, some of them were assiduously tracked down and compared. Except in the case of a Charlie Parker, where the end of a career brings it out of the vaults, the use of tape makes such material somewhat of a rarity. The position Miles Davis holds among modern trumpeters makes a detailed study of his creative impulse desirable. And it is now made economically attractive by the use of a speed previously limited chiefly to talking books, permitting a total playing time of 85 minutes and a program formerly contained on three 10-inch LPs, plus three alternate takes. These are the fresh items among the reissues selected by Prestige to make up the four records which introduce jazz to 16⅔ rpm.

At the same time, Vox is making an initial release of four 12-inch Extended Long Plays of remastered classical items, carrying up to two hours of music on a single disc, and a "Cook's Tour" of seven countries in the popular category. Both companies are scheduling future releases, some containing previously unissued material.

While speculation on the development of a stereophonic disc occupied the audio limelight in months past, the two companies were quietly preparing to offer the public the first music compatible to home systems at the speed found on many of the newer turntables. It began with a conversation in June, 1956, between Dr. Rudy Van Gelder, who does quite a bit of mastering for Vox, and that company's Ward Botsford, who tells the story: "We agreed that advances all along the line in respect to both home equipment and manufacturing facilities made a quality product possible at the slower speed. It was decided to go ahead and try to cut a master to be produced by our plating and pressing companies as part of a regular run. Compatability was somewhat of a watchword all the way through, as we didn't want an expensive oddity which would not survive in competition with other speeds.

"Not only do our test programs include piano concertos, among the most exacting material to reproduce, but one side plays sixty-five minutes. Dr. Van Gelder deserves full credit for the engineering and a test pressing was ready on November 25, 1956. It warranted planning our first releases for this fall, and experience gained since then has led to further improvements."

In his combination office and tape-editing room at Vox, where he deals with the complications besetting a recording director, Botsford played sections of both the original 33⅓ rpm and the first test pressing. There is no appreciable difference in sound between them and, unexpectedly, the volume level is the same. He stated that on most subsequent tests the volume level is higher than on the original. When asked about what trials the tests might have been put through, he said, "No one has tried to play one until it is worn out, but our first pressings have been around for nearly a year and have withstood severe treatment. Both Dr. Van Gelder and I feel that reduced friction at the slower speed will ensure them longer life. Many audio fans are overly conscious of the weight on the stylus and forget that wear on the grooves is caused by friction. There is also less chance of surface noise, though it shouldn't be noticeable now on a good pressing at the other speed. We have played them on various grades of equipment and the most popular record changers. Once the motors warmed up, there was no difficulty."

"As to the future," he continued, "I wouldn't want to predict anything beyond our January releases, but there is a lot of room for speculation. The distributor response is gratifying and the dealers seem to be happy with something to offer customers who ask why the fourth speed is on their turntables. Several record companies wrote for test pressings as soon as they heard about our venture and we intend to encourage them. There is nothing about their production not available to all. Our pressings are by Plastylite, while Prestige uses the Abbey Record Manufacturing Co. It is not often a small company pioneers a brand new product of such importance, and industry support will help it succeed.

"I think the 33⅓ rpm speed will be the more popular for some time to come, depending upon the progress of the stereophonic disc. Eventually, many fine monaural performances may be preserved only on the slower speed. Right now," Botsford calculated, "I am more concerned as to the number of compatible turntables. When we ran the first tests, both the plating and pressing firms had older machines."

Dr. Van Gelder told a similar tale of its development and also pointed out: "Now we have a record label which can be read while it is revolving on the turntable." He said the mastering was done on his Scully automatic lathe and, though the grooves are cut to accommodate the 1-mil stylus, expressed keen interest in the trend in the direction of a smaller stylus. He looks forward to the time when it might become an industry standard. Its widespread use would permit further advances at 16⅔ rpm, but its final size and shape seems to depend upon the development of a stereo pickup. Again the question of compatability arises, and it is likely to be an important factor in all experimental work along these lines. Some monaural cartridges already employ the ½-mil size used by London in its stereo demonstration, though Fairchild is working on an elliptical stylus of the same dimensions. But both these, and other manufacturers, are aware the ideal may be found to lie somewhere between the two sizes.

Prestige entered the picture late last Spring when Bob Weinstock, twenty-nine-year-old head of the jazz company, was discussing with Van Gelder its reissue program. He speculated that it might be advisable to explore the possibility of putting some of them on 16⅔ rpm. At first, Van Gelder thought news of his work for Vox had leaked out. He found this was not so, but could not give an honest answer until he had permission from Vox. As Vox is not in the jazz field, it was finally decided to schedule first releases by both companies for October.

"I have been a collector since the age of thirteen," said Weinstock, while outlining some of his plans, "and my immediate reaction to the extended playing time was that it would permit other collectors to keep performances of their favorites in the most compact space possible. And I hope it will succeed to the point where newer collectors will be helped in putting together a representative selection cheaply. Our first releases are designed with this in mind. One, in Concorde, groups two LP's by members of the Modern Jazz Quartet which still sell well at the other speed. "Trombone by Three" with J. J. Johnson, Kai Winding, and Benny Green presents them in their earliest recordings as well as later examples of their work. Another, by the Billy Taylor Trio, is meant for a stretch of relaxed listening as it comes as close to mood music as anything we have in the catalogue.

"As for the Miles Davis sides, I would like to make it clear that the alternate takes are not the warmup run-throughs. Some labels have salvaged such material from Parker sessions, but I make it a rule to erase all tapes the musicians would not want released. They were taped as final takes and then the musicians decided to have another try at them. I had forgotten about them until they were found in the files with the rest of the tapes from the dates. They were untouched as I don't believe in the practice of intersplicing two tapes to obtain the best moments on each. Nor do I approve of switching the order of choruses and the other tricks of the tape editor. The only time I do anything along these lines is when somebody blows an ending. Then it is redone at once in the studio and spliced on later. It is not always easy to switch from free improvisation to a written ending. When I hear a track which fades out without one, I can't help wondering what happened to it.

"However, Miles has approved the release of these takes and I think collectors will want them. The session with Milt Jackson and Monk took place the day before Christmas and quite a few people have written in asking us to reissue it. Four extended LP's are scheduled for December to feature some of the newer men such as Phil Woods, Pepper Adams, Dave Amram, Idrees Sulieman, and John Jenkins. All this material is previously unissued and a proposed two-disc album called "East

* *732 The Parkway, Mamaroneck, N. Y.*

www.americanradiohistory.com

Coast School'' will now appear on a single record.''

When asked about other plans for the slower speed, Weinstock said, ''It opens lots of possibilities, but everything depends on public reaction. Moondog wants to do a reading of some of his longer works and it may well fit this speed. One reason I came into the business in 1949 was to do some of the things other companies were passing over. Some of the best moments of that period and the swing-era are lost because jam sessions were neglected. Now that they have practically disappeared from the scene, I try to recreate that atmosphere in the studio about once a month. I don't expect all of them to catch fire, but try to select musicians who will inspire each other. Often there is no other way for men of different units to get together and they really appreciate it. Everyone seems to like these dates but the critics, yet they become enthusiastic when a writer or arranger simplifies a jam session idea and works it into a score. I think even the workshop or laboratory composer will agree that jazz would soon become sterile without them. They are what I like to do most and I want to do as many as I can with men of different schools and styles.''

Weinstock prepares and edits tape on an Ampex stereo recorder in his office, but does most of his listening in the basement of his New Jersey home, where the most elaborate of his three rigs is kept. It consists of an Altec Voice-of-the-Theatre speaker system, Bell Amplifier, Rek-O-Kut turntable, and GE arm and cartridge. ''I worry more about good sound outside the studio,'' he said. ''When I am supervising a date, I don't want anything to interfere with my concentration on the music and musicians. That's why I like recording at Van Gelder's. I know he is going to do that part of the job and it is a weight off my shoulders. My only other staff member now is Esmond Edwards, who comes along to take photographs, as I have found what you do yourself is likely to be the most satisfying.''

The Miles Davis album is the product of two recording sessions. The first was held on June 29, 1954 and features Sonny Rollins, tenor sax; Horace Silver, piano; Percy Heath, bass; Kenny Clarke, drums. Two takes of *But Not For Me* complete a program of *Doxy, Airegin,* and *Oleo.*

Three members of the MJQ were present at the second on December 24, 1954. They were Percy Heath, Kenny Clarke, and Milt Jackson on vibes, in company with Thelonious Monk on piano. Alternate versions of *The Man I Love* and *Bags' Groove* are paired with *Bemsha Swing* and *Swing Spring.* As superior performances of increasing historical moment in what is likely to be their final recorded form, they should be welcomed by all collectors. For their benefit, a short talking stretch by Miles was not deleted from the tape, as a remembrance of the time before his voice deepened.

That this development should emerge on the Tenth Anniversary of the long playing record is perhaps significant, for it makes inclusive use of the many advances of a decade of progress in audio. Direct comparison with an early LP is a comforting experience. With the war of the speeds behind it, the industry is aware of the need for compatability in a stereo disc and cartridge. I wouldn't want to hazard a guess as to whether there ever will be a stylus to play stereo or monaural at 33⅓ rpm and monaural at 16⅔ rpm, hut the prospect is enticing.

I have listened to four different pressings of jazz and classical music at 16⅔ rpm

INTRODUCING

LORENZ by IT.&T.

Audette Sr.

the speaker that opens

a new world of sound!

For years, engineers have strived to achieve really BIG SPEAKER PERFORMANCE IN SMALL SPACE. Today, we can say it has actually been done! Because the Audette *Sr.*—the newest of hi-fidelity speakers—employs all the features of systems many times its size! It is a two-way speaker system, with true Helmholz construction. It has an extremely wide frequency range (45-17,000 cps), and an amazing balance of natural sound. Yet it gives you all this in a cabinet measuring only 22" wide x 10½" deep x 27" high, including matching legs! See it today, hear it today . . . you'll recognize it as the perfect answer to the problem the hi-fidelity industry has long sought to solve – BIG SPEAKER PERFORMANCE IN SMALL SPACE!

Can be used singly for monaural or in pairs for Stereo Systems.

IN MAHOGANY **$69.50** IN WALNUT OR BLONDE **$74.50**

For Small Space without Sacrificing Quality

LORENZ by IT.&T. KAL Audette Jr.

Superb two-way speaker performance in a cabinet that measures 11 x 23¾ x 10. Use as a consolette (legs available) or place on table, bookshelf, anywhere! Richly grained Brown or Blonde Tan Leatherette covered case. **$49.50** — *(4 brass legs $5.95)*

exclusive U.S. distributors

KINGDOM PRODUCTS, Ltd. 514 Broadway, New York 12, N. Y. WORTH 6-0800

www.americanradiohistory.com

Superb Craftsmanship
Magnificent Performance

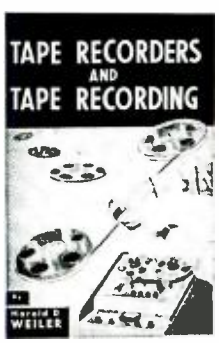
quality designed by **GRADO**

We announce with pride the development of a custom crafted phonograph cartridge of revolutionary design ...*THE GRADO CONSTANT IMPEDANCE MOVING COIL TRANSDUCER.* This unit for the first time reproduces the peerless quality of the master tape. The Grado is precision made by master watchmakers to the highest electronic standards.

Used by leading audio manufacturers and research technicians as a laboratory standard.

Audiophile Net Price $45.00

GRADO LABORATORIES • 4614 SEVENTH AVENUE • BROOKLYN 20, NEW YORK
EXPORT DIV. • 25 WARREN ST. • NEW YORK 7, N. Y.



TAPE RECORDERS AND TAPE RECORDING

By

Harold D. Weiler
Author of
"High Fidelity Simplified"

The first complete book for the home recordist. Tells why, how, and what in easily understood language—not too technical, yet technically accurate. Covers sound, room acoustics, microphones, microphone techniques, editing and splicing, sound effects and how to make them, maintenance, and adding sound to slides and home movies.

RADIO MAGAZINES, INC., Book Division
P. O. Box 629, Mineola, N. Y.

Please send me ..... copies of Weiler's TAPE RECORDERS AND TAPE RECORDING. I enclose check ☐ money order ☐. Paper cover, $2.95.

Name .....

Address .....

City ..... **Zone** ..... **State** .....

and many nice things can be said about them. To say they are the equal in sound to a large majority of records on dealer's shelves might be accurate, but it would not mean too much. So far, I find a turntable without wow or rumble at 33⅓ rpm, detectable to the ear, is not likely to develop either at the slower speed. It is too worthwhile a step to be judged by any written recommendation, or disparaged on anybody's sayso. Your own opinion should be formulated on the equipment in your home. No audio fan or record collector can afford to miss such an important first.

Brother John Sellers In London
London LL1705

Restrictions have made it difficult for American musicians to tour England and impossible for them to record with their British cousins. What can happen in the way of really inspired playing when such a fusion of forces comes about is strikingly exemplified in a dozen blues, ballads and spirituals sung by Brother John Sellers, during a London visit this August, backed by a sterling (undevaluated) sextet of that city's jazzmen. Perhaps the most versatile of the blues artists, Sellers ranges from the sacred to the almost profane and from traditional to modern blues. He is accompanied only by Stan Greig's piano on *Motherless Child* and *House of the Rising Sun*, and by Diz Dizley on *I Want a True Lover*. Clarinetist Wally Fawkes and trumpeter Al Fairweather amply demonstrate their capabilities on all the others, with Frank Clarke, bass, and Tony Kinsey, drums. Greig is admirable on *Backwater Blues*.

Eight of the compositions are by Sellers and he somehow managed to smuggle a tambourine into the studio to give propulsion to his dynamic *Chicago Hop*. England has sent us no better jazz, to my ears, since before the War. If one lone blues singer can get such results, the powers-that-be might do well to consider what a further lifting of restrictions could accomplish. Fine sound, as is usual with this label.

Elder Charles D. Beck: Urban Holiness Service
Folkways FR8901

The midnight service of The Church of God in Christ at Buffalo, N. Y., recorded by William H. Tallmadge on December 30 and 31, 1956, appears here in edited form. Though his success as a faith healer takes him all over the country, Elder Charles Beck is on home ground and leads Brothers and Sisters through gospel songs in the shouting style loved by the Holiness denominations. Said to have taught himself to play all musical instruments, he switches from trumpet to vibraphone and bongo drums in *Don't You See* and *Drive Old Satan Away, Lord*.

Because he carries a large troupe on tour, Elder Beck appears mostly in urban centers to present religious music as it might be used in Africa. One of its members, Goldia Haynes from East St. Louis, shows a magnificent voice on *Job*, and the Heavenly Gospel Singers do *I Know the Lord*; *He Laid His Hand On Me*. Also heard are *Walk in the Light*, *Search Me Lord*, and *I'm a Soldier*. The hypnotic rhythms of the concluding *Satisfied* lasted an hour in actual performance. The engineering is of radio broadcast quality, and the record is valuable in revealing some Afro-American origins of jazz.

Jimmy Rushing: If This Ain't The Blues
Vanguard VRS8513

Not only is Jimmy Rushing one of the greatest of blues singers, but it is now pretty evident that there will never be another quite like him. This is a record to be treasured and described in superlatives, for it is not likely the circumstances which produced this fifty-four-year-young projector of the bare sentiments and steady pulse of the blues will be repeated ever. He is a most significant figure in a transition period which saw the transformation of the country blues into the modern blues. His style combines rare inventiveness with the earthy strength of the

www.americanradiohistory.com

former, while avoiding the complexities of the latter, or the banalities of rock and roll. All jazzmen must retrace, sooner or later, his course which begins at the life-giving roots and draws unceasingly from them.

Of the eight numbers, five are basic blues, while *Dinah* and *Pennies from Heaven* are swing classics made his by adoption. *Oh Love* is typical of the Kansas City style and the absorption of blues into other forms. Rushing's own tune, *Sometimes I Think I Do*, along with his delivery of *My Friend Mr. Blues, I Can't Understand*, and *Take Me With You, Baby*, explain from whence his reputation arises.

The splendid octet enlisted in his support could only have been chosen by John Hammond, who reaches up his sleeve to produce a fine guitarist in Roy Gaines. His every chorus is worthy of study, as is the work of Emmett Berry, trumpet; Vic Dickenson, trombone; Buddy Tate, tenor sax; Clarence Johnson, piano; Aaron Bell, bass; Jo Jones, drums. Adding an electronic organ, played by Marlowe Morris, to this complement, would be to court disaster at the hands of less accomplished engineers. Besides, there is enough of the vox HUMANA stop in the Rushing voice to make it hardly necessary. But it might be interesting to hear him with the organ alone.

Wilbur De Paris: Jimmy Witherspoon Sings New Orleans Blues **Atlantic 1266**

A singer with several hits in the rhythm and blues field is promoted to the company of the Wilbur De Paris band on ten numbers, none of which can be called New Orleans blues. Jimmy Witherspoon sings well in a strong, polished voice on traditional tunes and two modern blues of his own composition, aided by the clarinet obbligatos of Omer Simeon. Unfortunately, the echo-chambered recording technique, usually reserved by this label for its rock-and-roll clientele, is employed. As an effort to broaden the popularity of De Paris, it might be laudable, but it prevents the band from ever sounding as though it is together with the singer and will hardly please its usual audience.

Buck Clayton: Buckin' The Blues **Vanguard VRS8514**

When Buck Clayton first put his trumpet on record more than twenty years ago, his highly vocal way of playing, based in the tradition of the great Joe Smith, was a fully formed image of consummate good taste and intense personal statement. It has not changed in substance since then, though it has broadened with the absorption of a carefully-sifted ideas. More recently, due to the increasing demand on his services to direct recorded jam sessions, it has taken on more of the driving force required of a leader. Though this album is devoted to the blues, they are present in such variety that the Clayton horn shines in several tempos and assorted moods.

Featured with the Benny Goodman Orchestra and Sextet when the recording was made in March, 1957, Clayton brought along another member, the brilliant new guitarist Kenny Burrell, and pianist Hank Jones. Earle Warren on alto sax, trombonist Vic Dickenson and drummer Jo Jones are all companions from his days with Count Basie. Aaron Bell was called in to replace the ailing Walter Page on bass.

All his originals, *Buck Huckles* and *Claytonia* are mellow-textured items taken at a medium pace and the tempo increases on *Cool Too* and *The Queen's Express*. Even that modernist Hank Jones seems to enjoy himself on *Ballin' the Jack* and *Squeeze Me*, as Clayton drops in an Armstrong touch. He is supreme on *Good Morning Blues*, and his *Blues Blasé* is a finely conceived showcase for trumpet alone, said to be his first recording of a complete solo number. Wonderful balance is kept throughout the recording to continue the high standard set on this series.

Webster Young: For Lady **Prestige LP7106**

This is such a good idea that the wonder is why it was never done before. It most certainly will be repeated among the sheaf of releases to accompany the completion of the autobiographical film on Billie Holiday. A

ALLIED'S OWN knight® HI-FI COMPONENTS

MONEY-SAVING HI-FI • COMPARABLE TO THE FINEST

★ Advanced Design, Performance and Styling
★ Outstanding For Superior Musical Quality
★ You Get the Very Finest For Less
★ Each Unit Guaranteed For One Full Year

EASY TERMS AVAILABLE

Model KN-110 $99.50
Only $9.95 down

NEW knight Deluxe KN-110 FM-AM Tuner

Features:

- 2½ μv FM Sensitivity
- Dual Limiters
- RF Stage on FM and AM
- Tuning Meter for FM and AM
- AFC "Lock-in" FM Tuning
- Flywheel Tuning Mechanism
- Tape Output Jack
- Illuminated Slide-Rule Dial

Equal to the finest, yet far lower in cost. Features remarkable sensitivity—2½ microvolts for 20 db of quieting on FM, 5 microvolts for 1.5 volt output on AM. Supplied with FM folded dipole antenna. Deluxe features: Separate RF stages on FM and AM for extra sensitivity; FM discriminator with dual limiters; cathode follower with 2 outputs; AFC on FM, tuning meter and flywheel mechanism for effortless tuning; 10 kc whistle filter on AM; rotatable AM loopstick antenna; U.L. Approved. Handsome leather-tone case, 4 x 13½ x 10". Shpg. wt., 17 lbs.

Model KN-110. Net, F.O.B. Chicago, only $99.50

NEW knight Deluxe 30-Watt Hi-Fi Amplifier

Model KN-530 $94.50
Only $9.45 down

- Rumble and Scratch Filters
- "A-B" Speaker Switch
- Variable Loudness Control
- DC on Filaments of Preamp Tubes

More output, more features, more style for your money. Response, ± 0.5 db, 20-40,000 cps. Harmonic distortion at rated output, 0.5% at mid-frequencies—never exceeds 1.5% from 30-20,000 cps. Additional features: 8 inputs for all signal sources; full equalization for all records; separate Bass and Treble controls; variable damping. Leather-toned case, only 4 x 15½ x 11". Shpg. wt., 30 lbs.

Model KN-530. Net, F.O.B. Chicago, only $94.50

SELECT FROM A COMPLETE LINE OF MONEY-SAVING knight HI-FI COMPONENTS

Deluxe FM-AM Hi-Fi Tuner $99.50

30 Watt Deluxe Hi-Fi Amplifier $94.50

15-Watt "Bantam" Hi-Fi Amplifier $64.50

"Bantam" FM-AM Hi-Fi Tuner $74.50

10-Watt "Mini-Fi" Hi-Fi Amplifier $42.95

32-Watt Basic Hi-Fi Amplifier $74.50

"Uni-Fi" Tuner-Amplifier $119.50 less case

FM-AM Tuner-Preamplifier $139.50

Stereo-Monaural Preamplifier $79.50

FREE!

404-PAGE 1958 ALLIED CATALOG

Your Buying Guide to the world's largest selection of Hi-Fi components, complete music systems, recorders, Public Address Equipment—as well as Everything in Electronics. Send for your FREE copy today.

See our 1958 Catalog for full details

ALLIED RADIO
America's Hi-Fi Center

our 37th year

ALLIED RADIO, Dept. 17-M7
100 N. Western Ave., Chicago 80, Ill.

Ship the following KNIGHT Hi-Fi Components:

_____ $_____ enclosed

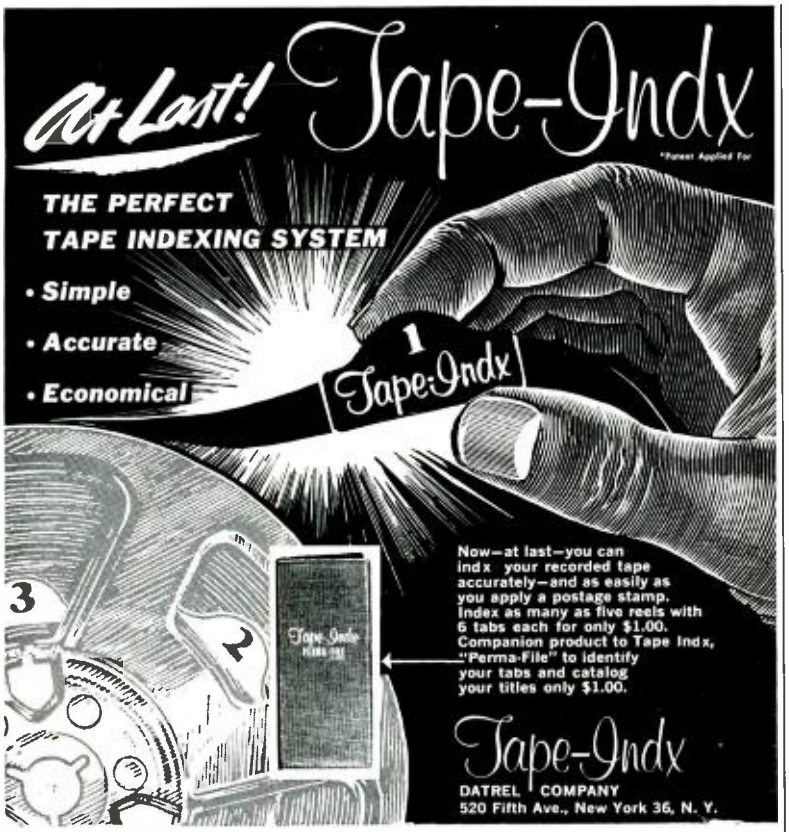
☐ Send FREE 1958 ALLIED 404-Page Catalog

Name _____

Address _____

City _____ Zone _____ State _____

www.americanradiohistory.com



New

REVISED EDITION AVAILABLE ABOUT
December 1, 1957

ELECTRONIC MUSICAL INSTRUMENTS

By Richard H. Dorf
(AUDIO Library — Vol. 1)

Up-to-date information about:

- SCHOBER
- CONN
- MINSHALL
- THOMAS
- KINSMAN
- ORGAN TUNING

$7.50 Postpaid

Customary discounts to dealers and distributors

If you missed the first edition, you're sure to want this new and revised second edition. And even if you have the first edition you are sure to want the latest information about the newest instruments. Order direct, Dept. E2, Radio Magazines, Inc., Mineola, N. Y.

choice sextet of instrumentalists express their admiration for the singer on five numbers she has made pretty much her own, and pay reflective tribute in *The Lady*, a dedicatory piece by cornetist Webster Young. A disciple of Miles Davis and new arrival on the scene, he exhibits at twenty-five a good command of his instrument in a tantalizing likeness of the Holiday vocal style.

Arrangements by Mal Waldron, her present pianist, deliver the message of *God Bless the Child* and the soul-tearing story of *Strange Fruit*. Paul Quinichette, tenor sax, relenting in his determination not to resemble Lester Young too closely, matches the style which accompanied her so often, before having his own say. The musicians also know and love *Good Morning Heartache* and *Don't Explain*, and give long-awaited instrumental expression to them in this excellent recording. Earl May, bass, and Ed Thigpen, drums, are from the Billy Taylor Trio. There is a tendency nowadays to emphasize the sad and somber theme of the Holiday career. Guitarist Joe Puma helps recall her lighter and swinging side on *Moanin' Low*. If it prompts someone to engage Buck Clayton for a similar treatment of her earlier tunes, this album, already doubly welcome for Webster Young, will more than pay its dues.

The Stylings Of Silver
Blue Note 1562

The man who is doing the most to extend the boundaries of the jazz piano is Horace Silver. He could safely rest on his laurels for the balance of his career, for he has reached the point where he is being showered with credits for accomplishments not entirely his. But such complacency is not in the Silver makeup, and his restless imagination is constantly exploring new horizons. As the leader of his own quintet, he is able to write originals for it which make it an extension of his own creative channels. It has, in consequence, a cohesion of thought and a wholeness of expression all too rare in such units.

It is with this spirit of muscular sureness that it moves through this album, which finds Silver at his most earthy in five originals. On *The Back Beat*, he is rhythmically adventurous, and *Metamorphosis* involves a beguine. *No Smokin'*, *Soulville* and *Home Cookin'* are accurately descriptive titles. The melody is played in octaves on the ballad *My One and Only Love*, and the piano blends well with the horns in the recording. Hank Mobley, tenor sax, is always at his best with Silver, and Art Farmer, trumpet, is in good form. Teddy Kotick, bass, and the excellent young drummer, Louis Hayes, complete the rhythm section.

Max Roach: Jazz In ¾ Time
EmArcy MG36108
Kenny Dorham: Jazz Contrasts
Riverside RLP12-239

Of the modern groups which exercise a prerogative to deal freely with established ballads, or create fresh material in their image, the musicians gathered about Max Roach have always been most successful in mating absolute jazz values to popular forms. Whether this is due to the skill and taste of the drummer, the way Sonny Rollins, tenor sax, can take a tune apart, or the ability of trumpeter Kenny Dorham to play intelligently at slow or rapid tempo is not of moment here, as all three are present on both discs.

Perhaps due to the acclaim which greeted Rollins' *Valse Hot*, with its Noel Coward quotes, Mercury's Bob Schad asked Roach to put his ingenuity to the test of this tempo and discover what could be done to finish out an LP. Roach added his tightly-woven *Blues Waltz* and a lilting *Little Folks*. The others are the evergreens *I'll Take Romance*, *Lover*, and *The Most Beautiful Girl in the World*, all of which began their careers as waltzes.

In showcasing the Dorham trumpet, Riverside aims at the contrast of a quiet mood and a more intense expression of the same feeling. Harpist Betty Glamman is added on *But Beautiful* and the GiGi Gryce arrangements of *Larue* and *My Old Flame*. Dorham sets the pace on *Falling in Love with Love*, *I'll Remember April*, and his original *La Villa*, aided by pianist Hank Jones and Oscar Petti-

www.americanradiohistory.com

ford, bass. Both recordings are good and your choice lies between the ballad or waltz.

A Night At The Five Spot
Signal S1204

To record a jam session in memory of Charlie Parker before a live audience might seem a happy thought, but its success entails careful planning and no little luck. The room selected is one of New York's newest clubs devoted to Jazz, the Five Spot Cafe on the outskirts of Greenwich Village. It encourages a respectful audience and boasted a new Steinway when Rudy Van Gelder moved his recording equipment in one Monday night last August. Don Schlitten, Jules Colomby and Harold Goldberg of Signal picked Cecil Payne, baritone sax, to head a sextet of Phil Woods, alto sax, chosen for his devotion to the Parker idiom; Frank Socolow, tenor sax; Duke Jordan, piano; Wendell Marshall, bass; Art Taylor, drums.

The compositions by Parker had been recorded by him in different periods of his career. *Steeplechase* is his well-known conception of *I Got Rhythm*, and *Scrapple from the Apple* presents his thoughts on *Honeysuckle Rose*. *Parker's Mood* and *Buzzy* are also heard at length. When the session began with a warmup set at nine o'clock, the time for planning was over. What went on the tape could be a pale imitation, a carbon copy or a fitting tribute. Thanks to the sharply contrasting reeds and the ready rhythm section, the result is a record packed with emotion and inspired playing. The sound is excellent for an on-the-spot production and the crowd not too distracting. When the equipment was hauled away at 2 a.m., the era of Parker had been recreated.

The Bud Shank Quartet
Pacific Jazz PJ1230

A flutist of unfaltering lyricism and beauty, Bud Shank carries the same qualities to his playing of the alto sax in a pleasantly varied program, ranging from a dewy *Softly, as in a Morning Sunrise* to the fervently swinging *Jive at Five* and *Night in Tunisia*. A balladic treatment is given *Polka Dots and Moonbeams*, and *All of You* is begun as a ballad by the flute, before rising to medium tempo. Claude Williamson, featured on piano and celeste, conducts a few experiments in the blues during his three-part suite *Tertia*, and his rapid *Theme*. He feels the blues most thoroughly in the uptempo moments, but borrows on Ravel for a pensive introduction to *Lamp Is Low*. Don Prell on bass and drummer Chuck Flores do well in solo and rhythmic passages. It is graduate work by members of the West Coast school in a fine recording.

Kenny Drew: This Is New
Riverside RLP12-236

An aptly titled album brings Kenny Drew into the studio in a quartet, featuring trumpeter Donald Byrd on four numbers, which is expanded to a quintet by the addition of Hank Mobley, tenor sax, on three others. One of the most promising younger pianists, Drew has been overshadowed during much of his career by Horace Silver, whose footsteps he has followed with growing individuality, though he was born a month earlier in 1928. Both have the same sound background and technical skill, but now seem bent on divergent paths. Silver is becoming more preoccupied with complex rhythm and Latin beats, while Drew turns here to the show tune in *You're My Thrill, It's You or No One, Why Do I Love You*, and the title tune. Also in this direction is his melodic original *Carol*, an emotionally moving indication of his maturing talent. Byrd contributes *Little T*, while Wilbur Ware, bass, and G. T. Hogan, drums, are rhythmically agile in uptempo numbers such as Rollins' *Paul's Pal*.

Randy Weston: Jazz a la Bohemia
Riverside RLP12-232

To realize the advantages and disadvantages of a live performance in a club, it is only necessary to compare the piano of Randy Weston in this on-the-spot session at the Cafe Bohemia, last October, with some of his studio work. It contains some of the most inspired

New! And the Best Yet!

THE FABULOUS

FISHER 90-T

FM-AM TUNER

ELEVEN momentous features now available for the first time—plus TWENTY *other* terrific features. The 90-T reflects engineering excellence without equal. It incorporates the celebrated FISHER GOLD CASCODE RF amplifier and widest-band circuitry, to provide astonishing one-microvolt FM sensitivity. The new FISHER MICROBEAM TUNING INDICATOR is more accurate on weak signals than conventional meters or tuning eyes. At fingertip-touch, the exclusive, three-position FISHER PUSH-BUTTON FM MUTING/AM BANDWIDTH SELECTOR eliminates FM inter-station noise, and assures maximum AM reception with minimum interference. The Audio Control Center includes a new PRESENCE CONTROL and three-position, sharp-cut-off NOISE and RUMBLE FILTERS. Incomparable in performance and appearance, THE FISHER Model 90-T will meet the critical requirements of even the most particular professional. **$239.50**

Mahogany or Blonde Cabinet, **$19.95**

WRITE TODAY FOR COMPLETE SPECIFICATIONS

FISHER RADIO CORP.
21-29 44th DRIVE
LONG ISLAND CITY 1, N. Y.

FISHER RADIO CORPORATION 29-127
21-29 44th Drive • L. I. City 1, N. Y.
Please send specifications of THE FISHER 90-T

Name_____

Address_____

www.americanradiohistory.com

NEW... by GRAY

DUAL *viscous-damping*

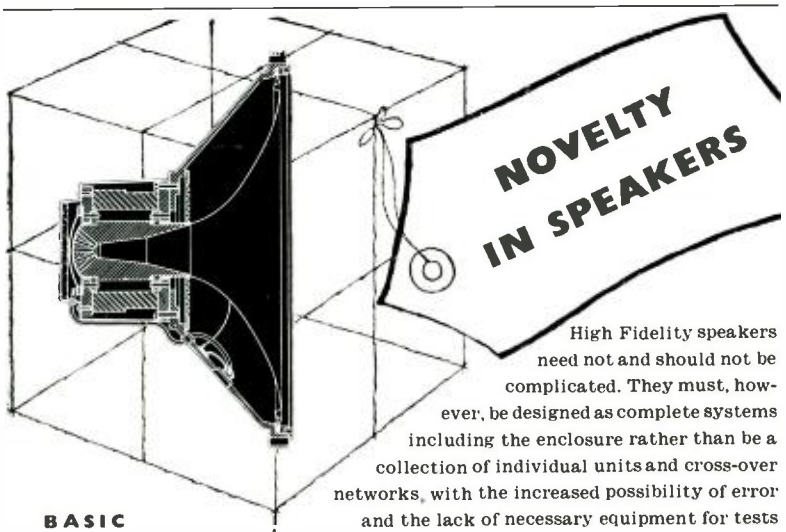
DUAL Viscous-Damping and complete static balance around the vertical pivot GUARANTEES maximum tracking stability—produces fuller, rounder, more natural sound reproduction.

FEATURES FOR THE HI-FI PERFECTIONIST

- ✓ Sealed viscous-damping on BOTH vertical and horizontal pivots
- ✓ Up to 12 inch records
- ✓ Can be used with ALL popular cartridges
- ✓ Counter-balance weight permanently adjusted at factory
- ✓ Cartridge slide plugs in
- ✓ Stylus force adjustable—eliminates cartridge weights
- ✓ Only $34.00—for any budget
- ✓ Get yours *today* at your local High Fidelity dealer, or write for complete details on ALL features.

THE **GRAY** MANUFACTURING COMPANY
18 ARBOR ST., HARTFORD, CONN.

Circle 76A



NOVELTY IN SPEAKERS

High Fidelity speakers need not and should not be complicated. They must, however, be designed as complete systems including the enclosure rather than be a collection of individual units and cross-over networks, with the increased possibility of error and the lack of necessary equipment for tests in the home when finally assembled. Few people would obtain a motor-car by buying the engine, chassis, body etc. and assembling it at home. They would rightly regard this as a job for expert engineers—and so with loudspeakers, where naturalness not novelty is the desired result.

BASIC SPECIFICATION
12" and 15" models

Frequency response 30—20,000 *c.p.* ± 3*dB.*

Polar Distribution for 60° *inc. angle-4dB. at* 10,000 *c.p.s.*

Intermodulation Products less than 2%

TANNOY

DUAL CONCENTRIC SPEAKERS

TANNOY (AMERICA) LTD. 38 PEARL STREET, NEW YORK, 4, N.Y., U.S.A.
TANNOY (CANADA) LTD. 36 WELLINGTON STREET EAST, TORONTO 1, ONTARIO, CANADA

Circle 76B

choruses he has yet recorded. In the balance, there are a few make-weight choruses which would not be carried over into the studio. The engineering by Ray Fowler favors the piano, and the room gives it a pleasant sound. When Cecil Paynes joins the trio on baritone sax, the balance is not as good. *You Go to My Head* and *It's All Right With Me* are by the trio alone, with Ahmed Abdul-Malik, bass, and Al Dreares, drums. Weston includes his *Chessman's Delight*, *Hold 'Em Joe*, and a robust reading of Sid Catlett's *Just a Riff*.

Duke Ellington: Such Sweet Thunder
Columbia CL1033

That Shakespeare should serve as the basis of a jazz suite by Duke Ellington is appropriate as both possess the same ageless quality and a parallel might be drawn between their respective positions in jazz and literature. A prelude by the band on the title theme introduces eleven vignettes to feature its soloists on some of the best writing the composer has done in years. When conveyed by his strongest instrumentalists such as Harry Carney, Johnny Hodges, Quentin Jackson, and Clark Terry, they are most successful. Most weak are a violin-clarinet duet and a bass interlude, though Cat Anderson, cast as a distraught Hamlet, plays surprisingly tasteful trumpet. Ellington has scope, wit and logic, regardless of any new insight into Shakespeare, and can turn to Proust for inspiration, where I'm concerned, if similar results are assured.

Leith Stevens: The James Dean Story
Capitol W881, World Pacific P2005

Despite Hollywood's willingness to pay well for movie scores, the very nature of the medium usually defeats the best efforts of composers to maintain a high creative level. Because original passages must be followed by barren patches or bombastic interludes, a film track is often robbed of sustained interest. A solution to the problem may well be in these two albums of a score by Leith Stevens, who was known to musicians as a workmanlike arranger and underrated composer in New York broadcasting studios nearly two decades ago. Since then he has gained no little reputation as a writer for movies, and the film score on Capitol displays an orchestrator's knack for making the patches less bare and the interludes more restrained.

On World Pacific, the new name for Richard Bock's Pacific Jazz in its expansion to other fields, Stevens worked with arrangers Johnny Mandel and Bill Holman to strip the score of nonessentials and frame its nine themes to fit a fourteen-piece orchestra of contemporary jazzmen. There is an abundance of space for urbane solos by Bud Shank and Chet Baker, whose trumpet has never seemed more beautifully poised, and an eloquent performance shows the most inventive and moving portions of Stevens' work at length. Mike Pacheco plays bongos and Claude Williamson is pianist. Included in both well-recorded albums is the Jay Livingston and Ray Evans ballad *Let Me Be Loved*.

Johnny Richards: Wide Range
Capitol T885
Les Brown: Composer's Holiday
Capitol T886

In the program launched this fall by Capitol to return big bands to favor, two albums hold more than ordinary interest for original composition. Johnny Richards, who most recently worked with Stan Kenton, has assembled much the same type of band from selected sidemen in a move to the East Coast. His writing favors the big sound, with tympani and large sections, and is leavened by the playing of Gene Quill, alto sax, on *Tappan Zee*, and trombonist Jimmy Cleveland on *Cimarron*.

A lively holdover from the swing era, the Les Brown band is noted for its danceable tempos, and the leader called on Hollywood composers Andre Previn, George Dunning, Frank Comstock, Marty Paich and Dominick Frontiere for fresh material. Most tuneful are Elmer Bernstein's *Tropics at Five* and Alfred Newman's highly-perfumed *Park Avenue Escapade*. Most suited to the band are the

www.americanradiohistory.com

Brown trombonist Jim Hill's *Bone Voyage* and *Apple Valley*, and trumpeter Wes Hensel's *Especially for Two* is a joyous flag-waver. Capitol knows how to engineer big bands and they are back, at least on records.

Curtis Fuller: The Opener
Blue Note 1567

The latest graduate from the school of young midwest jazzmen centered in Detroit to arrive on the larger scene is Curtis Fuller, at twenty-three a full-toned modern trombonist, who is given a chance to show his wares on both a slow and fast blues of his own. Also the ballad *Here's to My Lady, Soon*, and a swinging *Lovely Way to Spend an Evening*. He acknowledges his debt to his mentor J. J. Johnson in *Oscalypso*. Naturally forceful, though still raw in conception, his style is not beaten into the glassy cascade of notes favored by some technicians. Already well-grounded on his instrument, with greater shading and a tight grip on what is his own, he can go far. Hank Mobley, tenor sax, with pianist Bobby Timmons, bassist Paul Chambers and drummer Art Taylor, makes his introduction pleasant.

Jimmy Smith: Plays Pretty Just For You
Blue Note 1563

In relation to other discs at the Hammond organ by Jimmy Smith, this can only be called a mood album. But in relation to the work of other jazz organists, it is in a class with the all-too-few organ solos recorded by Fats Waller, whose *Jitterbug Waltz* occupies a place of honor beside *East of the Sun* and *The Nearness of You*. With his new guitarist Eddie McFadden and drummer Donald Bailey, he runs through *Autumn in New York, Penthouse Serenade, Old Devil Moon, I Can't Get Started*, and *The Very Thought of You*. Like Waller, he places his own stamp on everything he does. In this case, it is a relaxed melodic one in fine sound.

Leon Berry: Giant Wurlitzer Pipe Organ, Vol. 2 Audio Fidelity AFLP1829

In the first volume of this series, Leon Berry engaged in a pyrotechnical display of some of the more dramatic aspects of the theater organ located in Chicago's Hub Rink. As though to prove it has another side, he now subdues it with the melodic and moody playing of quiet tunes. Of a dozen numbers, only a rousing *College Medley* and *Tango of the Drums* disturb the comparative calm. But there is no lack of material to demonstrate instrumental effects on *Syncopated Clock, I Hear You Knocking*, and *Three O'Clock in the Morning*. And they remain in balance at low volume in this close, well-defined recording. Included are such favorites as *Squeeze Me, Louise, Night Wind, No Other Love*, and *Boulevard of Broken Dreams*.

The Story Of Moondog
Prestige LP7099

The third installment of the Moondog story finds him busy with further experiments in rhythm on instruments of his own design. Some are carried out against a background of the roar of Broadway in his impressions of Birdland and the Palladium. Drummer Sam Ulano helps describe the jazz emporium in a 1/4 time dog trot. Moving a block North to detail Afro-Cuban rhythms, he is aided by Suzuko on the Yukh, a log suspended from a tripod and hit with two rubber mallets held in the right hand. Ray Malone joins him for a softshoe dance in 5/4 and 7/4 time.

Other of his inventions are the Oo and Tujl, and he plays his last set of square drums made before shifting to the triangular-shaped Trimba. A piano improvisation, organ solo and his howling wolf theme are also engraved for posterity. Moondog likes to record when and where the mood strikes, so the quality of the fourteen tracks is variable. Most apropos is the cover design by Reid Miles, with its artful use of calligraphy by Andy Worhol's mother. That she also signs all his drawings makes her signature better known to Madison Avenue than Broadway, but it is a match for the "secret music" of Moondog.

Excerpts from PRESS COMMENT on the

AR-2

High Fidelity (Tested in the Home)

"... With the (tweeter) control set to suit my taste (best described as row-M-oriented), oscillator tests indicated that bass was smooth and very clean to below 40 cycles, was audibly enfeebled but still there at 35, and dropped out somewhere around 30 cycles. No doubling was audible at any frequency.

From 1,000 to 4,000 cycles there was a slight, broad dip in the response (averaging perhaps 2 db down), a gradual rise to original level at 8,000 cycles, and some minor discontinuities from there out to 12,000 cycles. Then there was a slow droop to 14,000 cycles, with rapid cutoff above that.

Because of its slightly depressed 'presence' range, the AR-2 has what is to me a refreshingly sweet, smooth, and highly listenable sound. Music is reproduced transparently, and with very good detail. Its high end is unobtrusive, but its ability to reproduce the guttiness of string tone and the tearing transients of a trumpet indicate that it is, indeed, contributing highs when needed. This, I feel, is as it should be.

Its low end is remarkably clean and, like the AR-1, prompts disbelief that such deep bass could emanate from such a small box.

"... Like the AR-1, the AR-2 should be judged purely on its sonic merits ... not on the theoretical basis of its 'restrictive' cabinet size. When so judged, it can stand comparison with many speakers of considerably greater dimension and price.—J.G.H."

AUDIO ETC.

"... I find the AR-2 remarkably like the AR-1 in over-all sound coloration. Its cone tweeter is not the same, but there isn't much difference in sound. (It costs less, but that doesn't prove much.) On direct comparison, given a signal with plenty of bass component in the very bottom, you can tell the difference between the two in bass response. Most of the time, in ordinary listening, I am not aware of it at all.

... I find AR-2, as with AR-1, remarkably clean and unobtrusive in its sound, easy on the ears for long-period listening, easy also to ignore in favor of the music itself. Either speaker has a way of simply fading into the surroundings (the size helps) leaving the music unattached and disembodied in the room. Excellent illusion! ..."

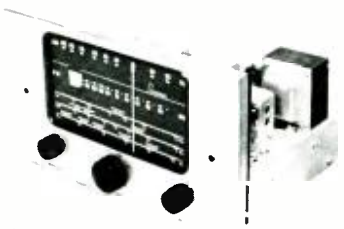
Prices for Acoustic Research speaker systems, complete with cabinets, (AR-1 and AR-2) are $89.00 to $194.00. Size is "bookshelf." Literature is available from your local sound equipment dealer, or on request from:

ACOUSTIC RESEARCH, INC. 24 Thorndike St., Cambridge 41, Mass.

www.americanradiohistory.com

NEW PRODUCTS

• **British AM/FM/SW Tuner.** Now available in the U.S. for the first time, the British-made Chapman Model S-52 "Globemaster" high-fidelity tuner provides good sensitivity and selectivity with drift-free tuning on standard FM and AM broadcast bands, as well as short-wave bands of 90-250, 35–100, and 12.5–37 meters. All AM bands use a tuned-r.f. amplifier, a triode/hexode frequency changer and a high-gain 470-kc i.f. amplifier. Sensitivity is better than 8 microvolts for a 20-db signal-to-noise ratio. The FM scetion of the Chapman employs two i.f. stages. The second stage serves as a high-level limiter and

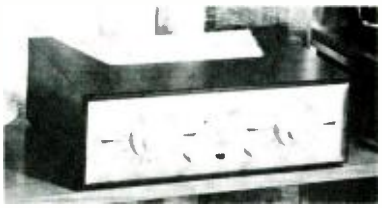


is followed by a high-quality wideband ratio detector. Sensitivity is better than 4 microvolts for 20 db quieting at 22.5 kc deviation. Remarkably small considering its many functions, the tuner measures 12" w × 9¼" d × 7⅝" h. The Globemaster is manufactured by C. T. Chapman Reproducers, Ltd., High Wycombe, Bucks., England, and is distributed in the U.S. by Ercona Corp., 551 Fifth Ave., New York 17, N. Y. **M-1**

• **Stromberg-Carlson FM-AM Tuner.** Recently added to Stromberg-Carlson's "Custom Four Hundred" line of high-fidelity components, the Model 403B tuner has a frequency response of 30 to 15,000 cps with less than 1.0 per cent total harmonic distortion. Sensitivity is 3.0 microvolts

for 20 db quieting on FM, and 5.0 microvolts for 0.1 volt audio output on AM. Temperature-compensated oscillator circuits prevent drift. Fully enclosed in a handsome hand-rubbed mahogany cabinet, the 403B has an edge-lighted slide-rule tuning scale, and is equipped with two utility outlets for plugging in auxiliary equipment. Front controls are an FM-AM selector, and tuning knob. A volume control is located on the rear of the chassis. The 403B meets all FCC and EIA specifications for spurious radiation, and is U.L. approved. Stromberg-Carlson Corporation, Rochester 3, N. Y. **M-2**

• **Scott Stereo Tuner.** Advanced engineering design has raised FM sensitivity to 2.0 microvolts for 20 db quieting in the newly-announced improved version of the H. H. Scott Model 330 stereophonic tuner. In addition to improved performance, new features include new chassis design for easier panel installation and illuminated signal strength meter. AM and FM sections are completely separate. Stereo is achieved by connecting one amplifier to the AM side, a second to the FM side, each with its own speaker. The tuner also



has provisions for multiplex reception so that it will be able to handle any future type of stereo broadcasting. For a complete descriptive bulletin on the new Model 330 stereo tuner write: H. H. Scott, Inc., Department P, 111 Powdermill Road, Maynard, Mass. **M-3**

• **High-Output Miniature Pentode.** Developed primarily for use as a class B power amplifier in hi-fi equipment with over 20-watt power rating, the new Amperex Type 6BQ5A delivers 24 watts with only 4.0

per cent distortion. It is one of the new Amperex series of "preferred" types for high-quality audio applications. Detailed data and applications engineering information are available from Special Purpose Tube Division, Amperex Electronic Corp., 230 Duffy Ave., Hicksville, N. Y. **M-4**

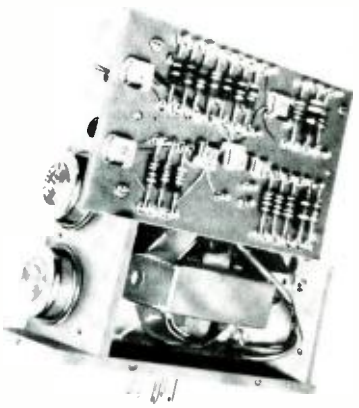
• **United Speaker Systems.** Two new models recently added to the United line, Types X-200 and X-100, in the moderate- and low-priced categories, respectively, are both of low-boy design and are suitable for either wall or corner placement. The X-200 employs two matched 8½-in.

AccuSonic bass drivers coupled to an exponential horn with a mouth area of 4 sq. ft. High frequencies are reproduced by two 3-in. cone tweeters. Frequency response is 37 to 18,000 cps. The X-100, illustrated, employs a single AccuSonic woofer with matching tweeter to obtain a smooth frequency response from 45 to 16,000 cps. Cabinets are made from ¾-in. furniture plywood throughout with hand-rubbed finishes. Descriptive sheets will be mailed on request. Write: United Speaker Systems, 34 New St., Newark 2, N. J. **M-5**

• **Plastic Tape Container.** A new permanent plastic package for its line of Sonoramic recording tapes has recently been introduced by Ferrodynamics Corporation, Ledi, N. J. The Sonoramic container is a

shatter-proof high-impact polystyrene box with a hinged front that snaps open at the flick of a finger, pushing the reel forward for easy access. The box closes tightly to protect tape against dust and dirt. Pressure-sensitive index labels are provided with each container to permit the user to identify recorded tapes. **M-6**

• **Small P. A. Amplifier.** A 20-watt transistorized plug-in amplifier for p.a. systems, which replaces comparable units more than eight times its size, is now be-

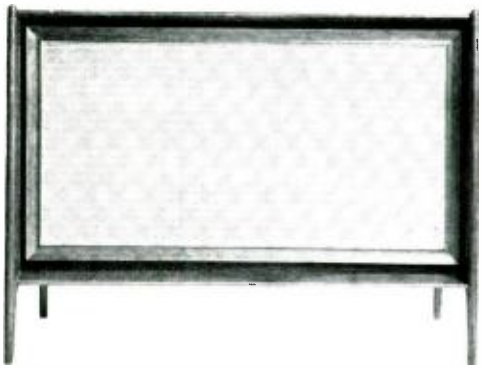


ing produced by Universal Transistor Products Corp., 143 E. 49th St., New York 17, N. Y. Measuring but 5" × 5" × 2", the amplifier is equipped with built-in equalization, has a signal-to-noise ratio greater than 30 db, and covers a frequency range of 50 to 20,000 cps. It incorporates peak clipping and gain control, and meets military environmental specifications. **M-7**

• **Glaser-Steers 4-Speed Record Changer.** Many features of interest to high fidelity enthusiasts are incorporated in the new "GS Seventy-Seven" record changer recently introduced by the Glaser-Steers Corporation, Belleville, N. J. Unique is the fact that the turntable stops during the change cycle, resuming motion only after the next record is in playing position, thus eliminating the grinding action which results when a stationary disc is dropped upon one which is revolving. A four-pole hum-shielded motor with dynamically-balanced rotor and highly cushioned mounts reduces rumble to a level which compares favorably with that of a manual turntable. The pickup arm is an aluminum die casting, acoustically isolated, with an easily accessible vernier

www.americanradiohistory.com

are you sure you have the best?



FRONT VIEW

SIDE VIEW

Consider the one forward step by which sound reproduction could be vastly improved:

A servo-mechanism to feed data from speakers to amplifiers to correct distortion even before it begins.

Even the finest conventional sound systems distort . . . the distortion coming from room acoustics, cabinet resonances, and especially the loudspeakers. All this could be dramatically reduced—actually, could have been reduced years ago —by this one change!

The servo principle has been used for years in automation, where servo-mechanisms check output to keep it correct. Obviously, audio engineers have recognized it too; some have even incorporated a few of the servo-speaker principles in their own sound systems. Yet the speakers and amplifiers available to *you* have continued to be offered in their conventional form, year after year. *Until Integrand.*

Just off the drawing board, the Integrand is the first complete amplifier — speaker system employing servo techniques. Distortion? The Integrand system permits less distortion in the overall sound than a good amplifier alone will produce under laboratory test conditions! Sound reproduction from the Integrand Servo-System is very, very near the ultimate . . . and very, very superior to any conventional system. Both stereo and monaural systems are available.

There are many other remarkable differences in the Integrand which contribute to superior sound reproduction. Integrand does far more than slash previous distortion levels. Among other new features: Original speaker design. Transformerless, direct coupled amplifiers, one to power each of the three matched speakers. Fully transistored amplifiers and crossovers. Full stereo sound. And an unconditional guarantee for 2,000 hours of operation (about five years).

To get the whole story, you'll want to write for complete specifications, test data and a folder reprinting what the experts are saying about this new system. And you'll want to listen to the Integrand, so we'll send you the name of the audio dealer near you. Write to:

Technical details and specifications. Model 372 Stereo system.

Servo System The unit employs 6 direct coupled transformerless transistor amplifiers feeding 6 specially designed loudspeakers. Information from each speaker is fed back to its own servo amplifier. This data continuously and automatically corrects for the effects of room acoustics, cabinet resonances and the distortion arising from amplifiers and the non-linearities of the magnetic structures and suspension devices inherent to *any* loudspeaker. The result is an acoustic output uniquely free of distortion. Distortion is guaranteed to be less than 1% over the entire audio range when operating at 1 acoustic watt (Radiating into a solid angle of $\pi/4$ steradians; approximately 20 electrical watts).

Loudspeakers All speakers in the system are specially designed to produce piston operation over their operating ranges. Each voice coil is wound with rectangular wire and bonded with high temperature Epoxy to assure extreme rigidity and long life. The two 15" woofers are each equipped with a magnetic motor assembly weighing in excess of 12½ lbs. High and mid-range ring radiators are constructed coaxial and coplanar to each other and thus provide an unprecedented smoothness in the response at crossover. The mid-range ring radiator is foam rubber edge damped. The high frequency ring radiator features a new type of acoustic horn termination that completely eliminates the standing wave dip which exists on most high frequency radiators at about 12,000 cycles.

Transistored Amplifiers and Crossovers Each of the 6 fully transistored amplifiers contains its own crossover network. Crossovers are at 350 cycles for the woofers, 350 and 2500 cycles for the mid-range ring radiators and 2500 cycles for the high frequency ring radiators. All crossovers attenuate at the rate of 12db per octave outside of their transmission band.

All servo amplifiers are coupled to their respective speakers without the use of output transformers.

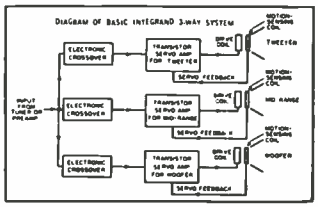
An input signal of 1 volt is required for the full power output of 72 watts.

Frequency Response Each Integrand Servo-Speaker System is supplied with an individual calibration of its own pressure response from 35 to 16,000 cycles and is guaranteed to be ± 3db over this range.

General Specifications The Model 372 Stereo Servo-Speaker System is housed in a handsome contemporary cabinet 44"w x 30"h x 20"d. Cabinets available in a selection of finely finished Walnut, Teak or Limba.

Model 372 may be instantly changed from stereo to monaural operation by switching the two servo channels into parallel. Each system is guaranteed for 2000 operating hours (approximately 5 years). The system contains a built-in timing device to protect this guarantee.

Model 372 Walnut $595.00. Monaural and other Integrand Servo-Speaker Systems from $375. All prices and specifications subject to change without notice.



Block diagram for basic Integrand three-way system. Model 372 Stereo Servo-system contains two (one for each channel).

BRAND PRODUCTS, INC. *Dept. A12, Westbury, New York • Marketing organization for Integrand Corporation*

INTEGRAND®

SERVO SPEAKER AMPLIFIER SYSTEM

www.americanradiohistory.com

PROOF OF *Excellence*

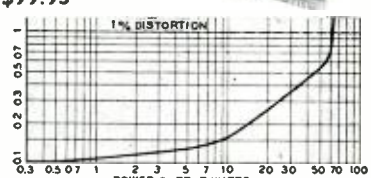
EICO HF-61A
MASTER-CONTROL PREAMPLIFIER

KIT $24.95
WIRED $37.95
(powered by any EICO power amplifier)

HF61 (with Power Supply) KIT $29.95 WIRED $44.95

"...the HF-61's performance rivals that of the most expensive preamps. There are inputs for several types of phono cartridges; five phono-equalization curves; a tape output which follows the filters but precedes the tone-control stages; inputs for tape recorder, tuner, TV, and an auxiliary; AC sockets for four other pieces of equipment; the Compentrol type of loudness control with a separate level control; the excellent tone-control action of the Baxendall circuit; a hum adjustment; and low-impedance main output. All in all, here is an example of a high level of engineering skill, which has managed to achieve fine performance with simple means and low cost."
Joseph Marshall – AUDIOCRAFT, April, 1957

HF60 60-WATT Ultra-Linear POWER AMPLIFIER with ACRO TO-330 Output Xfmr
KIT $72.95
WIRED $99.95



IM distortion vs. power output as measured by AUDIOCRAFT.

"As far down and as far up as we are equipped to measure, the frequency-response specifications were met easily. Square-wave response was nearly perfect with any kind of load: resistive, inductive, or capacitive. The only way we could make the amplifier show noticeable high-frequency ringing was to operate it with NO load at all. Low-frequency stability was excellent also . . . Listening tests confirmed the fine instrument test results without question. Our HF-60 produced firm, well-defined bass and clear, sweet treble on the finest speaker systems available. It clipped momentary overloads very well and recovered quickly, and this gave listeners the impression of tremendous reserve power. In our opinion, it is one of the best-performing amplifiers extant; it is obviously an excellent buy."
AUDIOCRAFT Kit Report, July, 1957.

Also Available:

HF50 50-WATT Ultra-Linear Power Amplifier with extremely high quality *Chicago Standard Output Transformer*. Identical in every other respect to *HF60* and same specifications up to 50 watts.

KIT $57.95 WIRED $87.95

HF52 Integrated 50-WATT Ultra-Linear Amplifier and Preamplifier-Control Section on one chassis. All preamp features of *HF61* less scratch and rumble filters. Power amplifier section essentially identical to *HF50*.

KIT $69.95 WIRED $109.95

Prices 5% higher on West Coast
IN STOCK at your neighborhood distributor
Write for free Catalog A-12

EICO® 33-00 NORTHERN BLVD. LONG ISLAND CITY 1, N. Y.

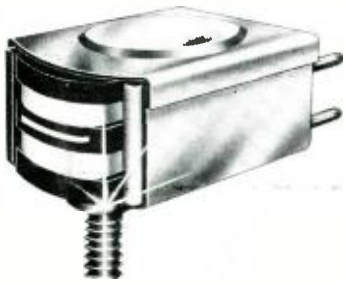
adjustment for stylus force. Specifications state that the arm has no resonance within the audio range, and that variation of stylus force between the first and tenth

record on the turntable is less than one gram. Other features include single, concentric operating control, muting switch, and jamproof operation—the arm movement may be restricted during change cycle without damage, or the arm may be relocated during automatic play without tripping the change mechanism. **M-8**

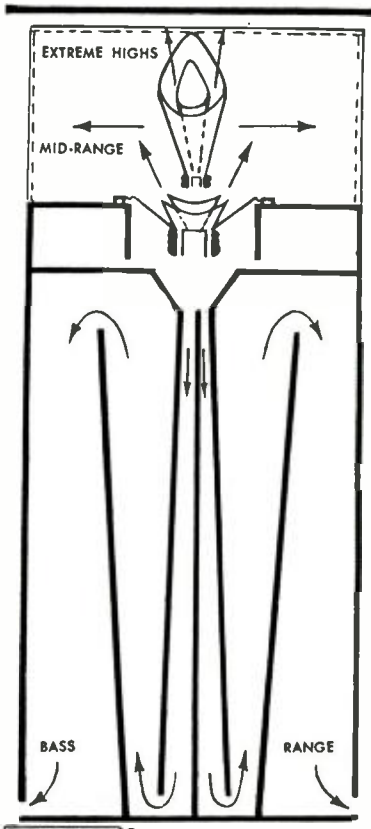
● **Transistorized Amplifier.** Although designed primarily for use in home music reproducing systems, the Vico Model 77 amplifier is equally suitable for installation on trains, buses and aircraft. At normal listening levels it consumes less power and generates less heat than an electric clock. Maximum rated power output is 20 watts. Frequency response is within ± 0.5 db from 20 to 30,000 cps. Distortion is less than 0.5 per cent. Hum is stated to be more than 100 db below rated output. Component life is expected to be

infinite since the maximum applied voltage is only 15 volts. The amplifier is designed for operation from a 117-volt 60-cycle source or from a 12-volt battery. It may be operated directly from vehicle batteries without requiring vibrators or other power conversion devices. The front panel is provided with bass, treble, input selection, and loudness controls. Complete technical specifications may be obtained by writing to the manufacturer, Video Instrument Company, Inc., 2340 Sawtelle Blvd., Los Angeles 64, Calif. **M-9**

● **In-Line Stereo Tape Head.** An interchannel magnetic shield which affords a high degree (48 db) of crosstalk rejection is a feature of the new Model TLD-S recording head, recently announced by The Nortronics Company, 1015 S. Sixth St.,



Minneapolis 4, Minn. Developed for high-fidelity recording and reproduction in both monaural and stereo applications, the head can easily be compensated to provide flat response between 30 and 10,000 cps. It is ideally suited for use in new equipment design, modernization, replacement, and for conversion of existing tape handling equipment. Economically priced, the Norco head is now available to manufacturers in quantity. **M-10**



EICO® *proudly presents . . .*
a major break-through in speaker system development

a new combined horn and direct-radiator system having uncolored transient response, superb damping, and non-directional sound distribution. Includes built-in LC dividing network and balance control.

Frequency Response: essentially flat 45-20,000 cps; useful response 30-40,000 cps.
Rated Impedance: 16 ohms.
Efficiency: can be driven satisfactorily from good amplifiers having a power output as low as 10 watts.
Rated Power Handling: 30 watts integrated program material.
Dimensions: 36" high, 15¼" wide, 11½" deep. Weight 45 lbs.
Finishes: hand-rubbed mahogany, walnut, or blonde.
Price: $139.95 net. Blonde, $144.95.

If you appreciate the difference between artificial "hi-fi" and truly natural sound, listen to the EICO New Standard Speaker System at your local distributor. For complete data, write for free Bulletin AX-12.

EICO® 33-00 Northern Blvd. Long Island City 1, N. Y.
Prices 5% higher on West Coast

www.americanradiohistory.com

a high quality system at low cost... from EICO

NEW!
FM TUNER
HFT90

KIT, less cover $39.95*
WIRED, less cover $65.95*
Cover ..... $ 3.95
*excise tax incl.

Newly-designed, extremely sensitive, low-noise "front end", supplied in a cast housing completely pre-wired, pre-aligned, ready to use. Employs temperature-compensated components and advanced circuitry to completely eliminate need for AFC. Drift less than 2 parts in 10,000 from cold start. Radiation supressed far below FCC standards. Also features new DM-70 traveling tuning eye. Sensitivity, unapproached among FM tuner kits, of 1.5 uv for 20 db quieting**. Input 300 ohms, IF bandwidth 260 kc, detector peak separation of 600 kc. Freq. resp. 20-20,000 cps ±1 db. Audio output 1 V for 10 uv input with 75 kc deviation. Hum 60 db below 1 V. Cathode follower and multiplex outputs. Flywheel slide-rule tuning. AGC, stabilized low limiting threshold for excellent performance from weaker signals, broad-band ratio detector for improved capture ratio and easier tuning, full-wave rectifier and heavy filtering, very low distortion. Uses 1-ECC85/6AQ8, 3-6AU6, 1-6AL5, 1-6C4, 1-DM70, 1-6X4. Flexible "low silhouette" design adaptable to any panel thickness for console installation; optional cabinet. HWD: 3⅝" x 12" x 8¼". Operates from 110-125 VAC, 60 cps line.
**Typical unit, measured with Marconi TF 955A/2 FM-AM signal generator.

12-WATT
Williamson-Type
HIGH FIDELITY
INTEGRATED AMPLIFIER HF12
with Preamplifier, Equalizer and Control Sec
KIT $34.95 Wired $57.95

Compact, beautifully packaged and styled. Provides complete "front-end" facilities and true high fidelity performance. Direct tape head and magnetic phono inputs with NARTB (tape) and RIAA (phono) feedback equalizations. 6-tube circuit, dual triode for variable turnover bass and treble feedback-type tone controls. Output Power: 12 w cont., 25 w pk. IM Dist. (60 & 6000 cps @ 4:1): 1.3% @ 12 w; 0.55% @ 6 w; 0.3% @ 4 w. Freq. Resp.: 1 w: ±0.5 db 12 cps–75 kc; 12 w: ±0.5 db 25 cps – 20 kc. Harmonic Dist: 20 cps: 2% @ 4.5 w; ½% @ 2.5 w; 30 cps: 2% @ 11 w; ½% @ 6 w; 40 cps: 1% @ 12 w; ½% @ 9 w; 2000 cps: ½% @ 12 w; 10 kc: 1% @ 10 w; ½% @ 4 w. Transient Resp: excellent square wave reproduction (4 usec rise-time); negligible ringing, rapid settling on 10 kc square wave. Inverse Feedback: 20 db Stability Margin: 12 db. Damping Factor: above 7, 20 cps – 15 kc. Sensitivity (input for 12 W): Mag. Phono. – 9 mv; Tape Head – 6 mv; Tuner, Aux – 0.5 v. Hum & Noise Level (below 12 W): Mag. Phono – *60 db; Tape Head – *55 db; Tuner, Aux – 75 db. Speaker Connections: 4, 8, 16 ohms. Tone Control Range: @ 10 kc, ±13 db; @ 50 cps, ±16 db. Tubes: 2-ECC83/12AX7, 1-ECC82/12AU7, 2-EL84, 1-EZ81. Mounts in or out of cabinet. Size: HWD: 3⅝" x 12" x 8¼". 13 lbs.
*includes effect of compensation.

TWO-WAY
SPEAKER SYSTEM
HFSI $39.95
complete with
FACTORY-BUILT
CABINET

Jensen heavy-duty 8" woofer & matching Jensen compression-driver exponential horn tweeter. Smooth clean bass & crisp, extended nautral highs. Overall response: ±6 db 70-12,000 cps. Power-handling capacity: 25 w. Impedance: 8 ohms. Bookshelf size: 23" x 11" x 9". 25 lbs. Wiring Time: 15 min.

IN STOCK at your neighborhood distributor.
Write for free catalog A-12
EICO® 33-00 NORTHERN BLVD. LONG ISLAND CITY 1, N. Y.
Prices 5% higher on West Coast

HOW TO PLAN

(from page 25)

formance. How much quality is gained by an additional outlay of money is important for the planner to have in mind before becoming obsessed with any one particular system, or with the struggle to achieve the ultimate.

After reviewing several synthetic systems, one begins to realize that high-quality audio reproduction can be achieved. In fact, some of the more advanced systems will give a performance that is virtually indistinguishable from the original. The second significant point is that the cost of a high-quality system is likely to be a little more than had originally been estimated. The choice of components that will lie ahead will be rather delicate because the mistakes can be costly.

Although the actual measures of performance of a hi-fi system are subjective, the person who has gained a limited amount of listening skill should be in a position to make comparative tests and to place his subjective reactions on a quantitative basis. If such crude measures can be made, then one can rate different systems. With these ratings together with the cost data, one can then construct the "cost-effectiveness" curve which can be an invaluable aid to system planning. In the beginning we recommend that the rater confine his attention to the general impression of "listening pleasure" or "presence" and take up more detailed refinements at a later time. Initial tests of this kind are sufficient to convice some "interested listeners" that the systems of moderate quality are adequate for the purpose, but others will lay aside all thoughts of intermediate steps and plan for the highest standards of performance that are possible.

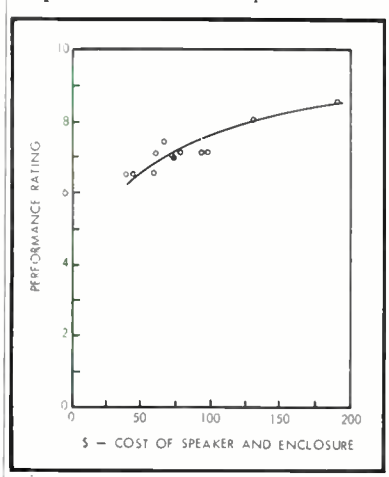


Fig. 2. Curve of cost vs. performance as constructed from the data in Table I, covering the test of the least costly systems.

two more BEST BUYS... from EICO

20-WATT
Ultra-Linear
Williamson-Type
INTEGRATED
HIGH FIDELITY
AMPLIFIER HF20
complete with Preamp-Control Section
KIT $49.95 WIRED $79.95

During its first year, the HF20 has received consistently high praise from users—has become established as the outstanding value in amplifiers of this power class. Employs an output transformer capable of handling far in excess of its rated 20 watts, a full Ultra-Linear Williamson power amplifier, and the finest pre-amplifier-control facilities. Rated Output: 20 w (34 w pk.) IM Distortion (60 & 7,000 cps @ 4:1): 1.3% @ 20 w. Harmonic Distortion: below 1% from 20-20,000 cps within 1 db of 20 w. Freq. Resp.: ±0.5 db 15-30,000 cps at any level from 1 mw to 20 w; no peaking or raggedness outside audio range. Square Wave Resp.: 20-20,000 cps essentially undistorted. Sens.: 4 mv on mag phono & .4 v on tuner, etc., for 20 w output. Hum & Noise: 60 db below 20 w on mag phono, 75 db below 20 w on tuner, etc. 5 feedback equalizations for LPs & 78s. 4 hi-level switched inputs (tuner, tv, tape, crystal), unused inputs grounded to eliminate cross-talk; 2 low-level inputs for proper loading with all cartridges. Low distortion variable crossover feedback tone controls: ±15 db @ 50 cps & ±15 db at 10 kc, with mid-freqs. & volume unaffected. Hum bal. control. DC superimposed on tube filaments to eliminate cathode-heater leakage as hum source. Centralab printed circuit "Compentrol." Loudness control & separate level set control on front panel. Extremely fine output transformer: interleaved windings, tight coupling, careful balancing, grain-oriented steel. Speaker Connections: 4, 8 & 16 ohms. HWD: 8½" x 15" x 10". 24 lbs. Matching Cover E-1, $4.50.

NEW! 30-WATT
High Fidelity
POWER
AMPLIFIER HF30
KIT $39.95 WIRED $62.95

Four EL84 output tubes in push-pull parallel; high power sensitivity eliminates need for extra driver stages, permitting Williamson-type circuit with large inverse feedback and high stability margin. 6 lb. output transformer, extensively interleaved windings & grain-oriented steel laminations. Surge-free, high reliability power supply using two EZ81 full-wave rectifiers. Power take-off socket for EICO HF61A Preamplifier. Rated Output: 30 w (47 w pk.) IM Distortion: (60 & 7,000 cps @ 4:1) 2% @ 30 w; 0.83 @ 20 w; 0.35% @ 10 w. Harmonic Distortion: below 1% from 20-20,000 cps within 1 db of 30 w. Freq. Resp.: ±0.1 db 15-80,000 cps & ±1.5 db 15-100,000 cps, at any level from 1 mw to 30 w; no peaking or raggedness outside audio range. Square Wave Resp.: 20-20,000 cps essentially undistorted. Inverse Feedback: 20 db. Stability Margin: 15 db. Damping Factor: above 10, 20 cps to 20 kc. Sens.: 1.24 V for 30 w. Hum: 80 db. below 30 w. Speaker Connections: 4, 8, and 16 ohms. HWD: 5" x 12" x 7". 17 lbs. Matching Cover E-3, $3.95.

EICO® 33-00 NORTHERN BLVD. LONG ISLAND CITY 1, N. Y.
Please send FREE catalog and name of neighborhood distributor or high fidelity specialist.
Name.....
Address.....
City.....Zone.....State.....
Prices 5% higher on West Coast A-12

www.americanradiohistory.com

DYNAKIT

Preamplifier

An Outstanding Companion Kit to the World Famous Dynakit Amplifiers

This handsome new control unit gives crystal clear, noise-free reproduction from *any* modern program source. Its unique all feedback design by David Hafler sets a new standard of pre-amplifier performance. The design of the Dynakit preamplifier is a synthesis of outstanding features which produce smoother, more natural sound. Compare these features with any other units regardless of price.

★ **Unequalled performance**
Actually less than .1% *distortion* under all normal operating conditions. *Response* ± .5 db 6 cps to over 60 kc. Distortion and response unaffected by settings of volume control. Superlative square wave performance, and complete damping on any pulse or transient test.

★ **Easiest assembly**
All critical parts supplied factory-mounted on XXXP printed circuit board. Eyeleted construction prevents damage to printed wiring. This type of construction cuts wiring time by 50% and eliminates errors of assembly. Open simplified layout offers complete accessibility to all parts.

★ **Lowest noise**
Integral dc heater supply plus low noise components and circuitry bring noise to less than 3 microvolt equivalent noise input on RIAA phono position. This is better than 70 db below level of 10 millivolt magnetic cartridge.

★ **Finest parts**
1% components in equalization circuits to insure accurate compensation of recording characteristics. Long life electrolytic capacitors and other premium grade components for long trouble-free service.

★ **High Flexibility**
Six inputs with option of extra phono, tape head, or mike input. Four ac outlets. Controls include tape AB monitor switch, loudness with disabling switch, full range feedback tone controls. Takes power from Dynakit, Heathkit, or any amplifier with octal power socket.

★ **Outstanding appearance**
Choice of bone white or charcoal brown decorator colors to blend with any decor. Finished in indestructible vinyl coating with solid brass escutcheon.

★ **Best Buy**
Available from your Hi-Fi dealer at only $34.95 net (slightly higher in the West), and yet the quality of performance and parts is unexcelled at any price.

Descriptive brochure available on request

Pat. Pending

DYNACO INC.

617 N. 41st St., Philadelphia, Pa.

Export Division: 25 Warren St., New York 7, N. Y.

TABLE I

COMPARISON OF SPEAKERS AND AMPLIFIERS — TEST No. 1

ENCLOSURE Type	Cost	SPKR No.	Cost	TOTAL COST	PERFORMANCE RATINGS L.F.	M.F.	H.F.	Overall
A	18.00	1	41.60	59.60	6	8	8	7
A	18.00	2	45.00	63.00	6	8	8	7.5
A	18.00	3	54.50	72.50	5	8	8	7
A	18.00	4	76.50	94.50	6	8	8	7.2
A	18.00	5	57.60	75.50	6	8	8	7.2
A	18.00	6	54.00	72.00	6	8	8	7
A	18.00	7	40.00	58.00	5	8	7	6.5
A	18.00	8	20.50	38.50	5	8	7	6.5
A	18.00	9	27.00	45.00	5	8	7	6.5
A	18.00	10	25.00	43.00	5	8	7	6.5
A	18.00	11	79.50	97.50	6	8	8	7
A	18.00	12	114.00	132.00	7	9	9	8
K	50.00	13	74.50	124.50	8	9	8	8.8

Williamson-type amplifier ($190.00), record changer ($68.00), and magnetic pickup not changed during test

Speakers tested included single-cone extended-range models, and two- and three-way integral models.

Enclosure types: A is bass reflex in kit form, unfinished plywood
K is Karlson-type, in kit form.

Typical Test Results

The results of two tests are tabulated in Tables I and II, and are plotted in graphical for in *Figs.* 2 and 3. These curves show a distribution of points up and down the scale of performance or effectiveness, plotted against the costs of the respective speakers and enclosures. The performance generally rises with cost. The total system costs could be derived by adding the amplifier and changer costs in each case. The most expensive system was $978, while the least costly was $296, but the lower figure could have been reduced by using less expensive amplifiers without affecting acoustical performance.

TABLE II

COMPARISON OF SPEAKERS AND ENCLOSURES — TEST No. 2

ENCLOSURE AND SPEAKER Type (Finished Unit)	TOTAL COST	PERFORMANCE RATINGS L.F.	M.F.	H.F.	Overall
(a) With amplifier and preamp at $190.00. Speakers include two- and three-way types					
BACK-LOADED HORN	244.50	7	9	9	8.5
BACK-LOADED HORN	276.00	7	9	9	8.5
CORNER HORN	300.00	10	9	9	9.3
CORNER HORN	720.00	10	10	10	10
INFINITE BAFFLE (Dual Spkrs)	100.00	8	9	9	8.3
INFINITE BAFFLE (Two-way)	126.00	5	8	9	7
(b) With amplifier and preamp at $203.00.					
INFINITE BAFFLE (5 Spkrs)	256.00	7	9	10	8
INFINITE BAFFLE (9 Spkrs)	450.00	9	10	10	9.5

Some changer ($68.00) and magnetic pickup used throughout.

The distribution of points shown is peculiar to only one rater. If some other rater was to evaluate the same systems, he would probably place the points in different positions, but he would most likely get curves of about the same shape after averaging the points. In conferring with other listeners, however, the most expensive system was consistently rated as the top in quality. This unit was arbitrarily scored as 10, thereby establishing a standard at the top of the scale. At the lower level, the table model radio and a radio phonograph were scored at about 3 and 3.5 respectively, but these scores are not shown in the data or curves. These latter ratings set a lower limit or standard of "low-cost" performance. The region of high-fidelity begins with an over-all rating of about 6. The over-all rating was derived from three separate components, one to evaluate low-frequency response and freedom from distortion, one for medium frequencies, and the third for the highs.

The two curves show the extremes available for home listening. The combinations between these extremes are many, and the measures that can be taken to reduce the costs of the systems of highest quality are not exhausted in these two initial tests. For instance, one would like to see whether a system could be assembled having a performance between 9 and 10, but at a substantially lower cost than those listed in the tables. By using the "do-it-yourself" kits for the more complex systems, if they are available, such costs can be reduced; but one may be forced to forego the styling and fine finish of the speaker enclosure and the auxiliary cabinets. Cost reduction by a factor of two is a reasonable expectation.

At this point, one may have enough information to stir his enthusiasm, but not enough to be sure of his precise needs so that the system can be laid out. There is still another step the beginner may take before making any major decisions. This step is not essential for one who has made up his mind but is recommended for those who wish to develop better judgment. This step is to construct an "interim system" which will permit the experimenter to observe over a period of time the factors of importance to him which affect the performance of the system. With a judicious choice of components, one could apply any items purchased for the secondary system to the more advanced one. This experimental approach has the advantage of allowing one to study his re-

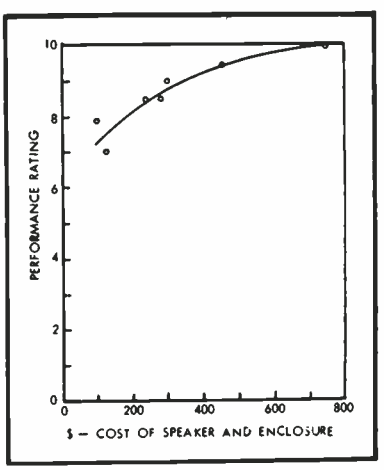


Fig. 3. Curve of cost vs. performance constructed from the data in Table II, covering the test of the most costly systems.

www.americanradiohistory.com

quirements more closely and to develop a better understanding of actual rather than fancied needs; it may also serve to stimulate more interest in still better performance. Another experimental approach is to take advantage of the free home trials offered by local shops. As much as you may like a piece of equipment in the store, sometimes it may not "wear well" at home.

A little rummaging around in the attic in my own case produced components that were adequate for the interim approach. For the dance party requirement, there developed a need for power output—undistorted—that was well beyond the ability of the secondary system. The audience was found to absorb substantial amounts of acoustic power, and in addition, create an ambient noise level which had to be overcome by the speaker output. The lack of low-frequency tones in the secondary system became apparent because the lows often carry the rhythm needed for dancing. For listening to concert music, the volume level had to be reduced to keep peace in the family, so the loss of lows was again accentuated. The lack of extreme highs caused no comparaable deep concern, so the extended high-frequency coverage will be included in the final system if it can be gained for a modest cost.

If you have been able to establish a standard of performance that the hi-fi system must eventually meet, then it is time to turn attention toward the second step in the planning cycle, that of selecting the individual components in such a way that the over-all cost is minimized without sacrificing the performance standard. In principle, at least, the beginner could extend the technique of listening tests so as to arrange the components to suit his need. We know of no better way to choose a speaker, but selecting a particular amplifier depends to some extent on how much the experimenter borrows from the "sound engineer" and the "music critic." Many would be satisfied with a simple substitution test using the chosen speaker and enclosure, and make use of a home trial. Selecting an amplifier in itself can be a detailed study the scope of this discussion; in fact, much has already been written on this subject.

Thus, if one can arrive realistically at some conclusions regarding his requirements in relation to what he can afford, the task of selecting the units for the system is reduced to manageable proportions; and one's limited energies and funds are not misdirected into unproductive channels. These two approaches are advocated as aids to planning: The comparative evaluation of system performance by actual listening tests, and the improvement of personal judgment through experience with an experimental or interim hi-fi system. Æ

LOUDNESS, ITS DEFINITION

(*from page 48*)

ing ten components of equal loudness and a common frequency difference of 100 cps. The results are shown in *Fig.* 9. It will be seen that although the points corresponding to the different frequency ranges lie approximately upon the same curve through the middle range, there are consistent departures at both the high and low intensities. If we choose the frequency of the components largely in the middle range then this factor b will be dependent only upon Δf and L_k.

To determine the value of b for this range in terms of Δf and L_k, a series of loudness measurements was made upon complex tones having ten components with a common difference in frequency Δf and all having a common loudness level L_k. The values of Δf were 340, 230, 112, and 56 cps. The fundamental for each tone was close to 1000 cps. The ten-component tones having frequencies which are multiples of 530 was included in this series. The results of loudness

TABLE V

COMPARISON OF CALCULATED AND OBSERVED FRACTIONAL LOUDNESS (LAIRD, TAYLOR AND WILLE)

Original Loudness Level	Level for ½ Loudness Reduction		Cal. Level for ½ Loudness Reduction
	Cal.	Obs.	
100	92	76.0	84
90	82	68.0	73
80	71	60.0	60
70	58	49.5	48
60	50	40.5	41
50	42	31.0	34
40	33	21.0	27
30	25	14.9	20
20	16	6.5	13
10	7	5.0	4

DYNAKIT

Amplifier Kits

A proven circuit of finest sound quality in a new deluxe 60 watt model and standard 50 watt model

MARK III 60 Watts **79.95*** net

4, 8, 16 ohm outputs

The new Mark III includes all the sensational attributes of the popular Mark II plus these outstanding deluxe features

★ 60 watts at less than 1% distortion. Instantaneous peak power of 140 watts. IM less than .05 at average listening levels.

★ Choke filtering and low noise circuitry reduce hum and noise to 96 db below 60 watts.

★ New rugged KT-88 tubes and other heavy duty parts used conservatively.

MARK II 50 Watts **69.75*** net

8, 16 ohm outputs

The Mark II is the best buy in high power high fidelity kits

★ Ease of assembly due to uniquely simple circuitry and printed circuit construction with factory-mounted parts.

★ Highest stability using patented stabilizing networks with minimum number of phase shifting stages. Suitable for all loudspeaker systems including electrostatic.

★ Dyna Biaset (patent pending) for simplified adjustment and complete freedom from effects of unbalanced components. No balancing adjustments required to meet published specifications.

★ Dynaco Super-Fidelity output transformer with patented para-coupled windings. This is the finest available transformer of its type for the most critical audio uses.

*Slightly higher in West

Available from leading Hi-Fi dealers everywhere
Descriptive brochure available on request.

DYNACO INC.

617 N. 41st Street, Philadelphia, Pa.

Export Division: 25 Warren St., New York 7, N. Y.

www.americanradiohistory.com

t-m KITS

■ Advanced designs for the best in high fidelity reproduction
■ Build and save • do-it-yourself
■ See them at your local radio parts distributor

New 60 WATT HIGH FIDELITY AMPLIFIER-PREAMP KIT

An integrated high power amplifier package for the audio perfectionist — complete with versatile pre-amplifier in one compact high styled unit — at a budget price. Undistorted power output is guaranteed to be 60 watts from 20 to 20,000 cps. Intermodulation is 1% at 60 watts and below 0.25% at ordinary listening levels.

Model 19K **$79.95**
Cabinet **7.50**

New 25 WATT HIGH FIDELITY AMPLIFIER-PREAMP KIT

Top quality integrated amplifier preamplifier system on a single chassis at exceptionally low price. Performance equals or exceeds any available amplifier up to rated power of 25 watts.

Model 21K **$59.95**
Cabinet **7.50**

WILLIAMSON TYPE 20-WATT AMPLIFIER

Frequency response flat and smooth thru entire audible range • Less than .0025 distortion at normal listening levels • Excellent transient characteristics.

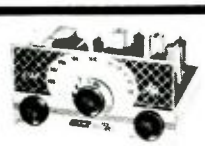
Model TM-15A, complete with tubes — sockets, terminal strips, and connectors mounted **$49.95**

PREAMPLIFIER with Cathode Follower Output

4 input channels • Separate bass and treble controls • 3-position equalizer • AC outlet for auxiliary equipment • Powered by main amplifier.

Model TM-17P, complete **$19.95**

HI-FI FM TUNER



Self-contained power supply • Tuning range 87-109 Mc • 200Kc IF bandwidth • Grounded-grid RF stage • AFC with front-control cutoff • Micro-vernier tuning • No-drift ratio detector • 4 uv sensitivity for 20 db quieting • Standard de-emphasis network • .8 volt RMS cathode-follower output • 3.2 volt RMS high-impedance output • 300 ohm input impedance • Switch-controlled AC receptacle for auxiliary equipment.

Model FM-18, complete with punched chassis, tubes, and hardware (less wire and solder) **$29.50**

TV Chassis Kit
For Picture Tubes Up to 21" (70°)

The most up-to-date TV kit, with the latest improvements. Coils are preadjusted and tuned at the factory. Sockets, terminal strips and connectors riveted on chassis • Super-selective, 12-channel turret tuner • New 600 ma, rugged, low-drain tubes • Operates 1v electrostatic-focus pix tubes • Circuit sensitivity of 9 microvolts at 20 v p-p • Three-stage stagger-tuned IF • AGC • Synchro-guide horizontal hold with AFC • Size 17" x 17" x 9".

Model 5516W... Same as above but with IF section fully wired and aligned. Uses Standard tuner (sensitivity 7 μv) **$99.50**

Deluxe
SUPERHET AC-DC RADIO

Broadcast Band — 550-1720 KC • Super-sensitive circuit with built-in loop antenna • AVC • 5 tubes.

Model 385K, complete with tubes and handsome bakelite cabinet (less wire and solder) **$19.95**

Write for latest catalog of complete Tech-Master line

t-m KITS *a product of* **TECH-MASTER CORPORATION**
75 Front Street, Brooklyn 1, N. Y.

TABLE IV

COMPARISON OF CALCULATED AND OBSERVED FRACTIONAL LOUDNESS (HAM AND PARKINSON)

S	L	G	Fractional Reduction in Loudness	
			Cal. %	Obs. %
350 Cycles				
74.0	85	25,000	100	100.0
70.4	82	19,800	79	83.0
67.7	79	15,800	63	67.0
64.0	75	11,400	46	49.0
59.0	70	7,950	32	35.0
54.0	65	5,870	24	26.0
44.0	53	2,680	11	15.0
34.0	41	1,100	4	8.0
59.5	71	8,510	100	100.0
57.7	69	7,440	87	92.0
55.0	66	6,240	73	77.0
49.0	59	4,070	48	57.0
44.0	53	2,680	31	38.0
39.0	47	1,780	21	25.0
34.0	41	1,060	12	13.0
24.0	29	324	4	6.0
1000 Cycles				
86.0	86	27,200	100	100.0
82.4	82	19,800	73	68.0
79.7	80	17,100	63	53.0
76.0	76	12,400	46	41.0
71.0	71	8,510	31	26.0
66.0	66	6,420	24	20.0
56.0	56	3,310	12	13.0
46.0	46	1,640	6	8.0
56.0	56	3,310	100	100.0
54.2	54	2,880	87	93.4
51.5	52	2,510	76	74.5
48.8	49	2,070	62	55.0
46.0	46	1,640	49	40.9
41.0	41	1,060	32	24.5
36.0	36	675	20	10.8
2500 Cycles				
74.0	69	7,440	100	100.0
70.4	64	5,560	75	86.4
67.7	62	4,950	67	68.1
64.0	58	3,820	51	49.5
59.0	53	2,680	36	32.8
54.0	48	1,920	26	23.3
44.0	39	890	12	13.0
34.0	30	360	5	6.7
44.0	39	890	100	100.0
42.2	37	740	83	94.6
39.5	36	675	76	82.2
36.8	33	505	57	61.1
34.0	30	360	41	46.0
29.0	26	222	25	27.8
24.0	21	113	13	14.9

www.americanradiohistory.com

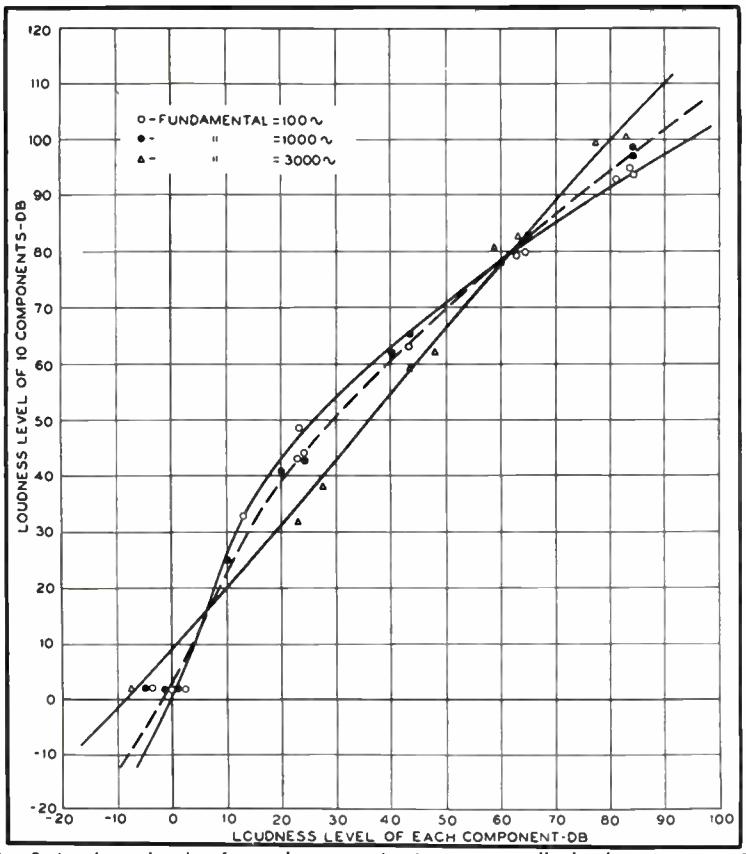


Fig. 8. Loudness levels of complex tones having ten equally loud components 50 cps apart.

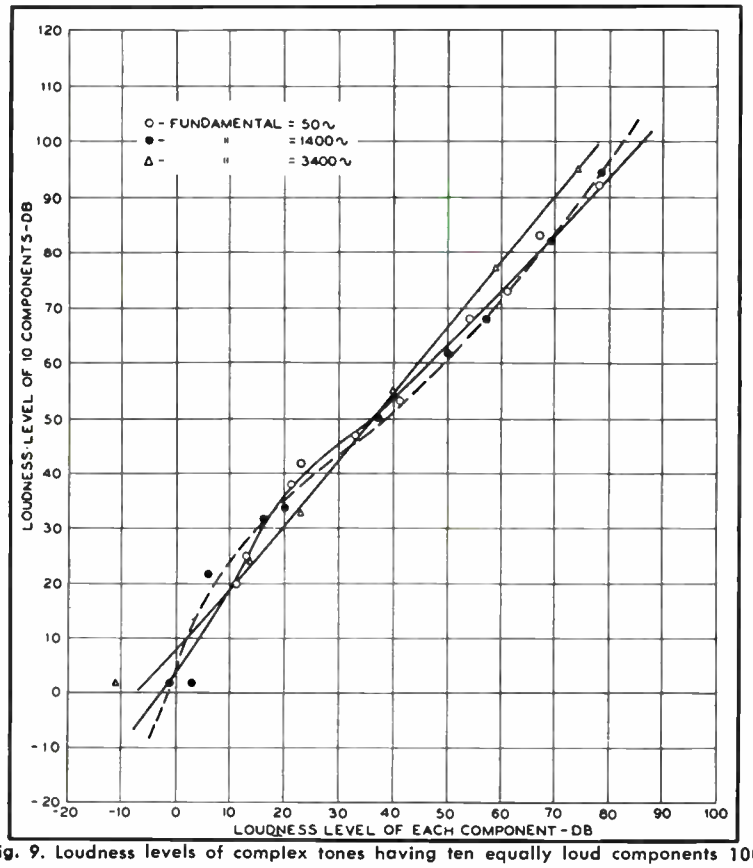


Fig. 9. Loudness levels of complex tones having ten equally loud components 100 cps apart.

Mister, You're Lucky...

For over thirty years Bakers have been making quality speakers for the discriminating British audiophile. These speakers are so outstandingly superior that they have long been known as "the best of the British speakers."

Mister, you're lucky...

for the new Bakers Ultra 12, full-frequency range, 12" speaker is now available in America for the first time.

A loudspeaker cannot be any better than what is put into it. The Bakers Ultra 12 is the best, not because of claims, but because design, parts, materials, and care in construction make it so. So look at the "specs." Frequency range ... 20 to 25,000 cycles. Flux density ... 18,000 gauss; 190,000 maxwells. High compliant, plastic foam, cone suspension. Non-resonant, cast, open, aluminum frame. Light, sensitive aluminum voice coil and former. Fully tropicalized. Hand assembled. Extra powerful Alcomax III encased in red cellulose. Dust, rust, and damp proofed. Exponential, bakelized apex, cone. Power ... 20 watts plus. Voice coil impedance ... 15 ohms. A full spread of 20 to 25,000 cycles without distortional crossover networks. Ingenious design and the use of new materials, processes, and techniques now make crossovers unnecessary. Acoustic, impedance and efficiency mismatch; "disembodied highs;" and other undesirable characteristics of crossovers, are thus eliminated.

This combination of features, *which cannot be found in any other speaker*, makes the Bakers Ultra 12, *unquestionably*, the finest reproducer today. And the price . . . a mere $85.00 . . . for the best.

If you want a speaker that is far superior to anything now available, insist on a dealer demonstration. You will be amazed at its smoothness, definition, cleanness, naturalness . . . a certain "something" that you have never heard before. Lucky owners say, *"Mister, this is it."* The "specs" tell you why.

Write for literature . . .
and become sound happy.

BRADFORD AUDIO CORP.
Sole distributors for the United States
27 East 38th Street
New York City 16, N. Y. OX 7-0523

www.americanradiohistory.com

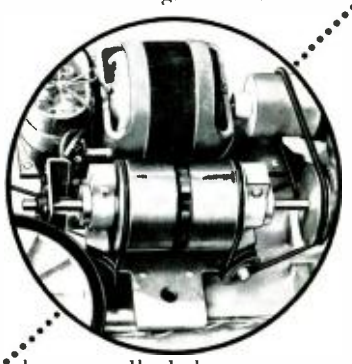
available now ...

the much talked about

ISI Tape Recorder

with the

magnetic clutch drive



the most talked about development in the industry

features

- Magnetic clutch braking and tape tension control — foul proof and virtually fool proof. Handles tape under all conditions and at all speeds without the possibility of spilling or breakage.
- Synchronous tape drive at 3¾ and 7½ ips or 7½ and 15 ips.
- Mounting space for six heads in all presently used head configurations.
- Designed for rack mounting with integral amplifier.
- Dual inputs and controls for mixing line and high impedance inputs.

THE ISI IS AVAILABLE NOW FOR EARLY DELIVERY ON A DIRECT FACTORY TO USER BASIS.

A truly professional piece of recording gear, the ISI is ideally suited for the serious audiophile, military and industrial data recording and the commercial recordist — priced from $345. The price of the machine is determined by the head compliment and accessory fittings.

For comprehensive information on this outstanding recorder write to:

Mid-Continent Engineering, Inc.

1712 Marshall N.E. Minneapolis, Minnesota

IF YOU ARE MOVING

Please notify our Circulation Department at least 5 weeks in advance. The Post Office does not forward magazines sent to wrong destinations unless you pay additional postage, and we can NOT duplicate copies sent to you once. To save yourself, us, and the Post Office a headache, won't you please cooperate? When notifying us, please give your old address and your new address.

Circulation Department
RADIO MAGAZINES, INC.
P. O. Box 629, Mineola, N. Y.

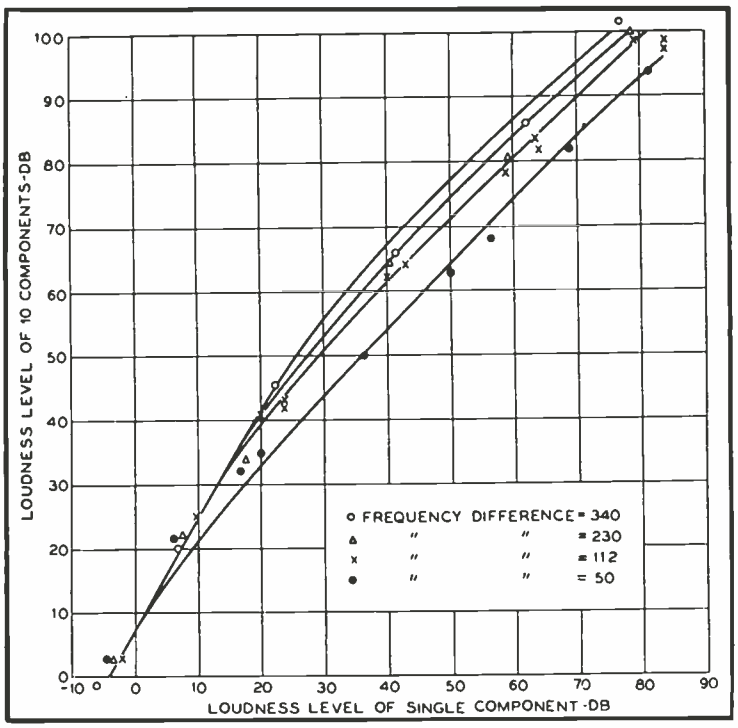


Fig. 10. Loudness levels of complex tones having ten equally loud components with a fundamental frequency of 1000 cps.

balances are shown by the points in *Fig.* 10.

By taking all the data as a whole, the curves were considered to give the best fit. The values of b were calculated from these curves as follows:

According to the assumptions made above, the component of lowest pitch in the series of components always has a value of b_k equal to unity. Therefore for the series of 10 components having a common loudness level L_k, the value of L is related to L_k by

$$G(L) = (1 + 9b_k)G(L_k)$$

or by solving for b_k

$$b_k = (1/9)[G(L)/G(L_k) - 1]. \quad (16)$$

(*To be continued*)

IMPEDANCE AND FEEDBACK

(*from page 34*)

back. In the case of current feedback and plate-to-cathode voltage feedback, the cathode swings in the same direction as the grid, although not quite to the same extent, so that the potential between the two is less than between grid and ground. For example, assume the incoming signal between grid and ground is 5 volts. Current or plate-to-cathode feedback may be such that the cathode potential with respect to ground varies 4 volts. Thus the grid-cathode signal voltage is only 1 volt and can be handled by the tube with much lower distortion than 5 volts.

Feedback and Impedance

A fundamental difference between the two types of negative feedback is that voltage feedback reduces the output impedance of a voltage-amplifier stage, whereas current feedback increases it. This is of vital importance with respect to frequency response and can also be of moment in the matter of gain. The lower the source impedance, the greater the assurance of flat response within the audio range, as discussed in the section on impedance and gain.

Why does negative voltage feedback decrease the output impedance? Referring to (C) of *Fig.* 14 and assuming a heavy capacitive load on V_2, it was previously explained that self-regulating action maintains flat frequency response. Similarly, a suitably small resistor in series with the capacitive load (see (B) in *Fig.* 5) would maintain frequency response to the same degree. Therefore the effective output impedance is that of the hypothetical small resistor.

www.americanradiohistory.com

Negative current feedback, instead of keeping output voltage constant, instead tends to keep output *current* at a constant value because changes in load current are opposed by the resultant change in potential between grid and cathode. Therefore slight changes in current flow through the output circuit are accompanied by relatively large voltage changes across the load on the tube; that is, with the load changing due to varying capacitive reactance at different frequencies, the output voltage varies since voltage equals current (nearly constant) times load impedance (varying). This situation is equivalent to that at a generator with a high output impedance inasmuch as a large resistor in series with the capacitive load would result in similar voltage changes across the load as the capacitive reactance varies.

From the foregoing it may be seen that although unbypassed cathode resistors are very useful as a means of reducing distortion by cancellation and/or by increasing the signal handling capacity of a tube, at the same time they can be a source of difficulty in maintaining treble response because of the resulting increase in output impedance. If the following stage is a triode and has large input capacitance due to Miller Effect, serious loss of high frequencies can take place.

There is one special and very important case in which negative current feedback effects a great decrease in output impedance, at the same time sacrificing voltage gain altogether. This is the case of the cathode follower, which illustrates some of the important relationships between feedback, impedance, and frequency response. *Figure* 17 is a typical cathode-follower circuit. It has very high input impedance and very low output impedance. Thus it has scant loading effect upon the preceding stage, and the input capacitance of the following stage has practically no effect upon frequency response.

The high input impedance of the cathode follower may be explained in a manner analogous to Miller Effect. Assume there is a positive-going signal at the grid. Feedback resistor R_f also goes positive due to increased current flow through it and the tube. Consequently the voltage across grid resistor R_g is less than if the resistor went directly to ground. A decrease in potential across a resistor of course decreases current flow through it, in this case the current of the signal source. But a decrease in current is precisely the same effect that would result from an increase in the value of the grid resistor. In sum, as far as the signal source is concerned, the effective value of R_g is increased because of the small potential across it and resultant decrease in signal current.

The input impedance of a cathode follower such as *Fig.* 17 is very nearly $Z \cong R_g/(1-K)$, where Z is impedance and K is the gain from the input to the tap on cathode resistor R_k (junction of the 1000- and 47,000-ohm resistors). When the grid resistor is connected to the cathode end of R_k or when the cathode bias resistor (1000 ohms) is well-bypassed by a capacitor, the value of K is equal to A, the gain of the cathode follower. $A = \mu/(1+\mu+r_p/R_k)$, where R_k is the total cathode resistance and r_p is the plate resistance. In cases such as *Fig.* 17, where r_p is substantially smaller than R_k, we have an approximate formula, $A \cong \mu/(\mu+1)$. Typically, A is about 0.95. Assuming this gain for *Fig.* 17, we have $K = 0.95 \times 47{,}000/48{,}000 \cong 0.93$. Therefore $Z \cong 1\ meg/(1-0.93) \cong 14.3$ megs. Had the 1000-ohm cathode bias resistor been bypassed, K would

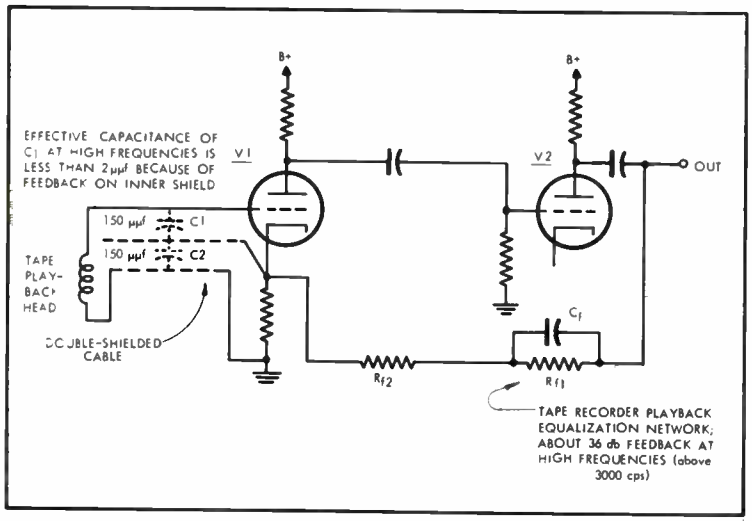


Fig. 16. Minimization of input capacitance at high frequencies by means of negative feedback.


FOR THE FINEST
EXTENDED RANGE LOUDSPEAKERS and MULTIPLE SPEAKER SYSTEMS
buy...
GOODMANS
For complete information on Goodmans' loudspeakers, speaker enclosure kits and the famous Goodmans' Acoustical Resistance Units, write to Dept. AG12, Rockbar Corporation, Mamaroneck, N.Y.
ROCKBAR Corporation
American Sales Representatives for Goodmans Ltd.

www.americanradiohistory.com

for the first time!

LOW COST

Hi-Fi

DO-IT-YOURSELF TEST RECORDS

89c

Fix and Test Your Hi-Fi System

So easy, so simple to fix your Hi-Fi system with any one of these records. Instructions and tests are in plain layman's language. No technical knowledge required.

QUIET, PLEASE! *Checks rumble.*

WHAT! NO HUM! *Measures hum.*

HOW'S YOUR STYLUS? *Stylus wear test.*

TRACKING SPECIAL! *Measures fundamental arm resonance, analyzes damping problems.*

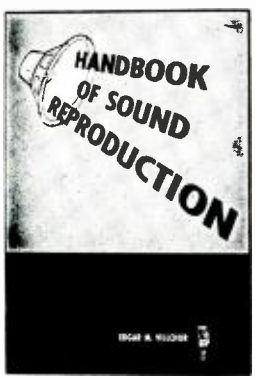
VERTICAL/LATERAL RESPONSE! *Measures ratio of vertical to lateral response.*

WOW! & FLUTTER, TOO! *Checks wow and flutter.*

PERFECT CHRISTMAS GIFT — for Christmas, give your Hi-Fi friends one or all six of these records.

AVAILABLE AT YOUR HIGH FIDELITY DEALER

Components Corporation
DENVILLE, NEW JERSEY



AT LAST!

The book you have waited for so long —

EDGAR M. VILLCHUR'S

HANDBOOK OF SOUND REPRODUCTION

For over two years, this material ran in consecutive issues of AUDIO and was followed avidly by every reader. Now available in book form, with corrections and minor revisions, this material will be recognized as the basis of a thorough course in sound reproduction. Covers the subject from the elements of sound to individual chapters on each of the important components of a sound reproducing system. Ready for immediate delivery. $6.50 postpaid.

Customary discounts to dealers and distributors

RADIO MAGAZINES, INC., Book Division
P. O. Box 629, Mineola, N. Y.

Please send me ..... copies of Villchur's HANDBOOK OF SOUND REPRODUCTION. I enclose check ☐ money order ☐ for $6.50 each.

Name .....

Address .....

City ..... **Zone** ..... **State** .....

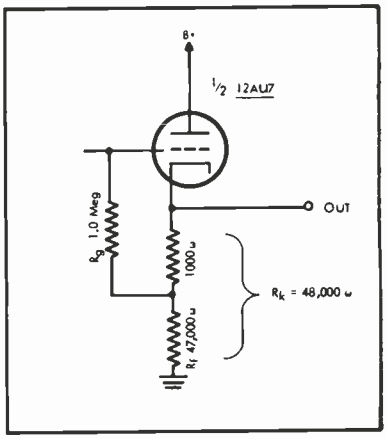


Fig. 17. Typical cathode-follower circuit.

been equal to A, namely 0.95, and Z would have been 20 megohms.

have been equal to A, namely 0.95, and Z would have been 20 megohms.

The low output impedance of the cathode follower may be explained as follows. If the load is so small in value as to decrease the voltage at the cathode by reducing the ground-to-cathode impedance, this also decreases current feedback. Accordingly, there is less opposition to the input signal, thereby producing more current flow through the tube and a higher voltage at the cathode. We have, then, the situation of small voltage changes at the output accompanied by relatively large current changes, which by Ohm's Law indicates a small effective a.c. resistance. Looking at the situation another way, a small resistance in series with the load would permit the same constant voltage output as does the cathode follower.

Cathode follower output impedance is expressed by the formula $Z = R_k r_p/[r_p + R_k(1+\mu)]$. But for the type of tube ordinarily used, R_k is substantially greater than r_p (about 8000 ohms for a 12AU7), so that the approximate formula becomes $Z \cong R_k r_p/[R_k(1+\mu)]$, or $Z \cong r_p/(1+\mu)$. Since μ is large compared with 1, we may further simplify, writing $Z \cong \mu/r_p$, or $Z \cong 1/g_m$. The g_m of a 12AU7 under typical operating conditions is about 2200 micromhos. Therefore $Z \cong 1{,}000{,}000/2200 \cong 450$ ohms. It is apparent that a cathode follower can accept a very great capacitive load without significantly affecting high-frequency response (although signal handling capacity may be radically affected). Æ

AUDIOCLINIC

(*from page 4*)

This same procedure should be followed for each speaker removed. Resistors used should be of appropriate wattage rating. This substitution need not be accomplished by bodily removing the speaker and then

www.americanradiohistory.com

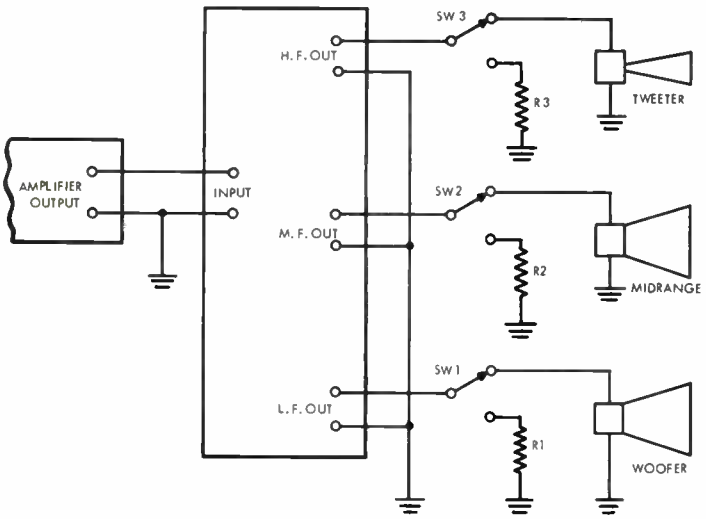


Fig. 1

replacing the resistor. One means for doing it is to place on each speaker a single-pole double-throw switch. In one position a resistor is switched in, while in the other, the speaker is switched in. (See *Fig.* 1.) Means could be devised for making these changes with just one multideck rotary switch. Such a switch would have to contain many positions, since provision would have to be made for connecting these speakers to the amplifiers in various combinations.

STEREO RECORDER

(*from page 23*)

Concertone is running during these pauses, the tape made on channel 1 will contain these pauses just like the commercial language records, and can now be used for channel-to-channel sound-on-sound practice.

Making our own Recordings

I have devoted some time to records, not only because they have been so useful to us, but also because they are likely to be the most available source of well-spoken French for readers who want to experiment with their own private language laboratory.

We have found, on the other hand, that some of our most fruitful activity with the tape recorder has consisted of making our own recordings with the help of French-speaking people. We can get onto the tape precisely what we consider we most need and get it in the form we want it.

Take Larry's school work, for example. Het is given periodically a group of French sentences and phrases along with their English equivalents. Whenever he gets such material, a young French friend, Allen Couturaud, records it for him. Larry handles the recorder himself, timing Allen with a movement of the hand so that he leaves a pause after each sentence. When the recording is completed Larry can use the tape in a number of ways. Playing it on his own tape player he can run it continuously for practice in aural comprehension. He can use it as dictation by stopping the player at the end of each sentence, writing down either the French version or the English equivalent, and in the end comparing his results with the original material. He make his own dictation tapes of the English versions for practice in providing the French versions. Playing the tape back on the Concertone the can use the sound-on-sound technique to practice pronunciation and evaluate his progress.

The versatility of the Concertone 23 is most evident at this point. Earlier it was suggested that owners of monaural tape recorders should purchase phonograph records with pauses rather than tapes containing the same material, since the disk and a microphone signal could be recorded simultaneously on *one* recorder, while the use of a tape original would require a second tape player. With live recording at home the original *must* be a tape. This presents no problems for the stereo recorder. But if the owner of a monaural recorder wants the tremendously valuable sound-on-sound practice, he will have to borrow another tape player.

I myself have a similar use of recordings made at home with native French speakers. I find that a large portion of the stock phrases and sentences on phonograph records and in textbooks are of little use to me. I have not, unfor-

LEONARD RADIO, INC.
69 Cortlandt St., New York 7, N.Y. COrtlandt 7-0315

presents a complete stereophonic system created by

madison fielding

THE MADISON FIELDING
SERIES 320
40 WATT STEREOPHONIC AMPLIFIER

PRICE $169.95

2 complete amplifiers on one brilliantly engineered chassis, together with 2 fully integrated preamplifiers. Provision for phonograph or tape-head playback, both fully equalized.

Individual controls for each section as well as a master volume control for adjusting stereo program levels. Dual magic eye takes the mystery out of level-setting. In addition to its stereo application, this versatile duo-amplifier will serve in monaural use as a complete electronic crossover system to feed separate woofer and tweeter combinations.

THE MADISON FIELDING
SERIES 330
FM-AM MULTIPLEX TUNER

PRICE $129.95

2 complete ultra-sensitive tuners on one compact chassis. The AM and FM tuners of this unit can be used individually, in single channel operation OR at the turn of a switch, both signals are available simultaneously for the latest stereophonic broadcast techniques.

Special Multiplex output permits later adaptation of the most advanced form of stereophonic reception. Exclusive Dual "stereoscopic" tuning indicator enables proper center-of channel tuning of both signals simultaneously.

Mail & phone orders filled
25% deposit, balance C.O.D.

LEONARD RADIO, INC.
69 Cortlandt St., New York 7, N.Y. COrtlandt 7-0315

www.americanradiohistory.com

startling silence
for the perfectionist
Connoisseur
TURNTABLE

The hush of an empty church, even though the synchronous motor is running — this is the Connoisseur, crafted in traditional English quality. Precision machining assures pure sound reproduction. Non-magnetic, 12" lathe-turned table; precision ground spindle; phosphor bronze turntable bearing; ±2% variation provided for all 3 speeds; hysteresis motor. $110.00

TURNTABLE: Rumble—better than 50 db down; Wow—less than 0.15% of rated speed; Dimensions: 13½x15¾".

PICKUP: Frequency Response — 20-20,000 cps ±2 db at 33⅓ rpm; Effective Mass—4 mg; Impedance—400 ohms at 1000 cps.

"Dynabalanced" tone arm with Mark II super-lightweight pickup
w/diamond stylus $49.50
w/sapphire stylus $34.50

Write today for literature.

ERCONA CORPORATION
(Electronic Division)
551 Fifth Ave., Dept. 24, New York 17, N. Y.
In Canada: Astral Electric Co. Ltd.
44 Danforth Road, Toronto 13

Circle 90A

SAVE ½ — PAY PART-BY-PART — HAVE FUN
Assembling the SCHOBER
ELECTRONIC
ORGAN in KIT form

Now you can afford a real, full concert organ, just like those made by the foremost organ manufacturers. Because over ½ the cost is saved when you assemble it yourself. And it's REALLY EASY: only 24 separate units, all with printed circuits, and detailed-to-the-smallest-step instructions. In addition, you purchase each of the 24 kits when you are ready for it — and can afford it.

You'll get a real kick out of putting the Schober Electronic Organ* together — and then sitting down and pulling the stops for Strings, Trumpets, Clarinets, Diapasons, Flutes, etc. Electronic Percussion optional; chimes available.

Compact CONSOLE

One of the many exclusive features of this exceptional organ is the handsome console, in a wide variety of finishes. It is equally at home in a traditional or modern setting, and takes little more space than a spinet piano.

Free Literature

Complete descriptive booklet and price list are available on request. And, if you wish to hear the glorious pipe organ tone of the Schober Electronic Organ, a 10" long-playing demonstration recording is available for $2. This is refundable when you order. Write today and see what a fine instrument you can get at such a great saving.

The SCHOBER ORGAN CORP.
2248-K Broadway, New York 24, N. Y.
*Designed by Richard H. Dorf

Circle 90B

tunately, had any contact with French customs officers, porters, station masters and hotel keepers in many years and it is quite possible that I won't for some years more. I also don't, in the normal course of my life, have occasion to say very much about pens, pencils, blackboards, aunts, and people's preferences as to spring, summer, autumn, and winter. We don't even have any brothers and sisters around. Also, most of the conversation I read in French literature is spoken by Frenchmen who apparently don't travel, go to school, or care very much about seasons. And what they have to say about concierges probably should not be repeated by American tourists. From French literature I gather that the talk in French homes is pretty much like the talk we hear in American homes. So from this literature and from conversations with French-speaking people, I have collected a large number of expressions which are *really common in everyday conversation* and am attempting to introduce these into our own conversations at home, utilizing them not for random practice but in situations calling for their use.

Again the tape recorder is our most useful tool. Our French friends record the expressions, the recording is made on channel 1 along with my beloved pauses. Then all members of the family can practice this material. After a good deal of practice we find ourselves adopting the phrases in our own conversation.

This consistent use of the tape recorder for commonly used expressions has also helped us immensely to understand French people to whom we speak. We find our expressions constantly popping up in their conversation and don't even feel the urge to translate them. Unfortunately, our French friends sometimes become too impressed with our progress and forget to give us any kind of a break, rattling away at high speed and *mumbling*. I'll know when I'm really doing well in French—when I can understand French mumblers as well as I understand the English-speaking variety.

Incidentally, we have found a real use for something I generally regard as an unmitigated bore—the "bugging" of conversations. We have recorded some of our conversations with our French friends. The replaying of these conversations has been a lot of fun and extremely useful at the same time.

Recording Radio Broadcasts

The extent of radio broadcasting of foreign language programs in the United States naturally varies with the size of the city, the importance of foreign language groups in the area, and the general cultural importance of the language being studied.

In New York City, for instance, you can hear Italian and Spanish programs throughout a large part of each day. Except during the summer months, spoken French programs are generally given every Saturday afternoon over the city station WNYC. Even the dreary stretch of programs in which only the French "classics" are broadcast will provide much that is useful, and the broadcasts of modern plays and poetry provide exciting and valuable practice material. Since everything is recorded in France, no concession is made to the problems of Americans learning French. Some of it is spoken so fast that even our French friends have some difficulty with it. This very fact makes the broadcasts particularly useful for practice in aural comprehension.

When we could only *listen* to these programs we could catch some of the dialogue, but a great deal more was lost for good. Now we record as we listen (or have someone record for us) and we can re-run the tapes as often as we wish. It is something of a game to see how much more of the dialogue we can understand with each replay. If we have too much difficulty and we think the material is important enough, we obtain the text of the play or poetry and study the text and tape together. In the case of Moliere's "Le Misanthrope" this procedure was so successful that when the play was presented in New York City by the Renaud-Barrault company, we had no difficulty at all in following the spoken lines.

When we finally get tired of a particular broadcast we have taped, we erase the tape and re-use it.

If a modern play which we have taped contains a great deal of conversational French which we think will be useful practice material, we utilize the editing technique previously referred to for re-recording the play on channel 1 of a new tape with pauses inserted after each complete expression. This tape is then used for practice with the sound-on-sound technique, recording the short speech units followed by our own repetition on channel 2.

There must be many other sources of good language material with which we are not yet familiar. We'll keep searching for them. But with just the material we have found, our private language laboratory looks like a great success to us.

English Speech Training

One of the most immediate and dramatic achievements of the tape recorder in our home was in the field of English speech. At about the time we got the instrument, Larry had entered a school recitation competition. He had chosen one of Thurber's "Fables for Our Times." This is a type of thing not often encountered in junior high school recitations, and requires unusually effective delivery to put over. A large part of

www.americanradiohistory.com

Larry's success in getting among the top finalists for his school can be credited to the tape recorder.

For much of this application, as for music and foreign language learning, the Concertone 23 is used as a single-track recorder. Within this limitation it does two jobs well: it permits Larry to record himself and listen critically to the playback, and it trains him to be at ease with a microphone. This last is not unimportant. We know of numerous cases where students who did well when practicing without a mike got quite a case of jitters when the final presentation had to be made in front of a mike.

The uses of two-track sound-on-sound are not so obvious for English speech training. In training for a specific recitation or speech, we think it would be unwise to provide the learner with a model which he can imitate. He must work hard at developing his own style of delivery.

However, for *general* speech practice the developing of skill in consciously imitating the style of delivery of another person is a worthwhile achievement. With a sufficient variety of models to follow there is little chance that the learner is going to get into a stylistic rut. My wife, who has had some stage training, often provides the model. We also use phonograph records, or record good speech from the air. For practice with these models, the two-track s-o-s feature of the stereo recorder is invaluable. It is difficult to mimic a delivery style if you first have to listen to an entire speech. But if you can break it down into individual sentences, with a pause after each sentence to provide for repetition, it is a simple matter indeed. Here the Concertone and the Viking are used together to get the "paused" version on channel 1 of a new tape, and the two-track s-o-s technique records the sentences of which the model followed by the repetition of the learner on channel 2, given the learner an opportunity to replay the two together and evaluate just how good his imitation actually is.

I have a feeling that we have only scratched the surface in finding special uses for the stereo recorder in English speech practice, but it has already proved its great worth.

Stereo Music

Although I am very much interested in both live and reproduced music, stereo music reproduction was certainly not uppermost in my mind when I decided to buy the stereo recorder. On the contrary, the pointless and noisy demonstrations of moving horses and fifty-foot-long pianos at the most recent audio show, together with what appeared to me to be pretty extravagant nonsense in advertisements and magazine articles about reproducing sound "exactly as you hear it in the concert hall," had left me more than a little skeptical and bored with the whole stereo business.

However, you simply cannot go on forever ignoring the musical possibilities of a stereo recorder that's sitting right there staring you in the face. Besides, now that I have (quite unintentionally) provided music-loving AUDIO readers with an irresistible justification for the purchase of a stereo recorder—the fact that it is so desperately needed for the good of the children—I think I ought to say something about my conversion to stereo for music.

In a way it was those of my friends with the most costly monaural systems who drove me into taking an interest in stereo music reproduction. As a result of their prodding I set up a system which, however, dismayed them no end. To the Wharfedale twelve-inch speaker already installed in a large floor-to-ceiling bookcase baffle that separates our rather large living room from a foyer, I added another twelve-inch Wharfedale. One speaker is fed by a Marantz 40-watt amplifier, the other by a modified 10-watt ADC amplifier which is installed in the same case that holds the recorder preamps. Of course, said the purists, even if stereo were superior, other things being equal, how could two direct radiators in an open baffle, fed by two different kinds of amplifiers, compare with their massive *n*-way speaker systems? Hah! One fellow whose speaker alone cost almost as much as our entire set-up and who uses a pair of cascaded electronic cross-overs and three top-notch power amps following his pre-amp, admitted ruefully that he would change for our stereo set-up as is. But I know what he'll really end up with—if he can get it all in his apartment—the tape recorder plus another set-up just like the one he has!

But to get back down into this world and our own set-up. What comes out of it sounds line no seat I ever found in a concert hall. In many cases the spatial relationships are obviously even *more* distorted than with single-channel reproduction. Yet one need not understand the nature of the stereo effect or even be convinced that it is more true to the live original to *feel* the very great difference between stereo and monaural reproduction.

The rest of my comments are nothing more than tentative ideas that have struck me during some months of listening to stereo.

The special quality of stereo is apparently not just a matter of the spread of sound. This has been seriously suggested by some visitors. But we have both the monaural LP record and the stereo tape of the RCA recording of the Berlioz *Symphonie Fantastique,* and we and visitors have often compared the playing of the monaural reproduction,

at last... clean record grooves... no static!

LEKTROSTAT®

RECORD CLEANING KIT

The only record cleaning kit *engineered* to clean record grooves! Contains the first functionally-designed groove-cleaning applicator and a recognized anti-static detergent. A few drops of Lektrostat and a few strokes of the special groove-cleaning applicator eliminates static . . . thoroughly cleans not only the surface but the *grooves.* Sold through dealers in New York area – or

send $2.00 for complete kit

check or M.O. – no C.O.D.'s

anti-static detergent | groove-cleaning applicator | plastic pouch

must be satisfied or MONEY BACK!

dexter chemical corp.
consumer products division
845 Edgewater Rd., New York 59
world's foremost chemical anti-static research organization.

www.americanradiohistory.com

we are ashamed

Made in England

to mention the price!

New R-A Coaxial 700 Series Mark III

Some manufacturers are ashamed to mention the price because it is so high . . . we hesitate because it is so *low!* We know that most Audiophiles feel they have to make a big investment to get a quality speaker. They spend hours reading claims that look impressive on paper but fall down severely when translated into actual performance. All we ask is that you close your eyes and listen to the majesty of sound that floats out of the R & A coaxial phenomenon. Compare it with others . . . or your present speaker. Your eyes will pop when your dealer whispers the price to you—less than the cost of 2 good seats at the Met!

8", 10" and 12" Models—all with Alcomax III Aniso-tropic Magnet systems of 12,000 Gauss Flux Densities.

Buy it . . . try it . . . we back claims with a money back guarantee. At all hi-fi dealers.

ERCONA CORPORATION
(Electronics Div.)
551 Fifth Ave., Dept. 25, New York, N. Y.
In Canada: Astral Electric Co., Ltd.
44 Danforth Road, Toronto 13

Circle 92A

THE LIBRASCOPE **MAGNETIC** ®
noiseraser

Because it *thoroughly* "cleans" the tape of random signals as well as prior recordings, these Librascope *Noiseraser* units are preferred by professional broadcasting recording technicians, exacting military users and Hi-Fi enthusiasts. Several models are available.

Tape up to 1" and reels to 14" dia.; operates on standard 110V AC; erases new as well as used tape. Made by one of the foremost manufacturers of computers and controls.

Bulletin M500-1 available upon request.

LIBRASCOPE
A SUBSIDIARY OF CPL INCORPORATED
129 E. SANTA ANITA AVE., BURBANK, CALIF.

Circle 92B

with the two speakers connected in parallel, with the stereo reproduction. Almost everyone has agreed that for this particular number the two speakers were better than one in monaural playback, but that the effect of the monaural reproduction with the two speakers in parallel was not nearly as sonically exciting and satisfying as the stereo reproduction from tape.

Another tentative conclusion relates to the "bearable" loudness at which music can be played. No one in our family likes loudness for its own sake, and we make every effort to play at comfortable levels, particularly avoiding the "larger-than-life" sound. But when I am listening in dead earnest to the reproduction of a large orchestra there is one ideal requirement I would like to have a reproducing system meet as closely as possible: that when it gives off with sounds that are as loud *to my ears* as those I would receive at some seat in the concert hall, I should be able to listen to these reproduced sounds as comfortably as I can listen to the concert hall sound. A good test with which to judge how well a system measures up to this standard is to note the reaction of ordinary folks (not hi-fi fanatics) to high intensity levels, *before* you have beaten them into submission with verbal and musical attacks on their sense and sensibility. (I'm not too bad a subject for this test myself. Some of my friends wake up from the blissful coma their "bigger bang for the buck" has put them into only to find that I've gone off). Now I have noticed time and again that people who tend to complain about anything louder than background music will accept quite high loudness levels in stereo without batting an eyelash. I haven't the least idea why this should be so, but for serious listening where the music *should* be loud the greater "hearableness" of loud stereo sound is an extremely valuable characteristic.

Not everything is rosy with stereo, though. Everyone who has purchased stereo tapes knows what the big rub is. Cost. You can buy a lot of LP's for the $18.75 that the *Symphonie Fantastique* costs. A lot of people ask me about this aspect of stereo, but I'm no better as a prophet than they are, and for the present I can only give them the kind of advice I give to my students in color photography who complain about the high cost of color materials: "Better little but better." Keep your large LP library, but for some occasions when you want something really superior, build up a small, select stereo library.

There are, of course, ways in which very resourceful people can build up stereo tape libraries at a somewhat more modest cost. If the reader is that resourceful he won't have to embarrass me by asking how.

CLASSIFIED

Rates: 10¢ per word per insertion for noncommercial advertisements; 25¢ per word for commercial advertisements. Rates are net, and no discounts will be allowed. Copy must be accompanied by remittance in full, and must reach the New York office by the first of the month preceding the date of issue.

THE AUDIO EXCHANGE has the largest selection of new and fully guaranteed used equipment. Catalog of used equipment on request. Audio Exchange, Dept. E, 159-19 Hillside Ave., Jamaica, 32, N. Y. AXtel 7-7577; 367 Mamaroneck Ave., White Plains, N. Y. WH 8-3380; 836 Flatbush Ave., Brooklyn, BUckminster 2-5300.

HIGH FIDELITY SPEAKERS REPAIRED
Amprite Speaker Service
70 Vesey St., New York 7, N. Y. BA 7-2580

LOOKING FOR CLEAN RESPONSE TO 20 CYCLES? Listen to the radically new Racon "Hi-C" 15" foam suspension speaker. Racon Electric Company Inc., 1261 Broadway, New York 1, N. Y.

FOR SALE: AMPEX 300, 350-2, 600, 601, 601-2 and A-Series, available from stock at Grove Enterprises, Roslyn, Pa. TUrner 7-4277.

CUSTOM HIGH FIDELITY systems designed and installed. Equipment expertly serviced and repaired. Free pickup and delivery in New York City area. Eastern Audio Co., 6139 Tyndall Ave., Bronx, N. Y. KI 9-8134

Write us before you buy any hi-fi, you'll be glad you did. Immediate replies. Key Electronics, 120 Liberty St., New York 6, N. Y. EV 4-6071.

Long Playing records 20 to 50% discounts: brand new; factory fresh; unplayed; all labels. Send 20¢ for catalog to Record Discount Club, 1108 Winbern, Houston 4, Texas.

RECORD CUTTING SERVICE
Tape to Disc. Write for literature and Prices. Electronic Associates Dept. C, Box 91, Merion, Pa.

FOR SALE: Weathers pickup system; new oscillator, 16" arm, sapphire stylus, $40. James Ozzello, 3559 S. Lenox St., Milwaukee 7, Wis.

With factory cooperation I can furnish 4-inch 30-minute tape for corresponding. Includes strong lightweight box, only $1.00. Can be used repeatedly for only 4¢ postage. Geo. Bischof, 1503 E. Vickery Blvd., Fort Worth, Texas.

FOR SALE: UTC 3A Equalizer, $55; Magnecorder 93X5 Tape Playback Amplifier and Power Supply, $30; Arthur Marko, 429 East 70th St., New York 21, N. Y. REgent 4-3573.

AMPEX Model 600 tape recorder, with special playback control on front panel. New heads, dual track. Guaranteed 30 to 15,000 cps, $400. H. White, 2123 Kenmore Ave., Bethlehem, Pa.

TAPE BUY—Leading manufacturers' recording tape; full frequency range, top quality guaranteed. Acetate: 1200 ft. 1½-mil $1.39, four or more $1.69; 1800 ft. 1-mil $1.87, four or more $1.69; Polyester: 1200 ft. 1½-mil $2.02, four or more $1.88; 1800 ft. 1-mil $2.60, four or more $2.35; 2400 ft. ½-mil $3.61, four or more $3.32. Add 25¢ per shipment. Other tapes available. Hi-Sonic, Box 86-T, New York 63, N. Y.

FISHER AM-FM 50-R tuner, realigned for optimum sensitivity. Excellent throughout, $95. Also, 53-ft. heavy-duty sectional antenna tower only $120, cost $270. L. Carini, Wethersfield, Connecticut.

EMPLOYMENT

ENGINEER WANTED: By progressive manufacturer of intercoms and related equipments, located in New York City. Top salary to man experienced, in the latest tuner and audio circuitry. Write to AUDIO Box 1201.

Leading Tape recorder manufacturer needs aggressive representatives for the following areas: Ohio, Texas, Oklahoma, Colorado, Northern California, Wisconsin. Must be handling Hi-Fi lines. Box 1202.

www.americanradiohistory.com

PROFESSIONAL DIRECTORY

"Continuously Since 1944"
HOLLYWOOD ELECTRONICS
DISTRIBUTORS OF HI-FI COMPONENTS
EXCLUSIVELY
7460 Melrose Ave · Los Angeles 46, Calif · WEbster 3-8208

Circle 93A

CANADA
High Fidelity Equipment
Complete Lines • Complete Service
Hi-Fi Records — Components and Accessories
ELECTRO-VOICE SOUND SYSTEMS
141 DUNDAS ST. WEST. TORONTO, CANADA.

Circle 93B

the finest in Hi-Fi featuring Electro-Voice®
HIGH FIDELITY COMPONENTS
RIEGALOFF SOUND CORPORATION
820 W. Olympic Blvd. · L.A. 15, Calif. · RI 7-0271

Circle 93C

HIGH-FIDELITY HOUSE
Most complete stock of Audio components in the West
Phone: RYan 1-8171
536 S. Fair Oaks, Pasadena 1, Calif.

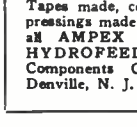
Circle 93D

FM/Q antenna systems
High gain Broadband Yagi for max. sensitivity in both 72 and 300 ohm input. Designed for fringe FM.
APPARATUS DEVELOPMENT CO.
Dept. C Wethersfield 9, Connecticut

Circle 93E

PROFESSIONAL RECORDING SERVICE
Tapes made, copied, masters cut, processed, pressings made — short runs our specialty — all AMPEX 300's Telefunken & Altec, HYDROFEED Lathes, monofusion presses. Components Corporation, 106 Main St., Denville, N. J. Phone: ROckaway 9-0290

Circle 93F


BE HAPPY AGAIN!
Write us your hi-fi needs now —you'll be glad you did.
Immediate replies. Complete stock
Dept. AE
KEY ELECTRONICS CO.
120 LIBERTY ST., N. Y. 6, N. Y.
Phone: EVergreen 4-6071

Circle 93G

Industry People...

CAPSULE COMMENT ON THE 1957 NEW YORK HIGH FIDELITY SHOW: Huzzahs galore to **Edwin Cornfield,** executive secretary of the Institute of High Fidelity Manufacturers, who directed the show to a success which saw approximately 35,000 visitors cross its threshold, and to **Elliot Davis,** his newly-chosen assistant. By far the most interesting and popular exhibit of high fidelity equipment to date, the show verified the fact that component high fidelity is the nation's fastest growing hobby. Knuckle raps are due a few exhibitors who displayed their equipment too loud—otherwise, everything was hunky-dory.

PEOPLE AND THINGS: Henry Klaus, Malcom Lowe and **Anthony Hoffman,** officials of KLH Research and Development Corporation, gave the first public showing of the new KLH speaker systems with resounding approval . . . ditto **Joseph Grado** of Grado Laboratories who displayed the new Grado pickup which has been on the market for only a few months, along with a new tone arm which will be marketed within the near future . . . Ampex Audio turned out virtually en masse, with **Art Foy** and **Bim Farrow** from California headquarters taking turns with **Dick O'Brien** and his New York staff in manning the lavish exhibit of tape recorders. **Hal Lawrence,** Ampex account executive for the **Boland Associates** advertising agency, was also in attendance.

Bill Shrader, Washington's pioneer custom builder and industrial sound contractor, reported a recent sound reinforcement installation which called for 3000 Altec Lansing Model 755's . . . **Peter Meisinger,** of Washington's L.E.E., Incorporated, elated at acceptance of the company's new line of Catenoid speakers . . . **Sidney Frey,** head of Audio Fidelity Records, was the show's largest individual exhibitor, occupying three large rooms on two floors . . . **Karl Kramer,** representing Chicago's Jensen Manufacturing Company, displayed a new outdoor full-range speaker with full weather-proofing, along with the Jensen line of speaker systems for custom installation.

Larry Racies attended the show in his dual capacity as proprietor of New York's Hi-Fi HQ, custom builders, and top camera man for CBS Television News. Shot a scene of healthy length for the Douglas Edwards news program . . . AMI, Inc. of Chicago, represented by amiable **Bill FitzGerald,** exhibited a grouping of walnut cabinetry which set a mighty high high for both design and finish. . . . The New York Times Review of the show, which was not entirely flattering, singled out British Industries Corporation for expressing good taste in its choice of demonstration music and the loudness (or softness) with which it was played. Personal credit should be accorded **Leonard Carduner, Eugene Carduner, Arthur Gasman** and **Frank Hoffman.**

Missing and missed at the show was **Emory Cook** of Cook Laboratories, Inc., without whose presence nothing seemed just right. He is on the receiving end of deep sympathy from the entire sound industry for the recent fire in which he was seriously burned and his Connecticut plant destroyed. . . . **Fritz A. Kutner,** writer on high fidelity and manufacturer of Musurgia Records, announcing completion of his new book devoted to so-called consumer "research" organizations. Expresses with lucidity his impression (and ours) of irresponsible persons and/or groups who set themselves up as authorities in fields where they are not qualified to have responsible opinions. . . . Another hi-fi writer, **Irving Greene,** author of several books, making his first appearance as head of the ad agency bearing his name, sharing time in exhibits of three principal clients, Pickering, Tetrad, and McIntosh.

Adolph Gross, Milton Thalberg and **Gersh Thalberg,** importers and distributors of Miracord record changers and Miratwin pickups, giving initial showing to a number of audio accessories which will be announced in the near future . . . **Anthony Doschek,** head of Pro-Plane Sound Systems, Inc., presided over one of the show's interesting displays—a 6-ft.-sq. speaker system designed for placement in the center of a room—weighs 750 lbs. and sells for twenty-five hundred dollars . . . Another attraction was the new Weathers turntable, introduced by **Paul Weathers,** president of Weathers Industries, Inc. In place of a powerful motor and heavy table, it uses a small 12-pole clock-type motor and relatively light table to achieve results which are truly remarkable.

Listen knowingly *for more musical enjoyment*

In this book one of the best-known and most highly regarded American composers shows you how to increase your enjoyment of music through creative listening. Now you can listen to more music—hear it with greater understanding and enjoyment—when you know and can identify the elements, forms, and qualities with which the composer has worked. Hear the great masterpieces of music as the composers wanted you to hear them!

New Revised Edition Just Out

What to Listen for in Music

By AARON COPLAND

307 pages, 5½ x 8, $3.95

THE author first discusses the creative process and the elements of musical anatomy—rhythm, melody, simple harmonic structure. He then gives a full and clear explanation of the principal musical forms—simple dance forms, the fugue, the variation, the sonata, the symphony, the symphonic poem, the opera.

Chapters on contemporary music and film music have been added to the new edition. Also new is a list of recorded music to illustrate each topic covered.

Praise for *What to Lisen for in Music*
(First Edition)

"The best book I know to explain things to the layman."—*Oscar Levant*

"Sound, practical, and sanely modern."—*The New Yorker*

"By far the best thing of its kind yet to appear."—*Modern Music*

"One of the most helpful, sensible and engaging discourses on the subject ever published."—*Victor Record Review*

SEE IT 10 DAYS FREE

RADIO MAGAZINES, INC.
P.O. BOX 629, MINEOLA, N. Y.

Send me Copland's What to Listen for in Music for 10 days' examination on approval. In 10 days I will send $3.95, plus few cents for delivery costs, or return book postpaid. (We pay delivery cost if you remit with coupon; same return privilege.)

(PRINT)
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position .....

For price and terms outside U. S. write McGraw-Hill Int'l., N.Y.C.

www.americanradiohistory.com

SUBJECT INDEX

1957

www.americanradiohistory.com

AUTHOR INDEX

1957

www.americanradiohistory.com

the
Magnificent
Ferrograph

Model 3A/N (portable) with built in speaker. 3¾-7½ ips
$379.50

The world's finest hi-fi tape recorder

The ultimate in high-fidelity tape recorders for home and professional use. Dual-speed, dual-track FERROGRAPH recorders are also available in custom models (tape decks available, from $195.) and with 7½ and 15 ips speeds. Independent field performance tests rate Frequency Response at ± 2 db between 50 and 10,000 cycles with wow and flutter less than 0.2% at 7½ ips.

Quality standards have restricted our production and unforseen demand may delay delivery, write TODAY for literature.

ERCONA CORPORATION
(Electronic Division)
551 Fifth Ave., Dept. 23, New York 17, N. Y.
In Canada: Astral Electric Co. Ltd.
44 Danforth Road, Toronto 13

Circle 96A

MAGNETIC TAPE ERASER

Erases recorded signals and noise from magnetic tape without rewinding. Spindle mounting of reel permits rapid coverage without missed spots. Noise level reduced below level of standard erase heads. Restores tape to like new condition or better. Reel size range 5", 7", 10½". May also be used for demagnetizing record—playback—erase heads.

Model HD-11 Price **$27.50**

TELEPHONE PICK-UP COIL

For transcribing telephone conversations with recorder or making messages audible on amplifier May also be used as probe for locating sources of hum. More constant signal level than base mounted units. Suction-cup mounting on any telephone receiver. Supplied with 68" shielded cable, terminated with standard phone plug for recorder or amplifer

Price **$7.95**

Model HP-61

MATCHING TRANSFORMER

A precision transformer developed to enable the audiophile to modify, enlarge, redesign, or rearrange his speaker systems. Permits use of additional speakers of different impedance ratings with present amplifier, or crossover net works, without impedance mismatch. Delivers equal, or 3 db. adjustable power, to all speakers. Power 50 watts, 100 watts peak. Frequency response 15 to 30,000 cycles. Matching range: any combination of 1 to 3 speakers of 16, 8, 4 ohms.

Model HM-80 Price **$21.75**

Available from Electronic and Audio Distributors

MICROTRAN COMPANY Inc.
Valley Stream, L. I., N. Y.

Circle 96B

ADVERTISING INDEX

the sound of
TALENTED
hands

In an era of mass production and automation there are still some products which are individually assembled by hand—slowly with painstaking care and attention to details. Vitavox loudspeakers are fine examples of this skilled workmanship in the art of sound reproduction. They are created for the high fidelity enthusiast who listens with his ears and his heart—rather than trying to digest a table of specifications. The DU120 Duplex Coaxial Full Range Loudspeaker is truly one of the most remarkable achievements in audio craftsmanship in the twentieth century!

VITAVOX
Duplex Coaxial
FULL RANGE LOUDSPEAKERS

Made in England by Vitavox Ltd., London

at leading hi-fi dealers
ERCONA CORPORATION
(Electronic Division)
551 Fifth Ave., Dept. 26, New York 17, N. Y.
In Canada: Astral Electric Co., Ltd.
44 Danforth Road, Toronto 13

Circle 96C

GIBSON GIRL® TAPE SPLICERS		
1. Semi-Pro	SP-4	$ 3.50
2. Junior	TS-4JR	6.50
3. Standard	TS-4STD	8.50
4. De luxe	TS-4DLX	11.50
5. Industrial (5 sizes to 1")	(net)	55.00
ROBINS PHONO AND TAPE ACCESSORIES		
6. Splicing tape	ST-500	$ .39
7. Jockey Cloth for Tapes	JCT-2	1.00
8. Tape Threader	TT-1	.98
9. AUD-O-FILE	AF-50 (net)	23.99
10. Changer Covers	CC-1, 2	2.00
11. Turntable Covers	CC-3	2.50
12. DisClosures	E10, 12 (pkg)	1.20
13. Jockey Cloth for Records	JC-1	1.00
14. KleeNeeDLE	NB-1	1.50
15. Phono-Cushion, 10", 12"	PC-10, 12	1.50
16. Atomic Jewel	SE-90	5.00

At Dealers Everywhere

ROBINS INDUSTRIES CORP.
BAYSIDE 61, NEW YORK

Circle 96D

www.americanradiohistory.com

SIMPLE AS A B C

To make it just as easy as possible for AUDIO's readers to subscribe, order books, get further information about the new products and the new literature mentioned in the pages of the magazine, or to get catalog sheets and brochures describing articles advertised, we provide herewith three cards. We know that many readers are loath to cut coupons from the pages of their favorite magazine because they have told us so. And we know that many times one would like to have complete and thorough data about something he sees in these pages, yet he considers it too much trouble to hunt up paper and envelope—not to mention the stamp—and write a long letter detailing what he wants to know. This is just as simple as we know how to make it with the exception of stenciling each subscriber's name and address on each of the postcards—an operation which would be highly impractical from the printing standpoint. But from now on, when you want more information about something you have seen advertised or mentioned in AUDIO you need only indicate it on the appropriate card, print your name and address, and drop it in the nearest postbox. We pay the postage, and it goes without saying that we wouldn't include these cards if we didn't welcome your use of them. And, for the first time, you can enter your subscription without sending a penny with your order—we'll bill you later. For books, we'll have to ask for the money in advance, but only for books.

Readers have told us that they often want to know more about some of the items mentioned in the *New Products* and *New Literature* pages of the magazine, but that they do not want to take the time and effort to write to each one of the sources individually to get all the information they need. As a matter of fact, in an average issue there are usually ten items in the *New Literature* column, and between ten and fifteen on the *New Products* pages. It is conceivable that the average reader might want information on at least ten of these items, since they are selected with the interests of most of AUDIO's readers in mind. Thus one would have to have ten envelopes, ten sheets of paper, and ten three-cent stamps, together with the need for writing the ten letters and inscribing each with name and address. We do it all for you, assuming that you are willing to circle the items about which more information is desired and to write your name and address once. We will forward your inquiries to the organization involved, and you will receive the data you want with only one inquiry. Isn't that as simple as A B C?

In just the same way you can get more information about any product that is *advertised* in the pages of AUDIO. Note the page on which the advertisement appears and circle it on the back side of this card. When there are two or more ads on the same page, the page number is followed by a letter, and the designation appears under each individual advertisement. Write your name and address clearly—someone has to decipher it—and it is a good idea to mark the card for all the information you want the first time, for there is only one card in each copy of the magazine. Of course, you *could* subscribe to two copies.

FOR OFFICE USE

M

Audio, P. O. Box 629, Mineola, N. Y.

GENTLEMEN:
PLEASE ENTER MY SUBSCRIPTION TO **AUDIO**

FOR:

1 YEAR - $4 ☐ (FOREIGN-$5)

2 YEARS - $7 ☐ (FOREIGN-$10)

LIFE - $50 ☐ U.S.A. ONLY

BILL ME ☐ PAYMENT ENCLOSED ☐

CHECK ☐ MONEY ORDER ☐

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

CUT APART ON DASHED LINES

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 142, Mineola, N. Y.

AUDIO
P. O. Box 629
Mineola, N. Y.

Postage Will be Paid by Addressee

www.americanradiohistory.com

Postage Will be Paid by Addressee

BUSINESS REPLY CARD

First Class Permit No. 142, Mineola, N. Y.

AUDIO

P. O. Box 629

Mineola, N. Y.

No Postage Stamp Necessary If Mailed in the United States

BOOK ORDER

Please send me the books checked below, postage paid. I enclose check ☐ money order ☐ for $ in full payment.

☐ **ELECTRONIC MUSICAL INSTRUMENTS**
(Revised Second Edition)
Cloth Cover — $7.50

☐ **TAPE RECORDERS & TAPE RECORDING**
Paper Cover — $2.95

☐ **The 3rd AUDIO ANTHOLOGY**
Board Cover — $3.50
Paper Cover — $2.50

☐ **HANDBOOK OF SOUND REPRODUCTION**
Cloth Cover — $6.50

NAME _____

ADDRESS _____

CITY _____ ZONE____ STATE_____

To start receiving **Audio** monthly without any effort on your part to locate one on the newsstands or at your jobber's, mark the appropriate boxes with crosses, tear out the card, and drop it into a handy postbox. If you are one of those who always pays in advance, we will accept your check or money order—we do not recommend cash to be sent through the mails—enclose the card in an envelope, and mail. This will cost you an extra three cents, so if you wait until we send you a bill, we'll enclose a business reply envelope for your convenience. We try to make it as easy for you as we know how.

NAME _____

ADDRESS _____

CITY _____ ZONE_____ STATE_____

AUDIO — Please send me further information about the coded items circled below and about those advertised on the circled pages of the December issue.

(PLEASE DO NOT USE THIS CARD AFTER APRIL 1, 1958)

M-1	M-10	M-19	1	14	39	56	67	76b	88	93c
M-2	M-11	M-20	2	15	41	57	68	77	89	93d
M-3	M-12	M-21	3	16	43	59	69	79	90a	93e
M-4	M-13	M-22	4	17	45	60-61	71	80-81	90b	93f
M-5	M-14	M-23	5	29	47	62	72	82-83	91	93g
M-6	M-15	C-2	6-7	31	49	63	73	84	92a	96a
M-7	M-16	C-3	8-11	33	51	64	74	85	92b	96b
M-8	M-17	C-4	12	35	53	65	75	86	93a	96c
M-9	M-18	SB	13	37	55	66	76a	87	93b	96d

NOW IT IS EASIER — ONLY ONE CARD

is necessary to get more information about any New Product or New Literature item, or about any product advertised in these pages.

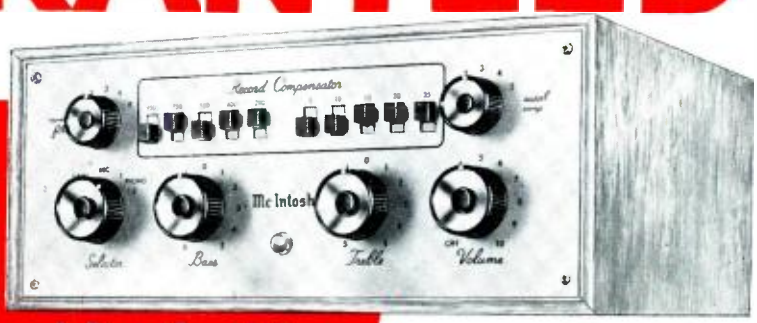
At the end of each item of **New Literature, New Products,** or **Equipment Reviews** you will notice a letter and a number—the letter indicates the month and the number indicates which item it is. All you have to do to get full information about the product or to get the literature described is to circle the appropriate number, add your name and address and mail it to us. We'll do the rest, and you may be sure that we'll be prompt because we are just as anxious for your inquiries to get to their destination as you are—and besides, we don't have room enough around the office to accumulate a lot of cards. Circle one item, if you wish, or all of them—we'll carry on from there. This whole system breaks down if there is a charge for the **New Literature** described, so if you can suggest any improvements in this service, we would appreciate hearing about them. To get more information about the products that are **advertised** in each issue of AUDIO—use the same card. Circle the number of the page on which the advertisement appears. When there are two or more ads on a page, each one has under it a notation such as Circle 23a, Circle 48b, or Circle 76c and the same numbers appear on the card. Numbers C-2, C-3, and C-4 refer to the covers—C-2 is the inside front cover, C-3 the inside back cover, and C-4 is the outside back cover. SB is "The Sounding Board."

The only way to derive any benefit from this service is to use the card for all the information you want. We think you will find this new system more convenient and that you will use it more and more.

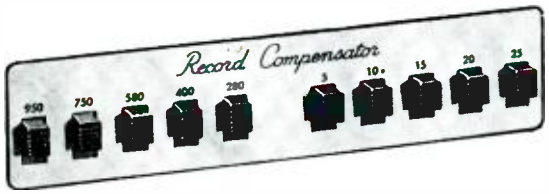
www.americanradiohistory.com

FLEXIBILITY GUARANTEED

McIntosh
C-8 Professional Audio Compensator and Pre-Amplifier



C-8 (Less Cabinet) $88.50



Record Compensator

Reproduction to satisfy the novice or the most critical listeners is achieved by the more than 500 compensation positions on these unique bass and treble switches. Room acoustics and electrical characteristics are completely controlled only in the flexible C-8.

Rumble Filter

A five position control designed to eliminate the annoying mechanical rumble inherent in turntables and record changers. A narrow band suppression that rejects noise not music.

Aural Compensator

Five fixed positions of balanced volume reduction with equalization for the hearing losses experienced at low volumes. Greatest flexibility for greatest enjoyment.

Here is the only compensator designed to critically balance electrical playback of records plus the flexibiliy to correct for all listening room acoustics. McIntosh, creators of the world's finest amplifiers and pre amplifiers *guarantees* 1 Flexibility, 2 Specifications, and 3 Craftsmanship. Hear McIntosh today at your favorite dealer.

Send for complete information or visit your nearest Franchised McIntosh Dealer.

McIntosh
LABORATORY, INC.
4 Chambers St., Binghamton, N. Y.
Export Division: 25 Warren St., New York 7, N.Y.
Cable: SIMONTRICE N.Y.

In Canada manufactured under license by McCurdy Radio Industries, Ltd.
22 Front Street W., Toronto, Canada

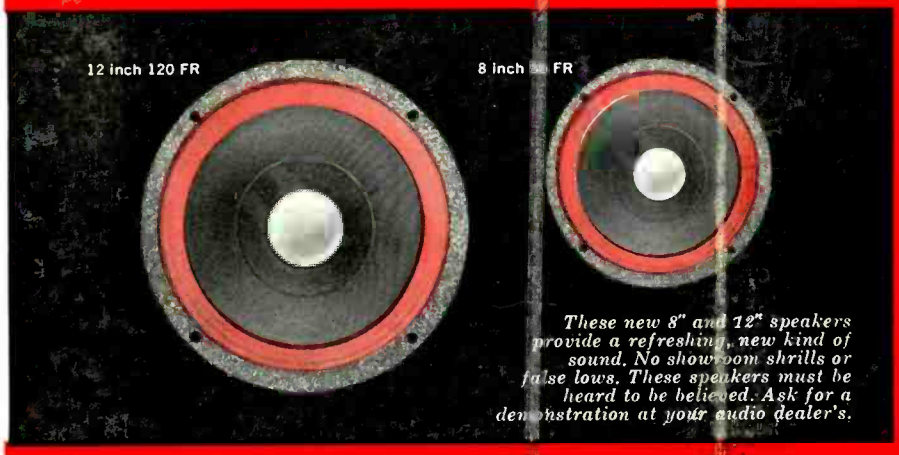
AE-11-57

www.americanradiohistory.com

new!

TRUSONIC FREE CONE SUSPENSION

A loudspeaker generates sound by moving air. If the speaker cone suspension is tight, the excursion buckles and bends the cone during operation. Stephens Trusonic has engineered the speaker cone in "free suspension," mounting it flexibly with a newly developed plastic-impregnated compliance. This allows the speaker cone to move as a true piston. The cone has a free excursion, eliminating distortion, giving a maximum bass response and the best translent response. The clarity and definition of Stephens Trusonic's new "free-cone suspension" speakers herald a new engineering achievement in high fidelity equipment.



These new 8" and 12" speakers provide a refreshing, new kind of sound. No showroom shrills or false lows. These speakers must be heard to be believed. Ask for a demonstration at your audio dealer's.

Listen... you'll always hear more from: STEPHENS TRUSONIC INC.

8538 WARNER DRIVE, CULVER CITY, CALIFORNIA

www.americanradiohistory.com