

AUDIO

CDC

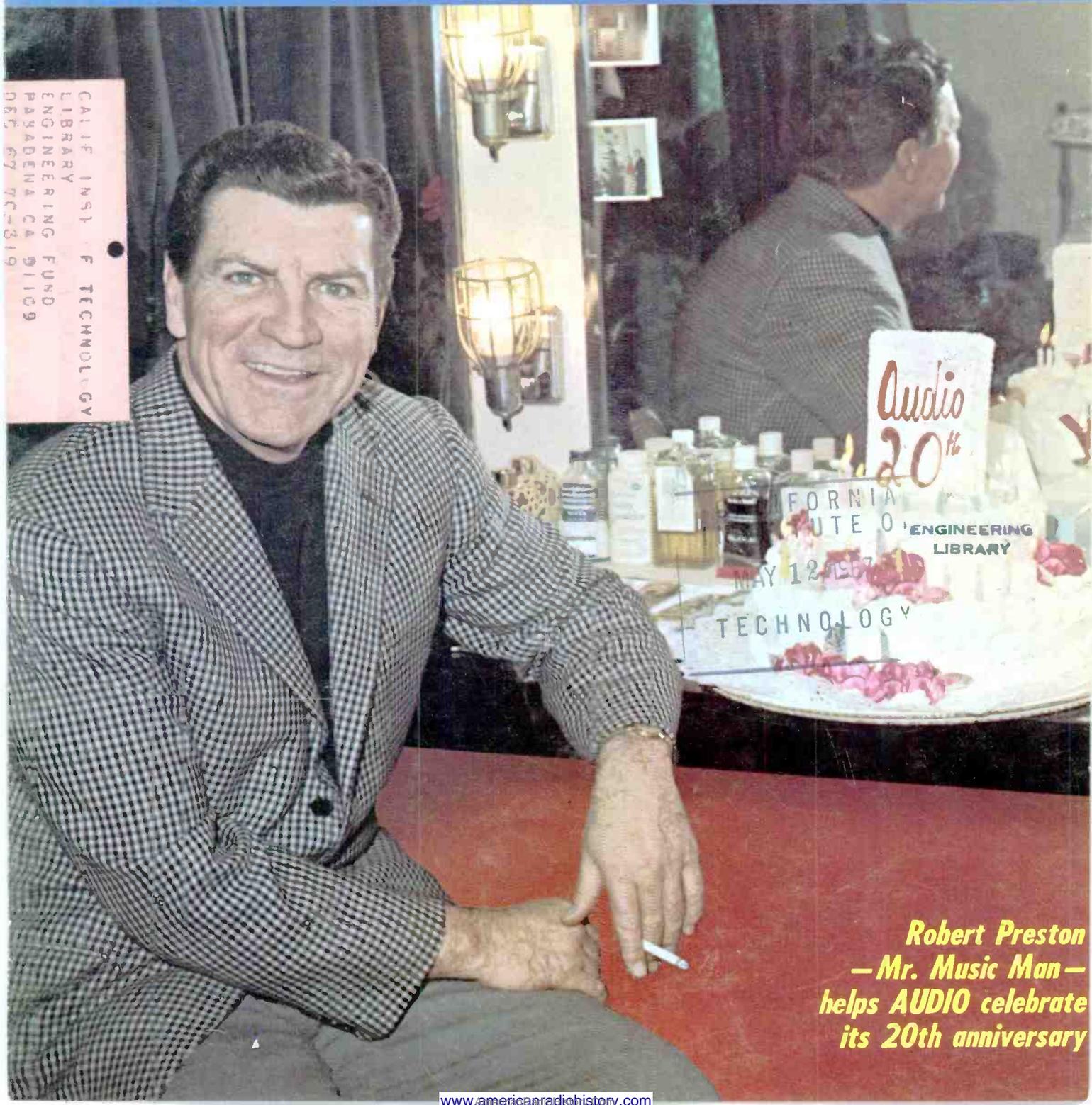
*Twenty*th Anniversary Edition

EQUIPMENT & MUSIC REVIEW

Amey
60c
ON SALE FOR
MAY
1967

... the authoritative magazine about high fidelity

SPECIAL ISSUE: CARTRIDGE TAPE SYSTEMS



CALIF (INS) F TECHNOLOGY
LIBRARY
ENGINEERING FUND
PASADENA CA 91109
DEC 67 7C-319

Robert Preston
—Mr. Music Man—
helps **AUDIO** celebrate
its 20th anniversary

FREE HOME TRIAL

Test drive a pair of new Scott S-11 speakers today!



You bring the wheels . . . Scott's got the speakers! Scott's all-new S-11 speakers are absolutely unparalleled in performance. To prove it to you, Scott wants you to listen to a pair at leisure, in your home, with your own equipment, at no cost or obligation. Test these speakers with your favorite records, with FM stereo . . . even with AM. Compare them with your present speakers . . . regardless of cost. Once you've enjoyed Scott's new S-11 speakers in your home, you'll never again be satisfied with any other speaker.

Who else but Scott, the top name in solid-state components, could design a speaker system so perfectly matched to the needs of solid-state components? Only Scott speakers have been specifically designed to give optimum performance with today's advanced solid-state amplifiers and receivers. Scott Controlled Impedance speakers both safeguard your valuable equipment and give you the kind of sound you wanted when you bought transistor components . . . the kind of sound that prompted AUDIO's Larry Zide to state, ". . . we were strongly impressed by the clarity of reproduction... These Scotts are as clear a musical sound as we would want . . . Frequency sweeps were unusually smooth over the entire range . . . Transient response is quite sharp with little hangover . . . a stereo pair will do justice to the finest sound source. We would like to think that we are quite fussy about the kind of sound we want. Certainly these Scotts fulfill our demands without need of qualifications."

Need more proof? Take home a pair of Scott S-11 speakers today, and hear for yourself the dramatic difference. Dimensions: 24" x 14" x 11 1/4". Price, \$149.95.

TAKE HOME TO YOUR DEALER

Take this certificate to your Scott dealer for your 10-day free home trial of Scott S-11 speakers.

Name _____
 Address _____
 City _____
 State _____ Zip _____

Here's all you do:

1. Take this certificate to your Scott dealer.
2. Pay the dealer for a pair of Scott S-11 speakers under his normal terms.
3. Take home the S-11 speakers and try them out.
4. If, within ten days, you are not completely, ecstatically delighted with the performance of the Scott S-11 speakers, return them to your dealer, in the same condition in which you received them, and get your money back.

Scott . . . where innovation is a tradition



For complete information, write: H.H. Scott, Inc., Dept. 35-05, 111 Powdermill Road, Maynard, Mass., 01754 Export: Scott International, Maynard, Mass.
 Another innovation from Scott, manufacturers of superb components, compacts, kits, speakers, and consoles. © copyright 1967, H.H. Scott, Inc.

Check No. 100 on Reader Service Card.

AUDIO

May, 1967

Vol. 51, No. 5

Number 44 in a series of discussions
by Electro-Voice engineers

Successor to **RADIO**, Est. 1917

SANFORD L. CAHN
Marketing Director

GEORGE PORTER
Art Director

PETER RENICH
Asst. Art Director

LEE IRGANG
Circulation Manager

R. KENNETH BAXTER
Production Manager

C. G. MCPROUD, Publisher

ARTHUR SALSBERG, Editor

HAROLD D. WEILER
Video Editor

EDWARD TATNALL CANBY
Associate Editor

Contributing Editors

JOSEPH GIOVANELLI
HAROLD LAWRENCE

CHESTER SANTON
HERMAN BURSTEIN

BERTRAM STANLEIGH

AUDIO Articles

- 20 Years of AUDIO **25** *C. G. McProud*
- Cover Story —
Robert Preston says:
I Was Raised on Red Seal Records **38** *As told to Larry Zide*
- PROGNOSTICATIONS —
What the Next 20 Years Will Bring **44** *The Industry*
- Professional Tone Controls **60** *Arthur C. Davis and Don Davis*
- Automobile Tape Cartridges **66** *Larry Zide*

AUDIO Reviews

- The AUDIO Music and Record Review Section **84**
- Classical **84**
- Light Listening **92**
- Jazz **100**

AUDIO Profiles

- Heathkit Solid-State Receiver **76** *AR-15*
- University Compact Speaker System **80** *Ultra-D*
- Superex Stereo Headphones **80** *ST-PRO*

AUDIO in General

- Audioclinic **2** *Joseph Giovannelli*
- Fundamental Audio **6** *Martin Leynard*
- Audio ETC **12** *Edward Tatnall Canby*
- Tape Guide **21** *Herman Burstein*
- Editor's Review **22**
- Sound & Sight **74** *Harold D. Weiler*
- Advertising Index **104**



AUDIO (title registered U. S. Pat. Off.) is published monthly by North American Publishing Co., I. J. Borowsky, President; Frank Nemeyer, C. G. McProud, and Arthur Sitner, Vice Presidents. Executive and Editorial Offices, 134 North 13th St., Philadelphia, Pa. 19107. Subscription rates—U.S. Possessions, Canada, and Mexico, \$5.00 for one year; \$9.00 for two years; all other countries, \$6.00 per year. Printed in U.S.A. at Philadelphia, Pa. All rights reserved. Entire contents copyrighted 1967 by North American Publishing Co. Second class postage paid at Philadelphia, Pa., and additional mailing offices.

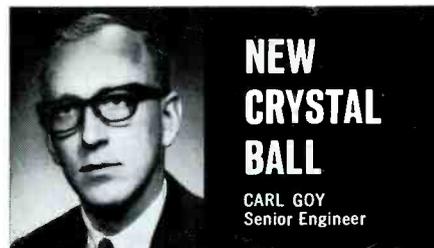
REGIONAL SALES OFFICES: Sanford L. Cahn, 663 Fifth Ave., New York, N. Y. 10022; (212) 753-8824.

Richard Reed, 205 W. Wacker Drive, Chicago, Ill. 60606; (312) 332-3910. Leonard Gold, 1900 Euclid Ave., Cleveland, Ohio 44125 (216) 621-4992. Jay Martin, 9350 Wilshire Blvd., Beverly Hills, Calif. (213) 273-1495.

REPRESENTATIVE: Warren Birkenhead, Inc., No. 25, 2-chome, Shiba Hamamatsu-cho, Minato-ku, Tokyo, Japan.

AUDIO, Editorial and Publishing Offices, 134 N. 13th St., Phila., Pa. 19107
Postmaster: Send Form 3579 to the above address.

AUDIO • MAY, 1967



Much of the development time needed to create any electro-acoustic product has been devoted in the past to trial and error experimentation with the elements that make up the device. In electronics, "bread-boarding" of a new idea is an accepted technique for proving ideas and improving performance. And in transducer design, actual construction of prototype loudspeakers, microphones, phono cartridges, etc., has been a requirement to test new designs.

But this time-consuming experimental work may largely become a thing of the past, with the introduction of the computer as a day-to-day tool available to the engineer. And with the aid of the computer, the engineer will have the ability to explore more fully the nuances of design in search of optimum relationships.

The first step in computer-aided designs is to construct a mathematical model of the device or circuit to be studied. Having fed the model into the computer, each variable can be independently controlled until results match the objectives. The final mathematical model is then translated into finished hardware that produces the effects predicted by the computer.

Not only will the computer provide mathematical statements of equivalent circuits, it can also be used to draw curves representing the output of the device under study. For instance, the effect of a feedback circuit can be shown as a family of curves created by varying the complex feedback impedance. The ideal circuit values can then be chosen based on the optimum curve displayed.

In like manner, a series of broadcast microphone attenuators were developed to meet various levels of input and output, while maintaining strict standards of frequency response and impedance.

Mathematical models of microphones and loudspeakers have also been developed by E-V engineers. Although the use of such equivalent circuits has been quite commonplace, the computer permits development of more detailed, precise models than could be easily accomplished by use of blackboard and slide rule. And with more comprehensive investigation comes more sophisticated answers to design problems.

While the surface has only been scratched in the application of computer analysis to electro-acoustic design, it is already clear that it will play a major part in future developments in the field.



For technical data on any E-V product, write:
ELECTRO-VOICE, INC., Dept. 573A
602 Cecil St., Buchanan, Michigan 49107

Check No. 105 on Reader Service Card.

AUDIO CLINIC

Joseph Giovannelli



If you have a problem or question on audio, write to Mr. Joseph Giovannelli at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

NOTE:

Elsewhere in these pages you will see that AUDIO MAGAZINE has been serving you for 20 years. For the last 11 years I have been privileged to write a column for this magazine. I am proud to say that, during this 11 years, I have not missed a single issue.

At this time I wish to thank all of you for including so many kind remarks in your letters. This has been a constant source of pleasure and, indeed, amazement to me. It has been my observation that, in general, a person does not write a letter unless he has some fault to find: apparently people seem to be more negative in their comments than positive. This has not been true in my case. To those of you who continue to like what I do, I say, "keep on writing." I can't say that I object to a little praise. However, to those of you who do not like what I am doing, I say, "Write me." Only by receiving letters in both the positive and negative directions can I know how to improve this column, making it better for you. This is a case in which a positive and a negative do not add up to zero. The positive numbers will lead, probably, to a somewhat increased cranial size. While this might make for difficulties in wearing a hat, it will mean increased cerebral capacity for storing information needed to help you with your problems. The negative

COMING NEXT MONTH

"Musical Broadcasting in the 19th Century," a fascinating picture of early methods of purveying music long prior to "wireless" as we know it today.

Getting to Know the Decibel—Simplifying the calculations pertaining to this all-important tool in the handling of sound levels.

In the June Issue—on your newsstand, at your favorite audio dealer's, or in your own mailbox.

comments will tend to reduce the aforementioned skull enlargement. Further, they will indicate those instances in which I have goofed or indicate new directions this column might take. Thank you, one and all, for what you have written and for what you will write in the future. I look forward to continued association with this fine magazine.

Throughout the years in which I have been answering your questions, I have received numerous letters concerning the problem of equipment obsolescence. To all of you I have said that if a piece of equipment is designed well, it is not made obsolete by the introduction of next year's models. Of course, there may be some new feature on next year's model which might dictate a change of equipment, but it is not necessary to make the change from the standpoint of really dramatic changes in performance levels. Such changes are hard-won and come along slowly. During these eleven years that I have been a contributing editor to AUDIO, we have all witnessed the phenomenal transition from vacuum tubes to transistors. Nevertheless, that high-quality, well-designed piece of audio gear you purchased in 1955 or 1956 can still give a good account of itself in 1967.

In order to demonstrate that good, fundamental engineering and design concepts are not out-moded, here are a few questions originally asked by you when my AUDIOCLINIC column first appeared:

Q. I have two tape recorders, a hi-fi system (incorporating a receiver), and an extra amplifier. I would like to connect tape machine A to the system for recording and playback, and I would like to use machine B for duplicating tapes. I would like to be able to record both from tuner and phonograph. How shall I hook up these various components?

A. To review, I take it that you want to do the following: (1) play FM through your hi-fi system; (2) play phono through your system; (3) play tape machine A through your system; (4) use machine A for recording FM and phono; (5) use machine A for duplicating tapes played on machine B. There is no need for your extra amplifier. Make your connections as follows.

1. Connect the output of the receiver to the speakers.
2. Connect the phonograph to the phono input of the receiver.
3. Connect the outputs of machine A to the receiver's "tape-input" (or "tape-amp") jacks. These outputs

should be the ones intended for an external amplifier rather than for an external speaker.

4. Connect the "tape output" jacks of the receiver to the high-level inputs of machine A.
5. Connect the outputs of machine B to one of the extra pairs of high-level inputs of the receiver; these inputs are labeled "aux" or "tuner." Thus when you are playing machine B into the receiver, the latter is feeding the same signal into machine A for duplicating.

Q. Would you consider VU meters which also operate in the playback mode of a tape machine as a professional feature? If so, can the needle be damaged by over-recorded tapes?

A. A VU meter that reads playback level may be viewed as catering to professional requirements. The professional is often concerned with feeding the proper amount of signal to the chain of equipment following the tape machine—enough to drive the equipment to a required level, but not so much as to cause distortion and cross-talk. Reading playback level is usually of secondary importance to the home user, although it can be useful in checking frequency response or azimuth alignment, thus eliminating the need for an external meter. It may be of some interest to the home user to know when he is dealing with a seriously under- or over-recorded tape.

There seems to be no danger that an overrecorded tape will damage the VU meter, provided the meter is properly adjusted so that it indicates 0 VU at a recorded level that produces about 1 per cent harmonic distortion on the tape at 400 Hz. Tape saturation—beyond which the recorded signal level cannot be increased—is then some 12 dB above 0 VU. A true VU meter can endure for 1/2 second a signal 20 dB above 0 VU, and it can continuously endure a signal 14 dB above 0 VU.

Q. I was recently given a speaker by a friend. There was no indication as to what its voice-coil impedance might be. Could you please tell me how to find this out? Arnold Weiss, Brooklyn, New York.

A. Here are three ways that you might try: 1. If you can determine the speaker's manufacturer, together with its model and/or serial number, give him this information. He can tell you its impedance, as well as advise you as to the type of enclosure in which it will work best.

2. If you have an audio oscillator, an ohmmeter, and some means of measuring low-voltage a.c., do this: Place the speaker in some kind of enclosure, since this has considerable effect upon its impedance. Connect the voice-coil leads, potentiometer, and output transformer of your amplifier as shown in Fig. 1. In it we see the voice-coil leads connected in series with the potentiometer, and this series combination is connected across the secondary of the output transformer. The potentiometer is connected as a variable resistor, with one of the end lugs not used. Since most speakers have impedances ranging from 3.2 to 16 ohms,



BRITISH INDUSTRIES CORPORATION

WESTBURY * NEW YORK 11590 * (516) ED 4-7450

CABLE: BRITIND
WESTBURY, N. Y.
TWX: 516-333-4728

April 15, 1967

Well Done!

It seems eminently fitting that on this 20th anniversary of "Audio," congratulations should be extended to you who read the magazine.

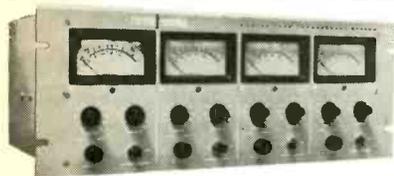
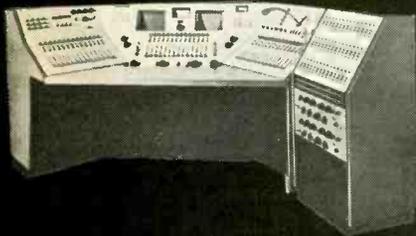
For you have done something quite remarkable. I wonder if you realize just how much the readers of "Audio" have contributed to the progress made in our industry. I can assure you that many of the most significant developments incorporated in Garrard, Wharfedale and Multicore products have been reflections of your direct comments to us, your dialogue in "Audio," and your appreciative response to better equipment. It was your informed influence on others that resulted in their awareness of high fidelity components and encouraged a growing audience for finer sound reproduction. Now, in the stereophonic era, the same process of personal recommendation is essential to further advancement.

Therefore - well done, "Audio" reader! And... appreciation to "Audio" itself for having provided, for 20 years, a major medium for progress.

Sincerely,

Leonard Carduner
President

SUPER SOUNDS start with FAIRCHILD



FAIRCHILD MASTER TAPE IMPROVEMENT SYSTEM

FAIRCHILD MTIS with "focused-gap" head design reduces bias-induced noise to a point where it is no greater than 1.5 db than the noise of virgin or bulk-erased tape. FAIRCHILD MTIS has an S/N ratio of 72 db on one track of a 4-track 1/2" tape. FAIRCHILD MTIS increases the recording level by 4 db over present standards, with the lowest harmonic, intermodulation, and cross-modulation distortion of only .5%. Only the FAIRCHILD MTIS comes in a compatible, convertible package allowing you to update your present tape transports to the highest quality "state-of-the-art" recording standards.

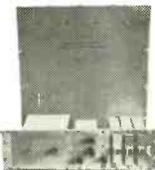


FAIRCHILD CONAX

The world-accepted way to control high frequency spillovers in FM due to pre-emphasis. Lets your station maintain real high levels even with brass and crashing cymbals and still avoid FCC citations.

THE REVERBERTRON

The new compact reverberation system which gives your station that real big voice. With the Reverbertron you can have that Carnegie Hall effect as close as the gain control on the Reverbertron. And there's the added plus of an increase in apparent loudness of your station sound due to reverberation, as originally described by Dr. Maxfield.



Write to FAIRCHILD — the pacemaker in professional audio products — for complete details.

FAIRCHILD
RECORDING EQUIPMENT CORPORATION
10-40 45th Ave., Long Island City 1, N.Y.

Check No. 108 on Reader Service Card.

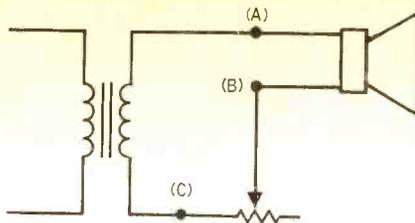


Fig. 1

a thirty-ohm pot should do nicely here. Connect the audio oscillator to the input of your amplifier, and set its frequency controls to 400 Hz. With the signal feeding the speaker, connect your a.c. voltmeter first from A to B, and then from A to C as shown in the figure. Adjust the potentiometer so that the two voltage readings remain equal as you change the pot from the circuit, being careful not to disturb its setting. Read its resistance with your ohm meter. This will be the approximate impedance of the speaker, since we can consider the impedance as a pure resistance. In a series circuit (which we have here), only when the resistances are equal can the voltage drops across them be equal. Of course, there is also a third impedance present, that of the secondary of the output transformer, which at a quick glance, might appear to be a factor here. However, this is not the case. We need only be concerned with there being equal voltage drops across the voice coil and the pot. The impedance of the secondary will determine only the voltage reading on the meter, but cannot influence the setting of the pot needed to obtain equal readings across it and the voice coil.

3. The last method is little more than a guess, but it can be used where there are no measuring instruments available. Simply feed a signal source of high quality, such as a record player or FM tuner, into the amplifier. Connect the speaker in turn to the various taps of the output transformer until one is found which gives maximum output and response as noted by ear. The impedance of the tap to which the speaker is connected will be in the vicinity of true impedance of the speaker. However, since considerable mismatch can be tolerated without substantially affecting performance, it is quite likely that you will not have determined the impedance quite so accurately as when following steps 1 or 2.

Tweeters

Q. Why are tweeters so often used in high-fidelity speaker systems? Harry Davis, Utica.

A. A tweeter is used to raise the level of the high frequencies to that of the middle and low frequencies. This must be done, as it is extremely difficult for a single speaker to respond equally well to all of the frequencies necessary for good sound reproduction.

Wow and Flutter

Q. What is the difference between wow and flutter? Bob Bloom, Cheyenne.

A. Wow is a slow variation in pitch caused by similar variations in turntable

speed. Either the recording or play-back turntable may be at fault. Flutter is a rapid variation in pitch caused by variations in turntable speed or capstan speed of tape recorders or tape phonographs. In phono turntables, it is usually caused by the idler, which may not be in the same plane as the motor pulley and the platter, or which may have a faulty bearing, or which may simply need lubrication.

Linearity

Q. As applied to electronics, what is meant by linearity? John Carlson, Bronx, New York

A. As you know, a microphone (or phonograph pickup) converts mechanical motion into electrical voltages. These are a.c. voltages whose instantaneous value depends upon the amount of mechanical motion, and whose frequency depends upon the number of vibrations imparted to it. These voltages are then applied to the grid of a tube. At the output of the tube, the voltage is larger by an amount equal to the gain of the tube. If the signal in the output circuit is perfectly linear, the relationship between the voltages in the output circuit should be equal to all the voltage relationships in the input circuit. This is the same as saying that when we copy a small picture by using an enlarger, the picture is made bigger; although all parts of the picture are larger than in the original, their relative sizes remain unchanged. Not only must the relationships between instantaneous voltage peaks be maintained, but the tube must not add any voltages of its own. Of course, there is a 180-deg. phase shift in the plate circuit of a vacuum tube, so that all voltages are now of opposite sign from those originally applied to the grid circuit. This is of no importance. What is important is that any phase change should affect voltage at all frequencies to an equal extent. Phase changes which vary with frequency do occur and are unwanted. Ask anyone who has attempted to design negative feedback circuits about this.

If an amplifier is perfectly linear, and if the microphone or phonograph pickup has properly interpreted the mechanical motion supplied to it, good sound reproduction should be had, again assuming that the loudspeaker can accurately reconvert the electrical voltages and currents into mechanical motion, and if the room acoustics do not alter the phase relationship between the soundwaves transmitted from the speaker or otherwise alter the relative magnitude of the soundwaves.

If some frequencies are stronger than they were in the original signal, or if some are weaker than they should be for good linearity, we have another way of saying that the amplifier in question suffers from a poor frequency response, or at least that the response is not flat. If there are voltages added other than any present in the original signal, the amplifier is said to have harmonic or intermodulation distortion, depending upon the means by which they were introduced.

Æ

Check No. 106 on Reader Service Card →

GARRARD'S 60 Mk II

quite possibly the **BEST BUY**

among all automatic turntables



Tubular aluminum tone arm has adjustable counterweight, resiliently mounted to prevent resonance.

Automatic anti-skating assembly neutralizes side pressure on stylus... prevents distortion and uneven record wear.

Cueing/pause control lever raises and lowers tone arm safely over any groove.

Built-in precision stylus pressure gauge, with knurled, optical-type dial.

Heavy cast, balanced, oversized turntable with decorative mat and trim.

Low mass plug-in shell with bayonet fitting; takes the lightest, finest cartridges.

CONSIDER FEATURES

Cueing and pause control. Automatic anti-skating assembly. Cast oversized turntable. Adjustable counter-balanced tone arm. Precision stylus pressure gauge. Shielded Laboratory Series® motor and other Garrard innovations built into this excellent unit.

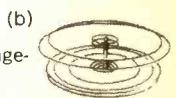
CONSIDER PERFORMANCE

Tracking as low as 1/2 gram. Wow, flutter, rumble, and speed accuracy surpassing NAB standards.

CONSIDER VALUE . . . only \$74.50

less base and cartridge

Built to unsurpassed standards... this very successful compact unit, bearing the Garrard name, is a source of utmost satisfaction and continuing pride in any music system. For complimentary Comparator Guide describing all five new Garrard automatics, write Garrard, Dept. AE-1, Westbury, N.Y. 11590.



Two interchangeable spindles for sure, safe, gentle handling of records (a) short—for single record play (b) long—for intermix automatic play when desired.

Fundamental AUDIO

MARTIN LEYNARD

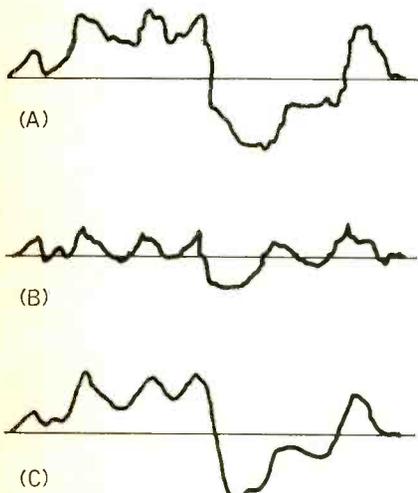


Fig. 1

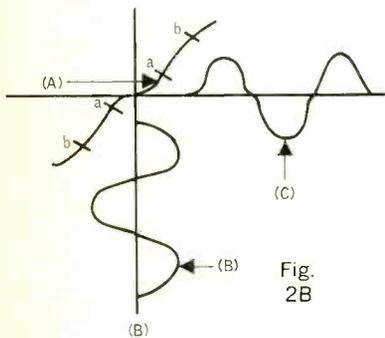


Fig. 2B

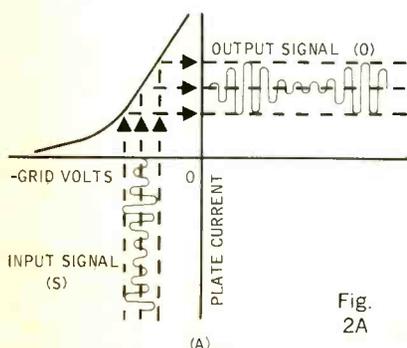


Fig. 2A

LAST MONTH, we discussed how the sound of a wave depends upon its shape. Unfortunately, all audio equipment alters wave shapes to some extent, and in the process, alters the sounds these signal waves produce. We call this alteration "distortion"—or more properly, "distortions," since there are several kinds. These may be classed as amplitude distortion, non-linear distortion, phase distortion, transient distortion, scale (or volume) distortion and frequency-modulation distortion.

An audio component should be equally sensitive to all the audio frequencies; if one volt of a 1000-Hz signal fed to an amplifier produces one watt of output, then one volt input should produce one watt output whether the signal frequency is 20 or 20,000 hertz. Any deviation from such an ideally "flat" frequency response may be called "amplitude distortion." We normally don't think of this as a distortion, but by our over-all definition, it is. For musical waveforms are complex mixtures of many frequencies at once, and a component that is more sensitive at some points of the audio spectrum than at others will alter the wave-shape—and the sound—accordingly (Fig. 1). A little experimentation with your sound system's controls (their purpose is to re-shape the system's frequency response deliberately to meet unusual or less-than-optimum conditions) will give you an idea of some of the difference amplitude distortion will make.

Non-linear Distortion

When we speak of distortion, we usually mean harmonic and intermodulation distortion, two forms of non-linear distortion. This brings us briefly to a property of tubes, transistors, tapes, and other

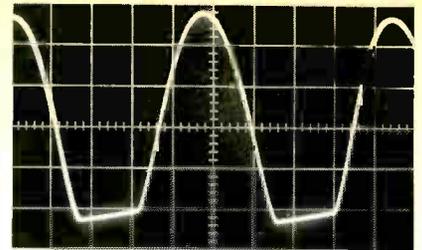


Fig. 3A

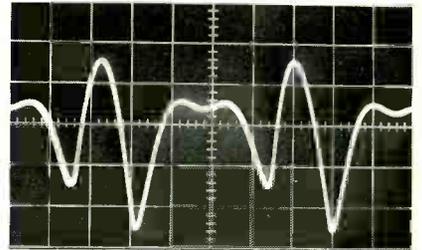


Fig. 3B

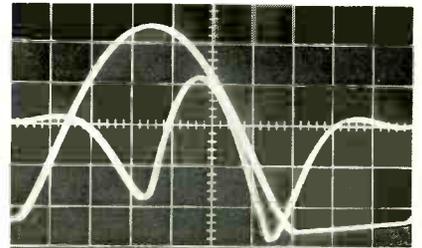


Fig. 3C

devices which is called the "transfer characteristic."

The transfer characteristic is one way of visualizing the change a signal undergoes in passing through a device. Imagine our signal wave moving upwards along a graph line until it hits the line that represents our transfer characteristic (A) in Fig. 2, with every point on our signal wave going off at a right angle to its original path to form the output signal, as soon as it hits the transfer curve. If the transfer curve is linear, the output signal will be an exactly proportioned replica of the input. If the transfer curve rises at an angle of more than 45 deg, the output will be greater than the input—amplified, in other words—but otherwise unchanged. (A 45-deg. curve would represent, for all practical purposes, the transfer characteristic of a straight wire, with no gain; a shallower angle would represent a resistor, diminishing the signal's amplitude but not otherwise affecting it.)

But if, for some reason, the transfer curve is *not* linear, the shape of the out-



Fig. 4

Check No. 107 on Reader Service Card →

Alabama

BIRMINGHAM
Llakis Stereo Center
DECATUR
Forbes Distributing
DOTHAM
Wiregrass Elec.
HUNTSVILLE
Electronic Whol.
MOBILE
Electronics World
Specialty Dist.
MUSCLE SHOALS CITY
Sound City Elec.

Arizona

GLENDALE
Merritt Electric
PHOENIX
Arizona Hi-Fi
Goway Dept. Store
Radio Shack
Woodco Dept. Store
SCOTTSDALE
Empire Radio
Goway Dept. Store
TEMPE
Woodco Dept. Store
TUCSON
Save Co. Dept. Store

Arkansas

PINE BLUFF
Ratley House of Music

California

ANAHEIM
Anahem Electronics
Henry Radio
Radio Shack
Save Co. Dept. Str.
White Front
AZUSA
Rancho Sound
BAKERSFIELD
Radio Shack
Berkeley
Cal Hi-Fi
Robert E. Lee
Pacific Electronics
BEVERLY HILLS
Sound Center
CAMPBELL
Alco Home Elec.
CANOGA PARK
White Front
CARMICHAEL
Cal Hi-Fi
CASTRO VALLEY
Audio Emporium
COSTA MESA
White Front
COVINA
Radio Shack
White Front
WEST COVINA
Radio Shack
Save Co. Dept. Str.
CULVER CITY
Barshel's
DOWNEY
Radio Shack
White Front
ENCINO
IFA Elec.
FRESNO
White Front
GARDEN GROVE
Radio Shack
GLENDALE
Logans Elec.
GOLETA
Disco Fair
HOLLYWOOD
Hi-Fi Corner
Yale Radio Electric
INGLEWOOD
Inglewood Elec.
Olson Electronics
Radio Shack
LA HABRA
Radio Shack
LA MESA
White Front
LONG BEACH
L. M. Barcus
Radio Shack
LOS ANGELES
ABC Premiums
Bel-Air Camera
Henry Radio
Radio Shack
Save Co. Dept. Str.
Shelley's Stereo
Warsco Sales
White Front
MONTEBELLO
Coastron
MOUNTAIN VIEW
Alco Home Elec.
Audio Video Forum
Cal Hi-Fi
Radio Shack
NORTH HOLLYWOOD
World Electronics
OAKLAND
Fisher Electronics
Radio Shack
Wayne's Sound
White Front
ONTARIO
White Front
OXNARD
Disco Fair
PACIFICA
White Front

PASADENA

Radio Shack
SAVO RIVERA
Save Co. Dept. Store
CASANT HILL
White Front
RICHMOND
Pacific Electronics
SACRAMENTO
California Radio
Lafayette Elec.
Lampert's
Radio Shack
Stereo Showcase
White Front
PLACENTIA
SAN BERNARDINO
White Front
SAN BRUNO
Radio Shack
SAN DIEGO
Brier Sound
Pro-Am Elec.
Radio Shack
Save Co. Dept. Str.
White Front
SAN FRANCISCO
Basic Listening Post
Eber Electronics
Fisher Electronics
Pacific Electronics
Radio Shack
White Front
SAN JOSE
Alco Paramount Elec.
SANTA MARIA
Lombard's Elec.
SANTA MONICA
Radio Shack
SOUTH GATE
Mac's Elec.
SUNNYVALE
Home Elec.
TORRANCE
Radio Shack
Save Co. Dept. Str.
White Front
VALLEJO
White Front
Boyd Wonn Hi-Fi

Colorado

DENVER
Denver Sound
Empire Audio
Lloyd's Hi-Fi
Radio Shack
CONN.
HAMDEN
Lafayette Radio
Radio Shack
HARTFORD
Barshel's Records
WEST HARTFORD
Lafayette Radio
Radio Shack
MANCHESTER
Radio Shack
NEW HAVEN
E. J. Korvette
Dean Smith
Radio Shack
NEW LONDON
Radio Shack
ORANGE
Radio Shack
STAMFORD
Radio Shack

Conn.

Delaware
DOVER
Lafayette Radio
Wilmington
Sloan Camera
Wholesale Elec.
District of Columbia
WASHINGTON
Audio Specialists
Custom Hi-Fi Elec.
Electronic Whol.
Giens Audio
Florida
CLEARWATER
Stereo City, Inc.
DAYTONA BEACH
Certified Elec.
FORT LAUDERDALE
Hopkins-Smith
JACKSONVILLE
Hoyt Hi-Fi
MIAMI
Electronic Equip
Friedman Sound
Hopkins-Smith
Sound Box
ORLANDO
Radio Shack
PENSACOLA
Grice Electronics
SARASOTA
Dow Electronics
TALLAHASSEE
The Sound Shop
WINTER PARK
Frutchey Audio

Georgia

Atlanta
Specialty Dist.
ATHENS
Specialty Dist.
BRUNSWICK
Specialty Dist.
COLUMBUS
Specialty Dist.
DECATUR
Alan's of Atlanta
MACON
Specialty Dist.
MARIETTA
Specialty Dist.
SAVANNAH
Norwood's Records
Specialty Dist.
VALDOSTA
Specialty Dist.

Illinois

CHICAGO
Allied Radio Corp.
Radio Shack
Ralph's Hi-Fi
ELMHURST
E. J. Korvette
MATTESON
E. J. Korvette
MOLINE
Home Elec.
c/o Arlan's
LORGEN DIST.
MORTON GROVE
E. J. Korvette
OAKLAND
E. J. Korvette
SUNNYVALE
Home Elec.
c/o Arlan's
N. RIVERSIDE
E. J. Korvette
SPRINGFIELD
Home Elec.

Indiana

ANDERSON
Electronic Supply
E. J. Korvette
George C. Mettle
Home Elec.
FORT WAYNE
Fort Wayne Elec.
Greiner's
Home Elec.
INDIANAPOLIS
Communications
E. J. Korvette
Graham Elec.
Valley Radio
LAFAYETTE
Lafayette Radio
MUNCIE
Muncie Elec.

Iowa

BETENDORF
Home Elec.
c/o Arlan's
DAVENPORT
Griggs Piano Co.
Kansas
LAWRENCE
Fred E. Sutton
WICHITA
Radio Shack
Sound Mdr.

Kentucky

LOUISVILLE
Hi-Fi Sales
Louisiana
ALEXANDRIA
House of Elec.
BATON ROUGE
Lafayette Radio
MOCHESTER
Metairie
Bell Radio
NEW ORLEANS
Custom Audio
Lafayette Radio

Maine

PORTLAND
Radio Shack
Maryland
BALTIMORE
American Dist.
E. J. Korvette
High Fidelity Hse.
Stansbury Photo
BETHDA
McGuire's Audio
CUMBERLAND
Radio Parts Co.
GLEN BURNIE
E. J. Korvette
LANGLEY PARK
Radio Shack
MOUNT RANIER
Lafayette Radio
ROCKVILLE
E. J. Korvette
SALISBURY
Lafayette Radio

Mass.

BOSTON
Cramer Elec.
DeMambo Hi-Fi
Lafayette Radio
Radio Shack
Raymond's
World of Music
BRAINTREE
Radio Shack
BROCKTON
Radio Shack
BROOKLINE
Radio Shack
CAMBRIDGE
Lechmere Sales
Radio Shack
Stereo Designs
DEOHAM
Lechmere Sales
FRAMINGHAM
Radio Shack
LOWELL
Radio Shack
LYNN
Mass. Camera Ctr.
MANCHESTER
Anahem
NATICK
Lafayette Radio
SAUGUS
Lafayette Radio
WOBURNE
Radio Shack
SPRINGFIELD
Lafayette Radio
Radio Shack
WEST SPRINGFIELD
Radio Shack
WILMINGTON
Lafayette Radio
Radio Shack

Michigan

ANN ARBOR
Home Appl. Mart.
BAY CITY
Home Elec.
c/o Arlan's
DETROIT
E. J. Korvette
Hershel Elec.
Olson Elec.
R. D. Larson
ESCANABA
Felton Radio
FLINT
Home Elec.
c/o Arlan's
GRAND RAPIDS
Home Elec.
c/o Arlan's
R. L. Karns
JACKSON
Jackson Photo
Paka Photo
LINCOLN PARK
Hershel Elec.
BADISON HTS.
Hershel Elec.
MT. CLEMENS
Home Elec.
PONTIAC
New Center Elec.
ROSEVILLE
E. J. Korvette
SAGINAW
Home Elec.
c/o Arlan's
ST. JOSEPH
R. A. Howard
SOUTH GATE
E. J. Korvette
WARREN
Audiotand
Home Elec.

Minnesota

MINNEAPOLIS
Audio King
Lew Bonn Co.
Radio Shack
Schaak Elec.
Sound of the N. W.
MOCHESTER
Lew Bonn Co.
ST. PAUL
B-Z Audio Clinic
Radio Shack
Schaak Elec.
Sound of the N. W.
WILLMAR
The Music Store
WINONA
Hal Leonard

Missouri

JOPLIN
Four State Radio
ST. LOUIS
High Fidelity Showrm
E. J. Korvette
King Sound Co.
Radio Shack
SPRINGFIELD
Norman Elec.

Montana

BOZEMAN
Montana Music
Nebraska
OMAHA
Radio Shack

New Hamp.

MANCHESTER
Radio Shack
New Jersey
ATLANTIC CITY
Rainbow Elec.
ASBURY PARK
Dart Electronics
AUDUBON
E. J. Korvette
BAYONNE
Gem Electronics
BRUNSWICK
Gem Electronics
BROOKLYN
Newmark & Lewis
HUNTINGTON
Gem Electronics
HUNTINGTON STA.
E. J. Korvette
Rite Electronics
ITHACA
Dryden Radio
JAMAICA
Classic Elec.
Lafayette Radio
JAMESTOWN
Warren Radio
LAWRENCE
Newmark & Lewis
E. J. Korvette
LITTLE NECK
E. J. Korvette
MONARDS
Gem Electronics
MIDDLETOWN
Gem Electronics
TOLEDO CENTER
MOUNT VERNON
Gem Electronics
NANUET
E. J. Korvette
NEW HYDE PARK
Dressner Audio
NEW YORK
Alex Radio
Audio Unlimited
Bryce Appliance
DEFA Elec.
E. J. Korvette
Koopers Products
Gem Electronics
Harvey Radio
Lafayette Radio
Leonard Radio
Packard Elec.
Rabson's
Radio Shack
PELHAM MANOR
E. J. Korvette
PLAINFIELD
Gem Electronics
PORTCHESTER
The Korvette
ROCHESTER
Hyatts Hi-Fi
ST. JAMES
Gem Electronics
SCARSDALE
Lafayette Radio
SCHENECTADY
Radio Shack
Seiden Sound
STATEN ISLAND
E. J. Korvette
SYOSSET
Lafayette Radio
Newmark & Lewis
SYRACUSE
Radio Shack
University Hill Mus.

New Mexico

ALBUQUERQUE
High Fidelity Consult
Radio Shack
Nevada
RENO
Art Rempel Sound
New York
ALBANY
Fort Orange Radio
Radio Shack
BATAVIA
Epo Electronics
BAYSHIRE
Gem Electronics
BELLEROSE
Gem Electronics
BINGHAMTON
Audio Service
Radio Shack
BRONX
Electronic World
E. J. Korvette
Gem Electronics
Lafayette Radio
BROOKLYN
Gem Electronics
E. J. Korvette
Newmark & Lewis
SYRACUSE
Radio Shack
University Hill Mus.

N. Carolina

ASHEVILLE
High Fidelity Sales
DURHAM
Vickers Elec.
HICKORY
Harrisburg Radio
Audio Sound
RALEIGH
Audio Center
N. Dakota
FARGO
Walter Elec.
Ohio
AKRON
Olson Electronics
AMHERST
Eastern Stereo
ASHTABULA
Warren Radio
CANTON
Walker Radio
George C. Wille Co.
CINCINNATI
Custom Crafters
Hi-Fi Audio
The Myronic Co.
Radio Shack
Steinberg's
United Radio
CLEVELAND
Forest City Material
Pioneer Standard
COLUMBUS
Anderson Hi-Fi
Custom Stereo
DAYTON
Stotts-Friedman
SOUTH EUCLID
Winteradio
FREMONT
Swartzlander Radio
PARMA
Winteradio
STUEBENVILLE
Lafayette Radio
TOLEDO
Home Elec.
c/o Arlan's
WARREN
Valley Hi-Fi
YOUNGSTOWN
Armies Elec.

Oklahoma

OKLAHOMA CITY
Larsen Music
Radio Shack
FULSA
Radio Shack
Oregon
BEAVERTON
Valley Hi-Fi
TRONICS
Lafayette Radio
Newmark & Lewis
SYRACUSE
Radio Shack
University Hill Mus.

Penn.

ALLENTOWN
Gem Electronics
E. J. Harte
ARMORE
Soundex Elec.
BALA CYNWYD
Radio Clinic
BETHLEHEM
Bitronics
EVYON
Harry Sugerman
ERIE
Warren Radio
HARRISBURG
Harrisburg Radio
KING OF PRUSSIA
E. J. Korvette
KINGSTON
A & B Stereo
MEADOW
Walick's Elec.
Warren Radio
PAOLI
Hi-Fi Center
PHILADELPHIA
Eastern TV
Herman Miller Co.
Radio Shack
Sam Goody
John Wainmaker
PITTSBURGH
House of Audio
Lafayette Radio
Radio Shack
Solar Electronics
WEST CHESTER
Hi-Fidelity Stereo
WILKES-BARRE
General Radio
WILLOW GROVE
Soundex Elec.
WYNCOTE
E. J. Korvette
Lafayette

Puerto Rico

HATO REY
Charrons
Rh. Island
FREMONT
Swartzlander Radio
PROVIDENCE
Radio Shack
EAST PROVIDENCE
Radio Shack
TACOMA
Lafayette Radio
Standard Records
C & G Electronics
Tennessee
CHATTANOOGA
Specialty Dist.
KNOXVILLE
Music Land Inc.
MEMPHIS
Radio Shack
NASHVILLE
Nicholson's Hi-Fi
Radio Shack
Texas
ABILENE
Radio Shack
R & R Elec.
c/o Arlan's
ARLINGTON
Radio Shack
Amateur Elec.
Niebler Electronics
Wisconsin Elec.

Texas

ABILENE
Radio Shack
R & R Elec.
c/o Arlan's
ARLINGTON
Radio Shack
Amateur Elec.
Niebler Electronics
Wisconsin Elec.

Utah

SALT LAKE CITY
Radio Shack
Virginia
ARLINGTON
Radio Shack
BAILEYS CROSSRDS
E. J. Korvette
FALLS CHURCH
Lafayette Radio
Television Workshop
HAMPTON
GEX Audio Dept.
RICHMOND
Audio Fidelity
Gary's
SPRINGFIELD
Capital Recording
VIRGINIA BEACH
GEX Audio Dept.
Radio Shack
Washington
BELLEVUE
Vega Trading Co.
SEATTLE
American Mercantile
LAFAYETTE
Radio Shack
Standard Records
C & G Electronics
W. Virginia
CHARLESTON
Electronic Spec.
WHEELING
Lafayette Radio
Wisconsin
MADISON
Home Elec.
c/o Arlan's
MILWAUKEE
Allied Radio
Amateur Elec.
Niebler Electronics
Wisconsin Elec.



Because our competitors' speakers are very good... we had to work very hard. We're glad we did. You'll be too!

Wharfedale's diminutive new Achromatic W20 represents an achievement in sound, above all... with dimensions and cost a secondary consideration. Instead of the usual 4", 5", or even 6" woofer... it uses a high compliance, low resonance full 8" speaker with exclusive Flexiprene cone suspension. And, this is topped off with a new highly advanced mylar-domed pressure tweeter having excellent omni-directional dispersion characteristics. Both speaker components have heavy magnet assemblies for controlled transient response. Network and voice coil values have been carefully designed to perform excellently with either vacuum tube or transistor amplifiers and receivers. Even a continuously variable acoustic compensation control is included. Listen to the W20 at any of these authorized Wharfedale dealers. Close your eyes, and you'll forget that it's so small (9 3/4" x 14" x 8 1/2" deep) and costs so little - only \$49.95 in genuine oiled walnut. One of 6 new Achromatic Speaker Systems, all illustrated in Wharfedale's full color comparator brochure. Let us send you a complimentary copy. Write Dept. HE1, Wharfedale Div. British Industries Corp., Westbury, N. Y. 11590.



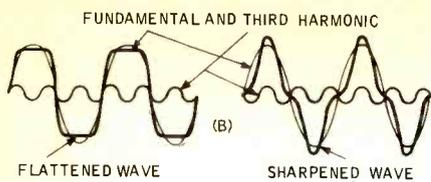


Fig. 5B

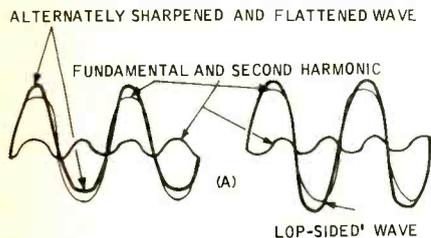


Fig. 5A

put waveform will be changed as in (B) of Fig. 2. The curve needn't even be contorted as that to cause distortion; if the input signal in Fig. 1 had a bit more amplitude, the peaks along its "left" edge would swing over into the non-linear portion of the transfer curve, causing the wave to "clip" and look rather like (A) in Fig. 3.

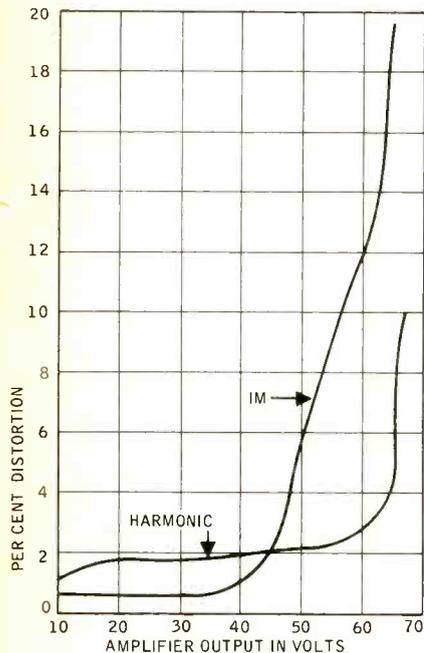


Fig. 6

Harmonic Distortion

As we mentioned last month, any waveform can be analyzed into a mixture of sine waves of various frequencies. And even though we fed only a single-frequency sine wave into the test amplifier that produced our distorted waveform, the output can be shown to contain several multiples, or "harmonics" of the original frequency—hence the name "harmonic distortion" for this particular result of non-linearity. A harmonic distortion

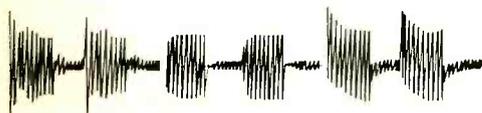


Fig. 8

meter (such as the one in Fig. 4), works by filtering the input frequency out of the output signal and comparing the amplitude of the remaining distortion products with the amplitude of the whole output signal. These distortion products can be fed to an oscilloscope and (B) in Fig. 3 shows the complex of harmonics which the amplifier's "clipping" action added to the original sine-wave signal, and (C) shows one cycle of this harmonic complex superimposed onto a cycle of the original output wave; the harmonic relationship can be plainly seen. Different distortion products alter the wave in different ways: Odd-numbered harmonics tend to flatten or sharpen the wave. Even harmonics make the wave lop-sided or alternately flatten and sharpen the wave's peaks, as in Fig. 5.

Harmonic distortion will not always make the sound unpleasant—after all, musical waveforms are made up of just such fundamentals and harmonics—but will always make the sound untrue, for it distorts the relationships between fundamentals and harmonics—but will always make the sound untrue, for it distorts the relationships between fundamental and harmonic that give each sound its distinctive timbre.

Intermodulation Distortion

Intermodulation distortion, unlike harmonic distortion, can only occur when two or more frequencies are present simultaneously in the input signal. It can take two forms: amplitude modulation of one frequency by another, or the production of spurious frequencies not present in the input signal.

If you were listening to a choir singing a high but steady "E" of 1320 Hz while the organ played a very low "A" of 27.5 Hz, you would hear only those two distinct notes. But if your sound system suffered from intermodulation of the amplitude-modulation type, the choir's high "E" would acquire an unpleasant vibrato, its volume rising and falling 27.5 times each second until the organ note ceased. Or you might hear spurious sum-and-difference tones of 1347.5 Hertz ($1320 + 27.5$), 1292.5 Hz ($1320 - 27.5$), 2688 Hz ($1395.5 + 1292.5$), and so on, few if any of them having any particular or pleasant harmonic relation to the music. The result of this latter form of intermodulation distortion is a harsh, buzzy sound; when we say that something sounds distorted; we're usually talking about IM.

Generally, a component exhibiting one form of non-linear distortion also exhibits the other. But there is no fixed ratio between them, and the ratio of IM to harmonic distortion for a given amplifier may vary with the amplifier's output as in Fig. 6.

Transient Distortion

Transient distortion affects the shape of the wave envelope, rather than that of the steady wave itself. No matter how fast a note's attack or cut-off, no matter how steep the leading and trailing edges of its wave envelope, the sound system should be able to reproduce that envelope exactly. When your system reproduces

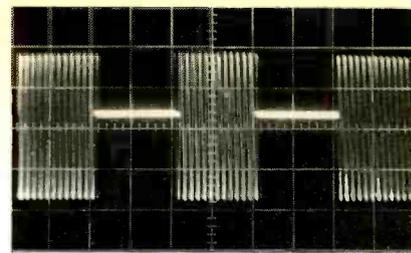


Fig. 7

a sharply-plucked string, or drum-beat during a quiet passage, it must jump almost instantly from a very small to a very large output . . . and if the note is quickly damped, it must subside instantly as well. If we turn a sine-wave test signal rapidly on and off, we get a "tone-burst" Fig. 7. Transient distortion will cause tone-bursts to start and stop with a slight, trumpet-like flare rather than a clean, square edge (Fig. 8).

Another type of transient distortion can be shown with a square wave test signal, as at (A) in Fig. 9. The amplifier may react to the sudden rise of the square waves by "ringing," as evidenced by a ripple after each of the square wave's switching points.

To be free of transient distortion, a component should have, among other properties, excellent high-frequency response (the sharp rise or fall of a wave can be considered a very-high-frequency component) and be free from phase distortion.

Let's assume that a particular musical note starts with all its component frequencies in phase, that is, at the same point in their cycles. Perhaps they are all at a positive peak at that moment, in which case the over-all waveform is at its highest possible peak. The phase relationships will change at once, of course, since a high-frequency wave takes less time to descend from peak to zero than does a low-frequency wave; and the par-

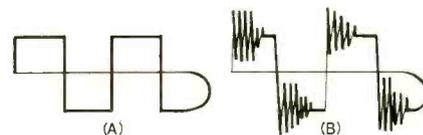


Fig. 9A

Fig. 9B

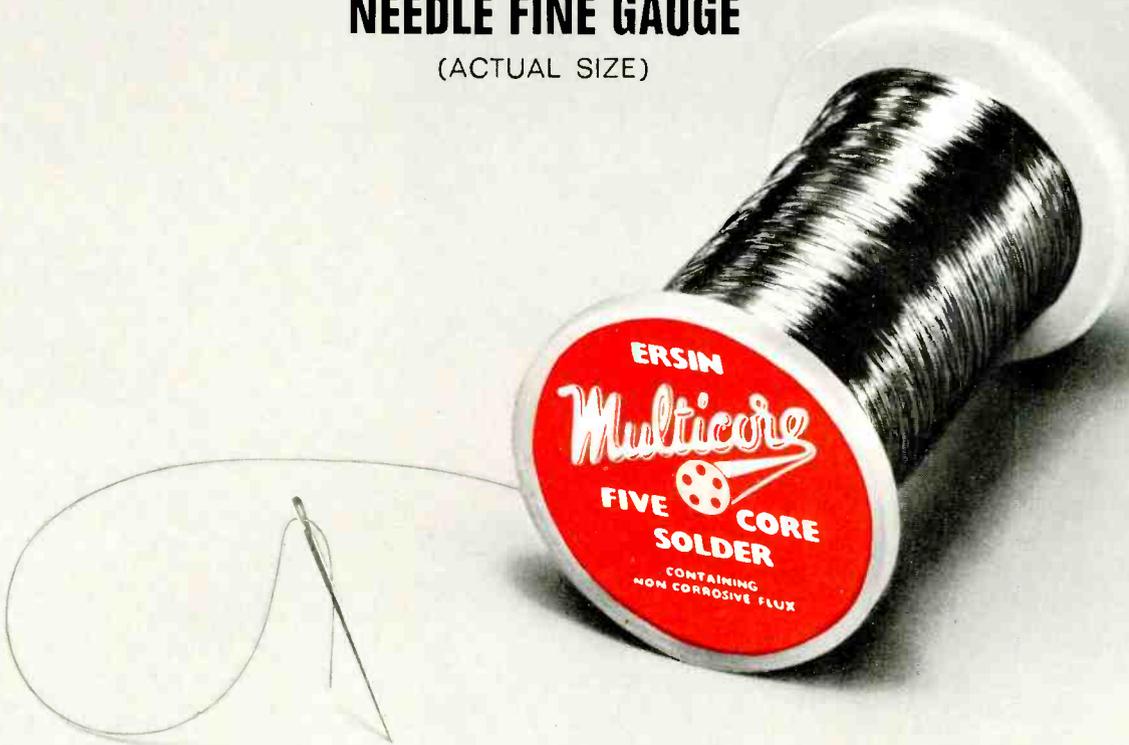
tial cancellations between out-of-phase waves cause consequent dips in the waveform. Obviously, if the phase relationship between these waves is shifted, the waveform will look different; that is phase distortion. Opinions differ as to how directly audible phase changes are. But since phase distortion does affect the wave envelope, it is a contributing cause of transient distortion.

Scale distortion results when music or speech are reproduced at unrealistic levels. If we play a strong quartet, for example, at full symphonic volume—or if we play a Sousa march at whisper level—the apparent frequency balance of the program will be altered. This is because of the way our ears change their frequency response characteristics at different sound levels. We fail to hear the lowest notes and highest overtones of the brass band when its level is reduced—and because we're used to hearing all

Check No. 109 on Reader Service Card. →

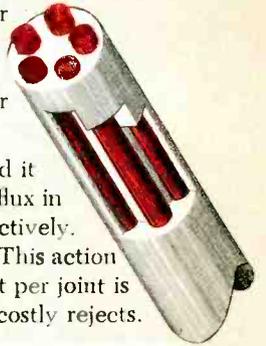
New!
**ERSIN MULTICORE
 5-CORE SOLDER IN
 NEEDLE FINE GAUGE**

(ACTUAL SIZE)



Today's electronics are moving more and more toward micro-miniaturization and integrated circuitry. For efficient soldering, these circuits require an ultra-fine gauge... a solder wire so thin it can pass through the eye of a needle! To meet these very special requirements, Ersin Multicore has developed a unique 5-core solder in 60/40 and 63/37 alloys from 24 through 34 S.W.G. It is imported from England, and available for immediate off-the-shelf delivery from your local distributor in any quantity you may require.

Ersin Multicore's exclusive construction with 5 cores of extra-active, non-corrosive Ersin flux, has established it as the most efficient, most dependable solder in the world. Its unique configuration guarantees uninterrupted flux in every part of the wire and near the heat source, causing the solder to melt faster and to wet the metal more effectively. Oxides are rapidly loosened and removed from the surface, and the solder is molecularly fused with the metal. This action enables Ersin Multicore solder to produce the consistently reliable joints for which it is known. The extra cost per joint is trivial, but the results are tremendously important on the assembly line, saving valuable time and avoiding costly rejects.



Reels and cartons
 1 lb. and 7 lb.
 Full range of gauges
 and alloys



69¢ Easy
 Dispenser Pak
 60/40
 18 S.W.G.—.048"



69¢ PC (Printed
 Circuit) Pak
 60/40 Extra Thin
 22 S.W.G.—.028"

You may not have an immediate need for a needle fine solder but it's good to know that the same unique five core construction is in every Ersin Multicore product. How much more does it cost to use the world's best solder? About one-one hundredth of a cent more per joint... and you eliminate costly, troublesome soldering failures. Ask for Ersin Multicore five core solder in these handy packages.

MULTICORE SALES CORPORATION, WESTBURY, N.Y. 11590
 DIV. OF BRITISH INDUSTRIES CORP.

Ersin Multicore conforms with Federal specifications.



WAITING AROUND FOR A PROFESSIONAL STEREO OR MONO CORDLESS RECORDER, with 7" REELS?



DON'T WAIT.

The world's first and only AC/Cordless recorder with 7" reels and 4 speeds is here... from Concertone. Go "where the action is" with this professional CORDLESS tape recorder. The truly portable... AC or battery operated Concertone features VU meters, standard inputs and pre-amp outputs, pause control, battery indicator, solid state, 23 transistors, 2 thermistors, 5 diodes. Self-contained with full range speaker systems... Light weight 12 lbs. for Mono 700... 16 lbs. for the Stereo 770. Some out-

standing features: 4 speeds - 7½, 3¾, 1⅞, ¾... frequency response 30-16000 c.p.s. - less than .3% wow and flutter. Stereo has 3 separate heads; Erase, record, playback. Remote control: Stereo dynamic microphones, plus remote control dictation mike. Built in "AC/Cordless" operation using 6 inexpensive D cells. Model 700 Mono, Dual track - less than \$140. Model 770 Stereo, 4 track - (mono-stereo) less than \$240. See your dealer today for America's newest "CORDLESS" or write for complete information.

CONCERTONE

Dept. HS1 • 3962 LANDMARK ST. CULVER CITY
CALIFORNIA 90230 • CALL (213) 837-6133



Check No. 110 on Reader Service Card.

these frequencies when we hear the band at its normal volume, we miss them. Of all distortions, this is the easiest to cure, and we'll discuss it in more detail when we get to amplifier characteristics and the "loudness" control.

Frequency-Modulation Distortion

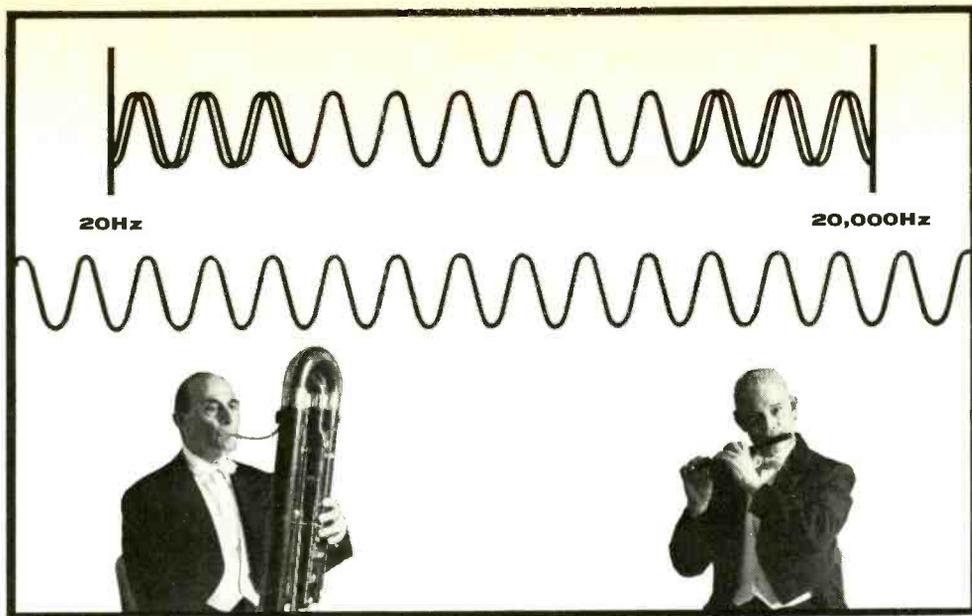
All forms of distortion which we've so far discussed can be found in any part of the audio chain—the record player, speaker, amplifier, tuner, tape deck, and so on. Frequency-modulation distortion is restricted, however, to turntables, tape recorders, and speakers. There are two main forms of frequency-modulation distortion—wow and flutter in turntables and tape machines, and Doppler distortion in speakers—and both consist of cyclical variations in the frequency of a tone.

Wow and flutter are the most familiar kinds of frequency-modulation (or FM) distortion. They occur whenever a turntable, record, tape capstan, or any part of the record- or tape-drive system is eccentric. You can demonstrate it for yourself with a 45-rpm record placed slightly off-center on your own turntable. As the one arm follows the record groove in its eccentric path around the center spindle, it will speed up and slow down, relative to the groove. Where it speeds up, the recorded pitch will rise, and where it slows down it will fall. Slow variations such as this are called "wow"; faster variations of the same type are called "flutter."

"Doppler" Distortion

The Doppler effect is more familiar to us from train whistles than from speakers. As a train moves toward us, the pitch of its whistle seems to rise, falling again as the train pulls away. This is because, as the whistle approaches us, each cycle of its sound starts from a point a little closer to us than the last one; this "bunching up" of sound waves shortens the distance between wavefronts, which is the same as shortening the wavelength by raising the frequency. When the train pulls away, of course, the reverse holds true.

A loudspeaker diaphragm also moves towards and away from us, pulling and pushing the air to form the compressions and rarefactions that make sound waves. And since musical waveforms are complex frequency mixtures, a loudspeaker reproducing such a wave is effectively vibrating with several velocities at once. A speaker reproducing two pure tones of 50 and 10,000 Hz. for example, may be considered as a body vibrating 10,000 times per second while moving in and out 50 times per second. The higher frequency will therefore seem to rise in pitch as the speaker moves towards us, and sound lower as the speaker moves back. This can be a major cause of distortion above 3000 Hz, but Doppler distortion can be considerably reduced by dividing the frequency spectrum among two or more speakers (e.g.: the familiar combination of a "woofer" for the low range and a "tweeter" for the highs). Such an arrangement also allows each speaker to be designed for best reproduction of its portion of the spectrum. AE



NO AUDIBLE-SOUND BARRIERS

We've been asked by many high-fidelity enthusiasts, "If nobody can hear frequencies below 20 and above 20,000 cycles, why bother to reproduce them?"

It's a reasonable question—one that has set off much discussion in hi-fi circles over the past few years.

Some manufacturers deliberately build audible-sound barriers into their amplifiers, clipping response at these arbitrary frequencies on the assumption that what lies beyond doesn't matter.

Don't get us wrong. We too are concerned mainly with the sound you *can* hear. But we've found, through years of research and listening, that frequencies above and below the "barriers" have a profound effect on audible sound. We—and you—have found that the farther we extend the response of our receivers, the more transparency of sound and the more total realism we achieve.

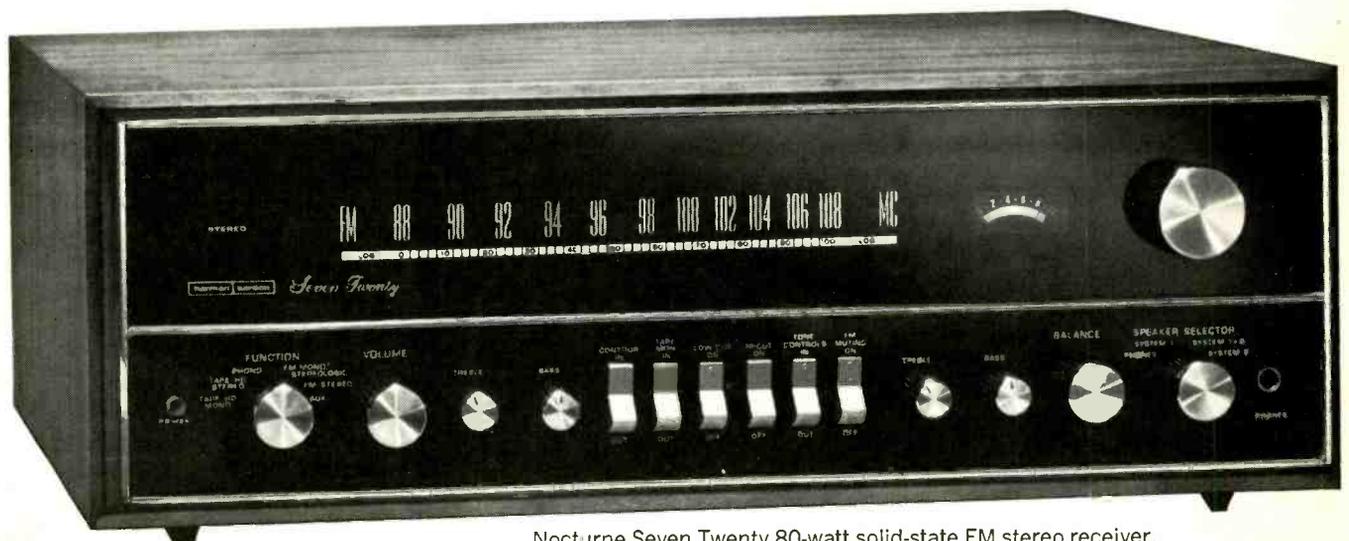
What happens when a stereo receiver *doesn't* reproduce faithfully the overtones and low fundamentals the ear can't catch? By deliberately chopping bandwidth at these boundaries, it's unwittingly added distortion—frequency and phase distortion—in the area where the ear *can* hear it. An otherwise good instrument is robbed of that ultimate degree of realism that distinguishes a truly great receiver from the crowd.

So it was natural for us to design our new Nocturne receivers with frequency response that's octaves wider than many manufacturers think necessary. It's this ultra-wideband concept that brings out all the pure undistorted sound you're entitled to. Ultra-wide frequency response lets Nocturne owners know one voice from another, one instrument from another, as easily as if they were sitting at a live performance.

Harman-Kardon, Inc., Plainview, New York 11803

harman kardon

ORIGINATOR OF THE HIGH-FIDELITY RECEIVER



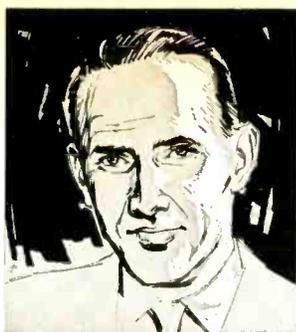
Nocturne Seven Twenty 80-watt solid-state FM stereo receiver.

Check No. 111 on Reader Service Card.

AUDIO ETC.

Edward Tatnall Canby

NOT-SO-RANDOM THOUGHTS



I did. I almost forgot. Our 20th Anniversary. It didn't catch up with me until a couple of months beforehand—almost too late. I made it, under the wire, as you see.

This is a modern magazine and the moderner we get, the more time we need. We're just normal victims of the Deadline Spread, which is the phenomenon that has all those happy commercial singers spilling out Xmas carols in July heat waves. (It's also why I've sometimes involuntarily reviewed Xmas records in the January issue, at the other end of the Spread.)

So, what with constant preparations for the month after next and the month after that, I can't for the life of me remember which issue I'm supposed to be in the middle of—*now*. Like, say the 20th Anniversary issue.

I play leap frog, as do we all. One column in the works, on my typewriter, another forming up dimly somewhere down in the cerebellum, a third down at the printers and a fourth just arrived in proof (did I write *that*??). And, of course, a fifth, hot on the newsstands and in the mailbox, the final product, the current production model. No wonder, when somebody says gee, I liked your article this month (or says the opposite), I look blank. *What* article?

So, a 20th, and it's a nice round number, I note. Funny idea. If we still used the vestigial duodecimal arrangement, the system that deprives us of the first two 'teen numbers (they should be, maybe, eleventeen and twelveteen), we'd have another four years to go before our Two-Dozenth.

(Take it back. Better make it firsteen and seconteen . . .)

And Heaven forbid the thought of a binary-system Anniversary. That would be every other year, and we'd all long since been fed up.

* * *

All I can say, then, is that twenty years ago this magazine began the sort of publishing operation which would allow a guy named Canby to write record reviews in such an *extremely* odd fashion that, after only a few issues, the Editor split the record review department in two, one section of which, wildly casting about for some sort of omnibus title that might successfully contain the miles of Canby print, he called "AUDIO, ETC." (Well, he *had* noticed my initials, even if he wasn't exactly the first.)

And so was born AUDIO, ETC, which has never appeared in any other magazine for the best of reasons: it just

couldn't. And for that degree of tolerance, understanding and appreciation, I am eternally grateful to C. G. McProud, whose numerous titles, as managing editor, editor and publisher, span his own twenty-year involvement in our magazine. With all due respect to the others who have helped (and to Mr. Potts, our first editor). AUDIO was McProud's baby.

And though I am sure he will cringe under the blow, I'll have to come right out and say it—this McProud character is a lot bigger man than he likes to admit in the trade. In spirit and mind, I mean.

He has quantities of those attributes which engineers are usually uncomfortable about admitting—imagination, perception, warmth, largeness of view. To be sure, he does his best to hide them from all of you who know him. Sort of like having to admit you were born with six fingers on the right hand. But the truth will out.

And the way this kind of truth has always got through to me—beyond the mere fact of being allowed to write what I write—is simply that an "imaginative" man like McProud is always *interested*. You toss an idea to him and he'll take it right up, turn and twist it along with you. He'll kick the ball around on almost any old thing.

It's a pleasure, I can tell you, and sometimes expensive. I can't recall how many long distance telephone marathons we've had about some wholly irrelevant and perfectly pointless idea, just because both of us were intrigued by it! Dozens. Also good ideas.

How much of this has rubbed off onto our venerable magazine (which at last has left its 'teens behind) I do not really know. Over the years, a good deal, and maybe more than you think. As I say, McProud has done his best to suppress these unwanted (should I say "unwonted") symptoms; he likes to be a regular fellow, engineer-style—he *is* one, too, and of the best. A good term for it is gregarious. And so are we as a magazine. We get along well with our friends, our readers, our advertisers, and we like it that way. Who wouldn't?

But, as I see our twenty years of growing up, AUDIO has been consistently unique. We have never put out an issue yet, good or bad, that was a carbon copy of somebody else's issue. There is only one AUDIO and you aren't too likely to confuse it with anybody else's mag. That's us.

To get personal again, there's only one AUDIO, ETC, for better or worse, and it is still an amazement to me that, given

my head to do what I wanted to, I ended up *here*. As aforementioned, I was hired in 1947 to write record reviews. I knew a lot about music and nothing worth mentioning about audio. (Nobody mentioned it, anyhow.) And here I am, now, still knowing 100 times as much about music as audio . . . well, maybe it's down to 99; and yet my usefulness, such as it is, in this magazine and in the hi-fi industry, gets more audio-oriented every year. Crazy, man! Just nuts.

Well, I can hear the cacklings from those who like to grow purple in the head over this department. It *is* sort of zany. And you can logically talk it out of existence in five minutes flat, any old day.

Indeed, if the editor called me in and started telling me why I had no business writing anything outside of purely musical areas, I'd ruefully have to agree. In all truth, there isn't any logical place for a column like mine—even in *this* magazine. Anybody can prove that.

But it has survived these twenty years (counting those early "record reviews") for a number of reasons. First, I've learned a whale of a lot. I'm still learning, like mad. My schoolteachers are the best minds in the entire hi-fi business and *they* are good. A lot of it rubs off on me. Second, though we come from opposite sides of the fence, the audio people and myself make a sort of publishing molecule, if you see what I mean, with many organic bonds that hold us together, giving us mutually interesting points of view and a constructive relationship. This could never be if I were a pro engineer writing on engineering.

It's a healthy interchange of ideas, in the over-all—even when I bungle, as I've often done. Some of the finest talents in the business rush right in to correct me. That's something!

Finally, for those who sputter with rage at the Canby style of writing, I have two comments.

First—I haven't said this for quite awhile—as most of our old readers have discovered, the more outrageously slangy is my language, the more likely is it to be carefully written, with messages for those who catch on which aren't apparent, perhaps, on the surface. Since this is an Anniversary issue, I'll have to admit to this special trade secret. It's an old journalistic trick, and well worth it.

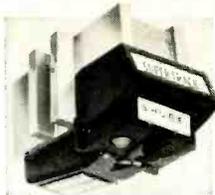
When I feel the corporate blood hounds breathing down my neck, when I sense that *whatever* I say, somebody'll say it's wrong, then I start writing cagey stuff. And it's up to you to know when. Some of those purple passages, believe you me, are written with extreme care. The editor knows it, I think; for he very seldom edits me. (Wish he would sometimes. Then I could blame him!)

And yet—I'd hate to give up the latitude of expression, in this tough-minded and hard-working audio industry, which I've managed to acquire via the unique Canby style, which, of course, *deliberately* avoids engineering parlance, if not engineering terms. (A big difference.)

Wouldn't it be terrible, now, if I started to be a know-it-all and wrote engineering papers? Boy, would I lose a

the most important advance in phono cartridges since the advent of stereo

THE TYPE II SHURE V-15



...a new genre of cartridge,
analog-computer-designed, and measured against
a new and meaningful indicator of total performance:

“TRACKABILITY”

The radically new V-15 TYPE II heralds a new epoch in high performance cartridges and in the measurement of their performance. We call it the era of high *Trackability*. Because of it, all your records will sound better and, in fact, you will hear some recordings tracked at light forces for the first time without distortion.

THE PROBLEM:

While audiophiles prefer minimum tracking forces to minimize record wear and preserve fidelity, record makers prefer to cut recordings at maximum levels with maximum cutting velocities to maximize signal-to-noise ratios. Unfortunately, some “loud” records are cut at velocities so great that nominally superior styli have been unable to track some passages: notably the high and midrange transients. Hence, high level recordings of orchestral bells, harpsichords, pianos, etc., cause the stylus to part company with the wildly undulating groove (it actually ceases to track). At best, this produces an audible click; at worst, sustained gross distortion and outright noise results. The “obvious” solution of increasing tracking force is impractical because this calls for a stiffer stylus to support the greater weight, and a stiffer stylus will not track these transients or heavy low-frequency modulation, to say nothing of the heavier force accelerating record and stylus wear to an intolerable degree.

Shure has collected scores of these demanding high level recordings and painstakingly and thoroughly analyzed them. It was found that in some cases (after only a few playings) the high velocity high or midrange groove undulations were “shaved” off or gouged out by the stylus . . . thus eliminating the high fidelity. Other records, which were off-handedly dismissed as unplayable or poor pressings were found to be neither. They were simply too high in recorded velocity and, therefore, untrackable by existing styli.

Most significantly, as a result of these analyses, Shure engineers established the maximum recorded velocities of various frequencies on quality records and set about designing a cartridge that would track the entire audible spectrum of these maximum velocities at tracking forces of less than 1½ grams.

ENTER THE COMPUTER:

The solution to the problem of true trackability proved so complex that Shure engineers designed an analog-computer that closely duplicated the mechanical variables and characteristics of a phono cartridge. With this unique device they were able to observe precisely what happened when you varied the many factors which affect trackability: inertia of tip end of the stylus or the magnet end of the stylus; the compliance between the record and the needle tip, or the compliance of the stylus shank, or the compliance of the

bearing; the viscous damping of the bearing; the tracking force; the recorded velocity of the record, etc., etc. The number of permutations and combinations of these elements, normally staggering, became manageable. Time-consuming trial-and-error prototypes were eliminated. Years of work were compressed into months. After examining innumerable possibilities, new design parameters evolved. Working with new materials in new configurations, theory was made fact.

Thus, the first analog-computer-designed, superior trackability cartridge was born: the Shure SUPER-TRACK*V-15 TYPE II. It maintains contact between the stylus and record groove at tracking forces from ¾ to 1½ grams, throughout and beyond the audible spectrum (20-25,000 Hz), at the highest velocities encountered in quality recordings. It embodies a bi-radial elliptical stylus (.0002 inch x .0007 inch) and 15° tracking.

It also features an ingenious “flip-action” built-in stylus guard.

It is clean as the proverbial hound's tooth and musical as the storied nightingale.

THERE ARE MANY WAYS TO PROVE ITS SUPERIORITY TO YOURSELF:

- (1) Shure has produced a unique test

recording called “An Audio Obstacle Course” to indicate cartridge trackability. It is without precedent, and will be made available to Shure dealers and to the industry as a whole. You may have your own copy for \$3.95 by writing directly to Shure and enclosing your check. (Note: The test record cannot be played more than ten times with an ordinary tracking cartridge, regardless of how light the tracking force, because the high frequency characteristics will be erased by the groove-deforming action of the stylus.)

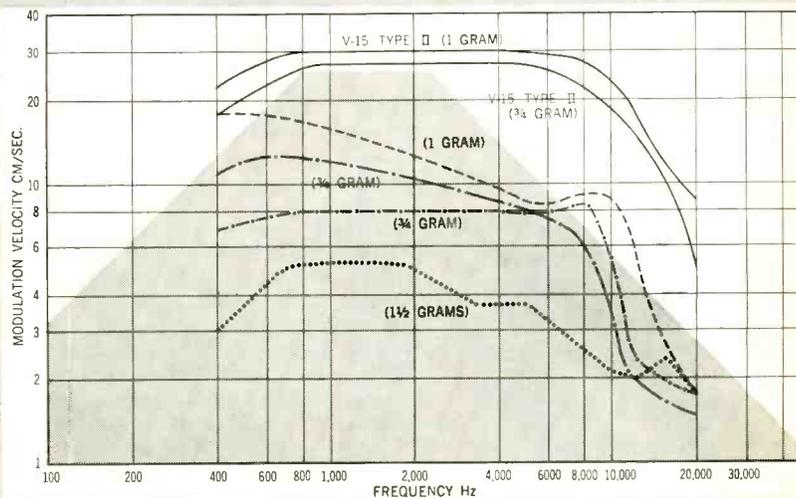
- (2) A reprint of the definitive technical paper describing the Shure Analog and trackability in cartridges, which appeared in the April 1966 Journal of the Audio Engineering Society, is available (free) to the serious audiophile.

- (3) A representative list of many excellent recordings with difficult-to-track passages currently available is yours for the asking. These records sound crisp, clear and distortion-free with the Shure V-15 Type II.

The Shure Super-Track V-15 TYPE II is available at your dealers at \$67.50.

Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois 60204

TRACKABILITY AS A NEW SPECIFICATION:

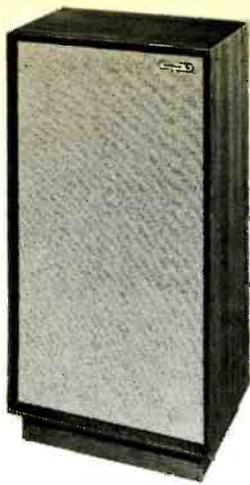


This chart depicts the new performance specification of *trackability*. Unlike the oversimplified and generally misunderstood design parameter specifications of compliance and mass, trackability is a measure of total performance. The chart shows frequency across the bottom, and modulation velocities in CM/SEC up the side. The grey area represents the maximum theoretical limits for cutting recorded velocities; however, in actual practice many records are produced which ex-

ceed these theoretical limits. The smoother the curve of the individual cartridge being studied and the greater its distance above the grey area, the better the trackability. The trackability of the Shure V-15 TYPE II is shown by the top (solid black) lines. Representative curves (actual) for other cartridges (\$80.00, \$75.00, \$32.95, \$29.95) are shown as dotted, dashed and dot-dash lines for comparison purposes.

*T.M.

Check No. 112 on Reader Service Card.



A Young Upstart creates a new concept in sound systems.



THE RECTILINEAR III is specifically engineered to eliminate one of the major failings of quality dynamic speaker systems,—narrow band frequency response, commonly referred to as "BOX SOUND".

There is absolutely no boom, which makes for reproduction of organ pedal tones and other such program material with a free sounding NATURALNESS rarely encountered in the art of speaker design.

THE RECTILINEAR III is a no compromise reproducer. Its wide linear frequency response and dispersion characteristics are indicative of the meticulous engineering that has produced this innovation in speaker design. We believe that our system is so superior that an actual AB comparison will support our claims.

RECTILINEAR III — \$234.50
Size: 35"H x 18"W x 12"D
Hand Rubbed Oiled Walnut
Frequency Response: 22-18,500 Hz ± 4 db
Impedance: 8 ohms

Detailed Specifications available upon written request.

Listen to it at better dealers or write,

Rectilinear Sound Systems

A development of Rectilinear Research Corp.,

Sweeney Bldg., 30 Main St.,
Brooklyn, N. Y. 11201

Check No. 113 on Reader Service Card.

good job in a hurry! I'd be the worst engineer in twenty years.

LEYDEN JAR

If you keep your mind open and your senses alert, you can learn a lot in this world, without benefit of schooling. Take capacitance, for instance. (*He said "capacitance" so we read on to see if he meant the case held a lot of stuff.* Ed).

A few months ago I bought a new black plastic briefcase, one of those soft models with a zipper around three sides and a solid handle. (It'll actually hold three LP records, which is more than most briefcases can do.) Now the oddest thing has been happening to me when I use this briefcase. It shocks me.

Regularly, with a spaced pulse, roughly every fifteen seconds. Mind you, I don't move a muscle. Not on the arm that holds the case, anyhow. I just walk straight ahead, holding the thing. And every fifteen seconds, this shock goes up my arm, straight to the elbow. Most disconcerting.

I figured what happens. The thing has a metal handle that is covered with a layer of plastic. Also a band of steel ribbon, about an inch wide and curved at the corners, to give some rigidity to the bottom half—the case being made of plastic of the artificial leather type. The handle is riveted to this inner steel strip at both ends.

Now I don't know which part is plus and which is minus, but the plastic rubs against my coat as I walk along and, anyhow, I am horribly electric in reasonably dry weather, even without plastic. So every so often my charge gets big enough to jump, and it goes straight through the plastic insulating layer between my damp hand and the inner steel core of the handle. I get a very sizable jolt. I'd hate to guess the voltage, but it isn't low.

Now here comes the capacitance. As far as I can see, I'm a walking Leyden jar, a static generator and a storage capacitor all in one. Two conductors (one being me and my slightly salty fingers) separated by a dielectric, the plastic. Charge gets too high and shorts. Always under the handle top, where the pressure of my fingers is greatest and the dampness saltiest.

So you always thought that static charges had to jump to ground, or at least to a semi-infinite hunk of metal? Not necessarily. If you're charged up, you can discharge to ground very nicely. I always swat a metal banister or a lamp fixture, so I won't feel the jolt. But here, you see, I am walking on rubber, wholly insulated, not in contact with anything else. A complete, self-contained charge generator, storage capacitor, and shorting dissipator. Fun. I can even hear the snap of the spark as I walk, when traffic noises allow. Regular as clockwork.

But what a hazard I'd be if I walked into a gas leak or maybe an explosive-dust-filled room! Automatic ignitor.

CISUM EPIPGAB

Someone has just sent me a clipping from an offset sheet called "Take Five"—no indication as to where it lives but

it looks like a house organ—which quotes a correspondent as having read an article in the *National Review* which passed on the news (this could go on and on . . .) that a British record company called EMI (nice little outfit, that one) managed to send out 1000 copies of a bagpipes record to its distributors before it found that the tape had been running backwards when the disc was cut.

The correspondent (above) thinks that Music Appreciation has sunk to a pretty low level. The *National Review* (see above) is reported to have said, after hundreds of these records had been sold without feedback, "Could you have told the difference?"

Well, no. That's my immediate thought. I rather doubt if most of us could.

In the first place, unless you know them very well, most bagpipe tunes sound pretty much alike. They sort of cackle and chortle, against the loud, steady drone tones, and even Yankee Doodle would sound OK backwards under such circumstances. You'd take it for some obscure Black Watch march. Bagpipes are a last representative of an extremely ancient and nobly primitive kind of music which goes back to pre-history. What you hear on bagpipes might as well come down from a thousand years ago as not. So how are you going to tell if it's frontwards or backwards?

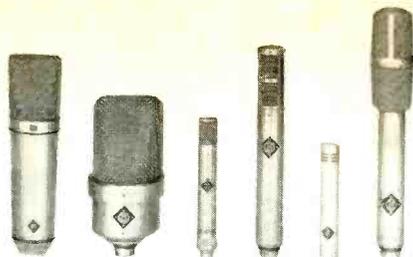
Much more to the point is the peculiar bagpipe sound. Of all kinds of music, I'd say, it is the most indistinguishably reversible. For it is largely made up of drone sounds, playing continuously and powered by an even flow of air from the pouch-like reservoir that the player keeps pumped up. Moreover, the pipe that plays the melody line is also powered by the continuous air flow—hence there is virtually no "chiff" or percussive accent, as in a Baroque organ pipe when air is suddenly admitted. No percussive transients at the beginning of each note.

Instead, as I figure it, we hear a kind of "break" for a micro-instant, as the fingers move over the holes and the pitch changes. The air-column length and the overtone patterns shift and the jump from one mode of vibration to another makes a very mild "accent."

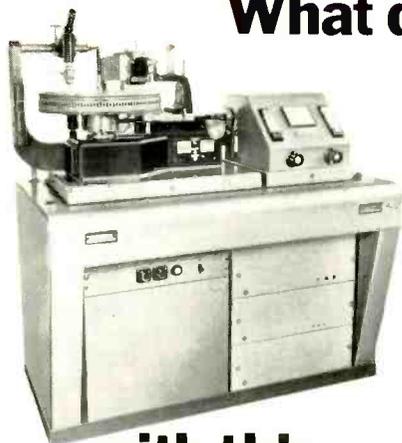
When these unusual musical sounds are played backwards there is bound to be very little change in quality. No backwards transients, as in reversed piano music—which is utterly unrecognizable. (It sounds like a harmonium with a cough.) The quick shifts of vibration mode that mark out the bagpipe melody probably sound the same in either direction.

And so bagpipe music backwards is simply more bagpipe music. Or, more accurately, cisum epipgab. Does that make EMI (and the *National Review* and the un-named correspondent and "Take Five") feel any happier?

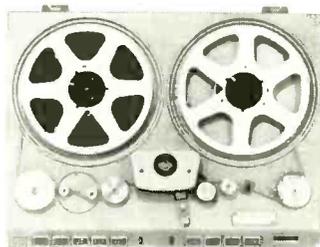
P.S. This is pure speculation. I don't own any bagpipes and can't find a bagpipe record in my collection. So I haven't actually tried the cisum epipgab, to see. If you hear any, let me know how it sounds. Æ



What do Neumann microphones have in common



with this...



and this...



and this...



and this...



and this...



and this?

Gotham Audio

Surprised? So are a lot of other sound engineers when we tell them. That's why it's time we set the record straight.

Gotham Audio is the sole U.S. importer of Neumann — the world's finest microphones. And we're proud of it.

But Gotham Audio is also proud of the more than 300 other quality sound products and services we offer. Including tape recording equipment. Disk recording lathes. Disk cutting systems. Disk reproducing equipment. Studio and control room equipment.

Test equipment. And other products.

These products are made by Europe's best-known companies. Beyer. EMT. Studer. And Neumann. Companies whose products have consistently made significant contributions to the technical excellence of American audio.

So, if you want the very best in professional sound equipment of all kinds, contact Gotham Audio. We've got a lot in common.



Gotham Audio Corporation
 2 W. 46th St., N.Y., N.Y. 10036
 Telephone (212) CO 5-4111
 In Canada: J-Mar Electronics Ltd.

**We could rave about the many features
and superb performance of this
BSR McDonald 500 automatic turntable.**



But don't take our word for it ...read what the experts say!

Electronic's World says—

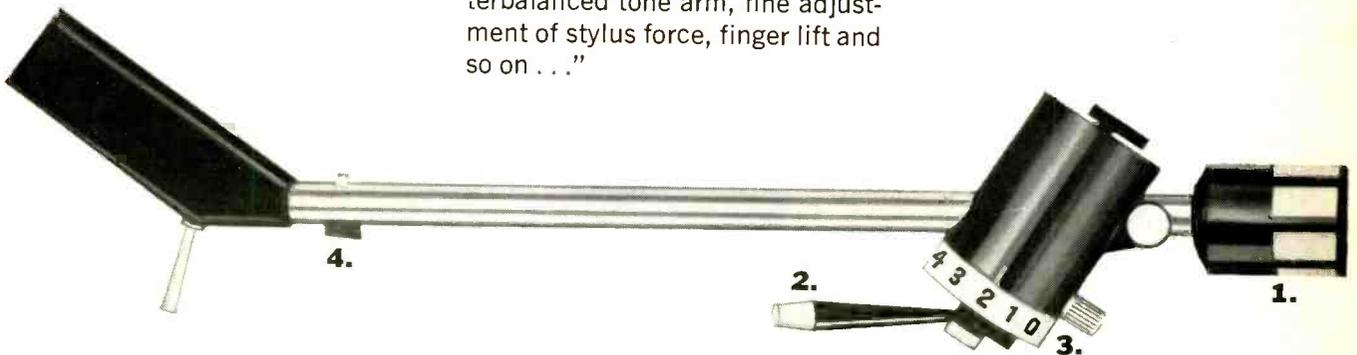
"...the BSR McDonald 500 automatic turntable is priced with the least expensive record changers... has many of the features heretofore found only in the more expensive players... the changer was mechanically smooth and quiet in operation, easy to handle, and lived up to all the claims made for it. It is a very good value...rivaling other more expensive instruments in performance and features."

Audio Magazine says—

"The BSR McDonald 500... has all the desirable features and some which we believe to be unique... Up to now a high quality turntable was an expensive item, but the McDonald 500 comes with a consumer price tag which puts it in reach of the most budget-conscious audio buff. Most lower priced record changers were useable only as record changers and were not equipped with the niceties which the high fidelity enthusiast has come to expect such as counterbalanced tone arm, fine adjustment of stylus force, finger lift and so on..."

Hi-Fi/Stereo Review says—

"... Now, the large British record-player manufacturer BSR has introduced into this country their McDonald 500 automatic turntable. It is heralded as offering the features and performance of the \$75-class turntables for less. And, we are happy to note, it does just that... Not only is it difficult under most circumstances to distinguish sonically from much more costly players, but it incorporates some of their most useful design features... it is a very good buy."



Here are just a few of the expensive quality features of the BSR McDonald 500 to which the experts refer:

1. Resiliently mounted, coarse and fine vernier adjustable counterweight. **2.** Cueing and pause control lets you select the exact band on the record. Pause at any point, and lower arm into same groove.

3. Micrometer stylus pressure adjustment permits 1/3 gram settings from 0 to 6 grams. **4.** Automatic lock secures pickup arm when machine is in "off" position. Jam-proof design eliminates readjustments. Before you buy an automatic turntable you must see the BSR McDonald 500. Write for free literature.



Precision crafted in Great Britain
BSR (USA) Ltd., Blauvelt, N.Y. 10913

Check No. 116 on Reader Service Card.



Letters from Readers

Erratum

SIR:

In your April issue, I am misquoted in the formula given for the relationship of speaker enclosure size to low frequencies. The formula should have read:

$$f_L = \frac{1}{2\pi \sqrt{MC}}$$

HERB HOROWITZ
Empire Scientific Corp.
Garden City, N. Y.

(Quotee Horowitz is correct, of course. We omitted the mathematical symbols. ED.)

Reverberation Devices

SIR:

Can you tell me of any books or manuals that show experiments with reverberation or delay mechanisms for electronic organs. I do a lot of experimenting and would like to build some of this apparatus.

JOSEPH R. MATTESON,
6 Roberts Lane,
Latham, N. Y.

(Suggest you write Fisher Radio Corporation, 11-35 45th Road, Long Island City, N. Y. 11101. To our knowledge, this company is the only one now making any reverberation equipment for hi-fi performance, although some others are available for use with auto radios. Several articles appeared in 1961 on the subject

of reverberation and the list follows: AUDIO, April; AES Journal, July; Radio-Electronics, December; Electronics World, January; Photofacts, January. ED.)

Unknown Company

SIR:

You carried an article by W. A. Rheinfelder of the Dickson Electronics Corp. of Scottsdale, Ariz. on FET's. I am interested in using these transistors in building an amplifier for the play circuit to use in my new Viking 87 tape recorder. I wrote the company at the address given in the magazine, but the letter was promptly returned marked "Unknown." Can you help me locate the company?

ERNIE GARRISON,
Box 2055,
Lakeland, Fla. 33803

(We had the same trouble, but you can reach Mr. Rheinfelder at Anaconda Astrodats Co., Box 3772, Anaheim, California. ED.)

Another Organ Enthusiast

Can you please give me the address of the American Association of Theatre Organ Enthusiasts—both the headquarters and the New York Chapter addresses?

JOSEPH V. VANECEK,
100 Winding Way,
Little Silver, N. J.

(AATOE Headquarters may be reached at P.O. Box 7404, Bitter Lakes Station, Seattle, Wash. 98133; the New York Chapter secretary is Allen W. Rosster, 250 Harrison St., Passaic, N. J. 07055. ED.)

Loudspeaker Design

SIR:

Interest in audio reproduction has led to the purchase of several books on the subject, but in all but one, *Radiotron Designer's Handbook* there is a definite lack of technical material dealing with loudspeakers. The book lists many references, but none later than about 1955. I would appreciate it if you would give me some ideas on where to look for really detailed literature on loudspeaker design.

ROY V. CHILDS,
1495 45th Ave.,
San Francisco, Calif. 94122

(Most definite information on loudspeaker design is proprietary, and remains on the files of the various manufacturers. The definitive work on the subject is simply titled "Loudspeakers" by McLachlan. A British publication, it can probably be obtained from Iliffe Books, Ltd., Dorset House, Stamford St., London, S.E. 1, England. Another useful book on the subject was authored by Gilbert Briggs, and Olson's "Acoustical Engineering" should also be of some help, though not dealing so much with the actual design of the speaker mechanisms. ED.)

Where is Grundig?

SIR:

Will you do an old subscriber a favor? I am trying to locate the address in Germany of the manufacturers of Grundig tape recorders. Can you help me out?

HENRY I. TAMBARA,
5505 S.E. Firwood,
Portland, Ore. 97222

(Grundig tape recorders are made by Grundig Werke, G.m.b.H., 851 Fuerth/Bay, Kurgartenstrasse 37, West Germany. ED.)

Capacitor Microphone

SIR:

I am very much interested in constructing a capacitor microphone system as in the article by Robert B. Schulein in the October, 1966, issue. Could you please advise me on where to get more information on constructing the condenser capsule, and where to get the 1/4-mil aluminized Mylar for the diaphragm? Also, any other information that might help in its construction.

DANIEL EICHNER,
R.R. #2, Box 344,
Storrs, Conn. 06268

(Suggest you write Mr. Schulein directly. His address is 1000 Austin, Evanston, Ill. 60202. ED.)

About the Cover

Our cover star is dynamic Robert Preston, recently awarded the Antoinette Perry "Tony" as best actor in a musical comedy. Our cover was shot in his "I Do, I Do," dressing room just before preparing for a performance. The cake on the cover was very real and very delicious. A personal interview with Mr. Preston is on page 38. Photo by Mano Mehanian of Philadelphia.



Check No. 117 on Reader Service Card →

For people who really listen, we offer the first receiver with \$400 specifications that sells for \$279

ADC 606 90 watt, solid-state, FM Stereo Receiver

SPECIFICATIONS

Amplifier Section

Power:

90 watts (IHF) @ 4 ohms
80 watts (IHF) @ 8 ohms

Total Harmonic Distortion:

@ rated output, .3%
3 db below rated output, .1%

IM Distortion:

@ rated output, .4%
3 db below rated output, .2%

Frequency Response:

10-60,000 Hz ± 1 db

Hum and Noise:

With volume control
minimum, -78 db
Magnetic phono input, -65 db
Musical instrument input, -60 db
Auxiliary input, -75 db

Input Sensitivities:

Magnetic phono, 3 mv
Musical instrument, 50 mv
Tape, 100 mv
Auxiliary, 100 mv

Tuner Section

Usable FM Sensitivity IHF:
1.6 uv

Harmonic Distortion
(100% modulation): .5%

FM Stereo Separation:

35 db at 400 Hz
32 db at 1,000 Hz
20 db at 8,000 Hz

Signal-to-Noise Ratio
(100% modulation): 70 db

Spurious Response Rejection:
80 db

Capture Ratio:
3 db

FEATURES

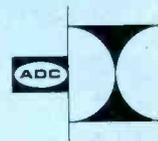
First, true bookshelf depth:
17" wide, 5" high, 9" deep
Side panels eliminate need for
separate cabinet
Large, readable, FM dial
Complete tape playback and
monitoring facilities
Headphone jack

Musical instrument input
Automatic frequency control
(switchable) for FM
Independent control for 2
sets of speakers
Each channel separately fused,
plus main power fuse
Automatic FM stereo switching
2-year warranty



Audio Dynamics Corp.

Pickett District Rd.
New Milford, Conn.



EDITOR'S REVIEW

TWENTY YEARS ON THE SAME JOB! Now on to the next 20. We must admit, however, that the past 20 have been singularly rewarding in that we were able to watch the upsurge of an industry from practically nothing to its present magnitude. It has been intensely interesting and exciting, and we believe that aspect of it will continue.

To be sure there was *some* good audio equipment around in 1947—but most of it was in theaters, movie studios, recording plants, and so on. Some very fine equipment was in use for speech reinforcement and in the better public address installations. But very little was available for the home user. The old Western Electric 10-A radio receiver was probably as good an AM tuner as has ever been built since (provided one increased the time constant on the a.v.c. bus) and the excellent Miller wide-range tuner was available before 1947. Those who were engaged in audio professionally usually built their own amplifiers, so there was some good equipment. But you couldn't go into a store practically anywhere in the U.S. and buy it over the counter.

THE NEXT 20

It would be normal procedure for an editor in this situation to try his hand at making predictions of what the next 20 years would bring, but we chose the easy way and asked a number of industry leaders to tell you *their* ideas instead. Many of them have done so, as you will read in the compilation starting on page 44.

One of the fascinating aspects of these many years in the audio industry is that there are so many applications of sound for which the hardware is already available. Some of the looks into the future suggest the possibility of some form of remote control—such as speakers turning on when one enters the room, or of remote selection of stations on an FM tuner, or of records from one's collection. We have long felt that some of the seemingly impossible manifestations could have been accomplished easily enough—the need was only to have the potential user specify what particular action he would like to have and it could have been provided. The speaker-turning-on bit, for example, needs only a capacitance relay—many of which have

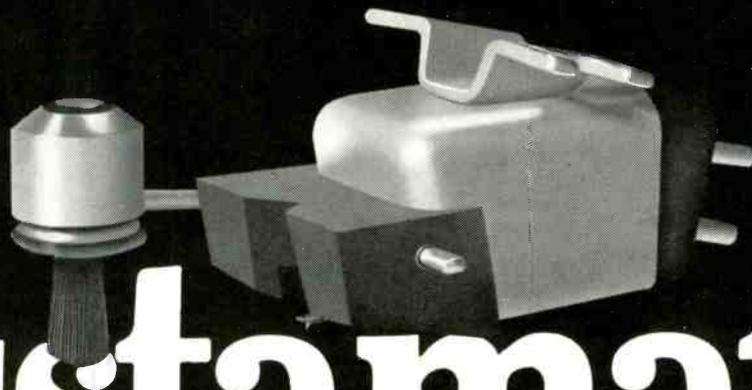
been described in the literature further back than 1947. A few years ago Fisher introduced a remote tuning arrangement enabling the owner to select stations at will from his armchair—as they have done with TV for years. But for all the talk about the possibility of this, it seems obvious that the public doesn't feel it is sufficiently important to warrant the extra cost. It is undoubtedly convenient for the channel-hopping TV listener-watcher, but one does not need to change FM stations every few minutes. The LP record eliminated the *need* for the record changer—every 20 minutes the listener needs to get another glass of milk so while he's up he might as well turn the record over. Now with the LP *and* the changer, one can program an entire evening's music listening.

In all seriousness, though, isn't it easy to imagine the facilities required to provide stereo music throughout the home, and using the same speakers to provide voice-actuated intercom over the system? Voice-actuated, automatic-volume-controlled dictating machines are available now. Suppose a centralized bank of tape recorders is desired for a dictating pool, so that perhaps 10 recorders could take all the dictation of 30 or 40 people. It would be no problem to connect them up to microphones on the desks of the dictators, with an idle machine being selected automatically whenever a mike was picked up. And after dictating one letter or a string of letters, the machine would take over and rewind, then signal an idle transcriber who would convert the tape to a letter. That is a simple arrangement, but one which could be done now, if the user is willing to pay for it. (We understand that there are similar systems in use, although we have never encountered one.)

Micro-miniaturization is here, of course—it only needs development to our specific needs. We are heartily in favor of the flat loudspeakers that roll up like a window shade, and would think a foam material metallized on both sides might be an answer, with the cells in the foam providing the restoring force.

Yes, the next 20 years ought to be exciting—and here we are on their threshold, just rarin' to see the new developments—just so we can continue to keep our readers up to date on them.

Check No. 118 on Reader Service Card. →



Dustamatic:

the cartridge that cleans the grooves while it plays.

The new Pickering V-15/3 Micro-Magnetic™ stereo cartridge proves that cleaner grooves combined with cleaner tracing result in cleaner sound. The built-in Dustamatic™ brush assembly automatically sweeps dust particles from the groove before the stylus gets there; and the new moving system reduces tracing distortion close to the theoretical minimum, thanks to Dynamic Coupling of the stylus tip to the groove. There are four "application engineered" Pickering V-15/3 Dustamatic models to match every possible installation, from conventional record changers to ultrasophisticated low-mass transcription arms. Prices from \$29.95 to \$44.95. For free literature complete with all details, write to Pickering & Co., Plainview, L.I., New York.

For those who can hear the difference. **Pickering**

COMPARE THESE NEW SHERWOOD S-7800-FET FEATURES AND SPECS! ALL-SILICON RELIABILITY, INSTANTANEOUS OVERLOAD PROTECTION CIRCUITRY, NOISE-THRESHOLD-GATED AUTOMATIC FM STEREO/MONO SWITCHING, FM STEREO LIGHT, ZERO-CENTER TUNING METER, FRONT-PANEL FM INTERCHANNEL HUSH ADJUSTMENT, MONO/STEREO SWITCH AND STEREO HEADPHONE JACK, ROCKER-ACTION SWITCHES FOR TAPE MONITOR, NOISE-FILTER, MAIN AND REMOTE SPEAKERS DISCONNECT, MUSIC POWER 140 WATTS (4 OHMS) @ 0.6% HARM DISTORTION, 1M DISTORTION 0.1% @ 10 WATTS OR LESS, POWER BANDWIDTH 12-35,000 CPS, PHONO SENS. 1.8 MV, H/M AND NOISE (PHONO) -70 DB, FM SENS. (IHF) 1.8 μV FOR 30 DB QUIETING, FM SIGNAL-TO-NOISE: 70 DB, FM CAPTURE RATIO: 2.4 DB, FM CROSS-MODULATION REJECTION -85DB, DRIFT ±.01%, AM SENS. 2.0 μV, AM BANDWIDTH 7.5 KC, 45 SILICON TRANSISTORS PLUS 18 SILICON DIODES AND RECTIFIERS, SIZE: 16 1/2 X 14 IN. DP.

Does Sherwood use F. E. T.'s?



Did you think because Sherwood makes such beautiful receivers we would neglect Field-Effect-Transistor circuitry? The new Sherwood ALL-SILICON Model S-7800-FET FM/AM 140-Watt Receiver shown above has been specially designed for urban strong-signal locations.* This ALL-SILICON receiver offers unexcelled FM reception in areas where powerful local stations can interfere with the reception of distant and weaker stations. The Model S-7800-FET also features two separate front-panel rocker switches for multiple speaker installations throughout your home. Write for complimentary copy of the new Multiple-Speaker Installation manual.

*Specially-selected Field-Effect Transistors in RF and Mixer stages of S-7800-FET improves cross-modulation rejection almost 10 times (20 db)

S-7800-FET 140-watt FM-AM ALL-SILICON Receiver
\$409.50 for custom mounting
\$418.50 in walnut leatherette case
\$437.50 in hand-rubbed walnut cabinet

Sherwood Electronic Laboratories, Inc., 4300 North California Avenue, Chicago, Illinois 60618. Write Dept. 5A

Check No. 119 on Reader Service Card

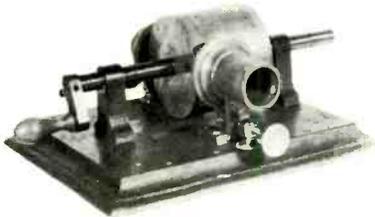


20 YEARS OF AUDIO

Reviewing the past twenty years of AUDIO Magazine is like reading a history of the high-fidelity industry—which hadn't even started when the first issue appeared in May, 1947.

Interspersed with a number of then-new products.

C. G. McPROUD



What started it all—a copy of Edison's first tinfoil phonograph. This was undoubtedly before high fidelity.



The once-familiar Audak cartridge and arm—one of the better phono pickups of its day—which was in the early 1950's.



The Garrard RC80 changer—a model which became the most widely used record changer of its day, only to be superseded by the 88, the Model A, and the current Lab 80.

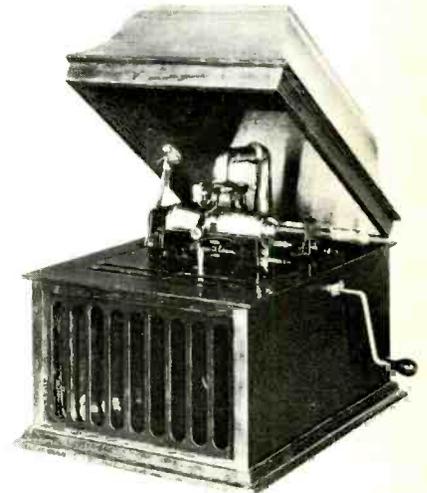
THE YEAR IS 1947. High fidelity is a limited hobby enjoyed by a few dedicated individuals who may have had contact with the professional aspects of sound reproduction and who couldn't enjoy coming home to what passed for radio and phonograph reproduction as exemplified by the then-available equipment. To make sure of having a good amplifier, one had to scrounge one from a broadcast station or the local movie house. The same sources were constantly searched for loudspeakers which would recreate music to satisfy the critical listener.

Thus began the story of AUDIO which appeared in the 15th Anniversary issue in May, 1962, and much of what follows is taken from that article and expanded to bring it up to date with the happenings of the past five years.

Hobbies

Golf, fishing, stamp collecting, and most other hobbies have long had their magazines which served as a common meeting ground wherein Joe from Boston could exchange ideas with Harry in Chicago, or George in San Diego, but high fidelity hobbyists had no such magazine in those days. To be sure there were occasional articles in the general radio magazines, but none specialized in hi-fi, a term then unknown.

Then came AUDIO ENGINEERING—the first magazine devoted to the sound engineer, ostensibly, but with a strong feeling for the problems of the audio buff who might be a surgeon, dentist, lawyer, or college student during the major part of his day. To be sure, AUDIO ENGINEERING was quite technical in its first years—and many of the earlier readers express a desire that we should go back to them—but with the growth of the Audio Engineering Society and the emergence of its *Journal*, the highly technical articles have a place for publication for a relatively small readership, while AUDIO



One of the earlier deluxe models of the Edison cylinder phonograph. At least it had no skating problem—the movement of the sound box (pickup to you) was tracked mechanically somewhere in this monster's innards.

strives to furnish good reading, accurate technical information, and general help to the dedicated audio buff.

The first issue of AUDIO ENGINEERING, May, 1947, showed Norman Pickering on the cover with his then-new low-stylus-force, high-compliance magnetic pickup which appeared in cartridge form a few months later as the first magnetic pickup of professional quality intended for home use. Its own successors and many other makes are now fully established as the accepted high-quality phonograph transducer, even though a number of other principles have been investigated, tried in the marketplace, and passed over. So far, nothing seems to have attracted the following that the magnetic cartridge has.

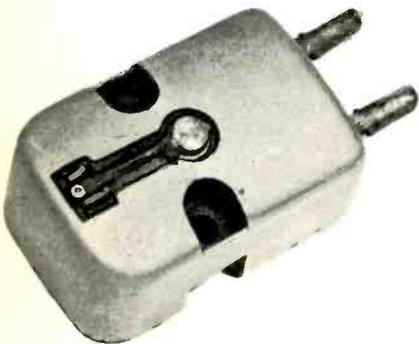
20 Years of AUDIO



One of the earliest "console" models of the disc phonograph. Old timers will remember the Brunswick, which could play both the lateral 78's and the vertical Edison discs. This isn't one of them, but they did make similar ones.

The second issue of the magazine showed an RCA Master Sound Console on the cover, and carried a complete descriptive story inside. For six months, everybody in the industry was saying, "It's a great issue, but how long can they keep it up?"

Another of the earlier covers showed one of the first published photos of an anechoic chamber, practically unknown outside of the laboratory in those days. Other covers were devoted to master and studio control facilities of radio stations.



The first magnetic cartridge to become the real "mass-market product"—the General Electric cartridge. Relatively inexpensive and of good performance, these were sold by the hundreds of thousands.

August, 1948, saw the introduction of the Vinyl LP record which simultaneously increased playing time and practically eliminated needle scratch, so that for the first time the listener could have full-range reproduction without the continuous noise of the shellac record, although according to articles and Scott advertisements in *AUDIO ENGINEERING* noise suppressors could be had that eliminated most of the noise without appreciably affecting frequency response. The first article in *AUDIO ENGINEERING* about transistors appeared in July, 1947, and a series on experimental (point-contact) transistor amplifiers commenced the following month and continued for several issues.



An early model of the Electro-Voice Patrician. A similar photo, except that the grille was phantomized to show the arrangement of the four speaker components) graced the cover of our May, 1951, issue. At approximately \$725 each, one can see why smaller enclosures became popular with stereo.

ALL OF THESE MODELS WILL PLAY THE NEW BLUE AMBEROL RECORDS JUST AS WELL AS OUR AMBEROLA MODELS. SEE THE OTHER SIDE OF THIS PAGE FOR PARTICULARS



Reproduction of an early advertisement for Edison cylinder phonographs. Styli used in these instruments usually were ground with a radius of 8 mils, and the cylinders rotated at different speeds throughout the history of the Edison machines.

20 Years of AUDIO

For almost two years, the AUDIO tradition grew under the editorship of John H. Potts, who died on March 16, 1949. After his death the trend toward the audio buff grew more rapidly, in step with the gradual availability of equipment designed for home use and offered by a handful of manufacturers.

Since there was then relatively little commercially available equipment except that made for broadcast stations and other professional users, AUDIO ENGINEERING had a strong leaning toward the do-it-yourselfer. Scores of articles describing home-built amplifiers graced the pages of the magazine over those early years—but always tucked in among the more professional articles. The popularization of the Williamson amplifier in

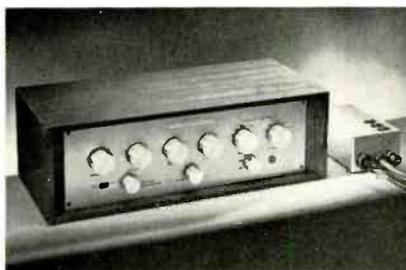
the U.S. dates from November, 1949, when the story of the "Musician's Amplifier" was published. The Ultra-Linear circuit was first brought to the public eye by Dave Hafler and Herb Keroes in November, 1951.

AUDIO Firsts

Aware of the potentialities of the hi-fi field, AUDIO ENGINEERING always endeavored to be the first to introduce any new idea. For example, the story about the loudness control—a well compensated device which has been credited with having brought hi-fi out of the basement into the living room—was published in the May, 1948 issue. The same issue also told of an elaborate "echo-chamber" device built by KFI in Los Angeles for



ESL Gyro-Jewel stereo cartridge actually employed a miniature gimbal to couple the stylus arm to the two moving coils.



The first Marantz product—the Audio Consolelette introduced in 1953.



Bogen DB-10 amplifier—a reasonably priced mono amplifier first on the market in 1951.



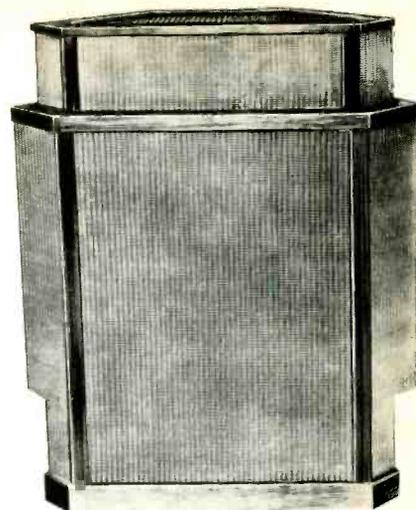
H. H. Scott model 331 AM/FM tuner, 1955.



The first Dynaco mono preamplifier. It has been updated and doubled for stereo, and now appears as the PAS-3X.



One of the earliest of the Norelco tape recorders—and now they sell the much less expensive, much newer, much smaller cassette recorder—the 150—in droves.

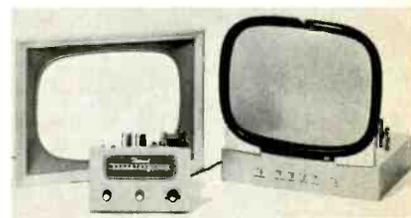


Wharfedale corner speaker, using the Briggs sand-filled panels, and accommodating an upward-directed midrange and tweeter.

radio station use, and copied in various forms since then for home reverberation purposes.

The first "feeling out" of readership on the subject of an Audio Engineering Society was in the form of a "planted" letter early in 1948, resulting in the formation of the Society later that same year—and AUDIO ENGINEERING was represented on the steering Committee that did all the early work, and later on the Board of Governors, followed by the vice-presidency and finally as President.

The back-loaded corner speaker was first introduced in AUDIO ENGINEERING in January and February, 1949—and many commercial speakers followed the design in varying degrees of imitation. And later in 1949 the first exhibit of audio equipment was planned at AUDIO ENGINEERING and the name "Audio Fair" was given to it to provide a simple title that was euphonic and easy to remember. Unfortunately, the Audio Engineering Society, sponsor of the show, did nothing to protect the proprietary rights to the name and so lost them. But even though the official name of the annual hi-fi shows is now different, the old title still sticks unofficially amongst the old-timers.



High Fidelity in a television set—the Conrac "Fleetwood 800" with remote control unit. No longer in the consumer market, Conrac still makes most of the monitors used in TV stations.

20 Years of AUDIO

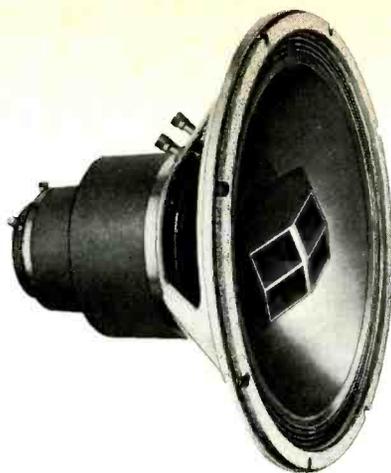
Stereo became a factor early in the 50's, primarily as an outgrowth of the use of a tape recorder originally designed to be used for instrumentation. Thus began the era of "staggered stereo" in which the two tracks were separated longitudinally by *about* 1/4 inches. The battle raged for a year or so between "in-line" stereo and "staggered head" with both types of tapes being available. The In-liners won, fortunately. Imagine the problem of editing a tape with a step of *approximately* 1/4 inches between the right and left tracks. And since some sources were writing about stereo as though it had been conceived in 1953, we began to publish articles from the archives of Bell Telephone Laboratories which chronicled stereo demonstrations back in the 30's. Even the patents on the early (1932) Western Electric 9A vertical/lateral pickup contained the full description of matrixing the coils of the 9A



The Miracord record changer—first to be introduced in the U.S. in 1954—was small and compact. It featured delays between records. Its successor, the 50H, no longer has this feature.

to permit reproduction of "45/45" stereo discs, which, according to the patent, were already envisaged by the 9A's inventors. Blumlein's disclosures in England about the same year (1932) proposed the same thing. And besides that, Blumlein investigated the "Ultra-Linear" principle around 1930, though he did not discover its advantages with respect to push-pull circuitry as did Hafler and Keroes in 1951.

Other firsts include a complete issue on stereo just at the time the multiplex story (for background music applications) broke—a lucky accident, it later appeared. Then, too, there was the first article describing how to modify a common GE mono cartridge for stereo, to play the almost-on-the-market stereo records, a number of articles about matrixing, two-channel switching, and control of separation, as well as others about the latest types of stereo control amplifiers. And, of course, the greatest "scoop" of all—five articles on the FCC-approved system for FM-stereo broadcasting in an issue that was in the readers' hands only forty days after the decision was announced—at least a full month before any other magazine published any technical details whatever.



Altec 604C, introduced in 1952 as the third or fourth in the 604 series, which has long been a standard in broadcast station monitor rooms.

The Covers

Over the years, the front cover of *AUDIO ENGINEERING*—and *AUDIO*—has gradually shifted from the professional to the home user. There was even a brief interlude of an insert "magazine within a magazine," called *VIDEO ENGINEERING*, but that only proved that we were always ahead of the times.

Cover subjects ranged from ultrasonics to the home installation. In order to appeal more to the audio buff, the "ENGINEERING" was dropped from the title beginning in January, 1954, with a fading of the word, followed by its complete absence in the February issue, which introduced a whole new cover design. The designer of the new cover, Leo Lionni, felt that because of the diversity of subject material inside the book, the cover should show something technical and something not technical—hence the schematic along with a photo of a home installation for several months. Late in 1957, another cover design evolved which continued until last year, when four-color designs were introduced.

Actually, of course, the appearance of the inside of the book was not changed much over the years. We felt the reader would become accustomed to a certain style and arrangement and would prefer it to remain reasonably constant—with something familiar about each issue from month to month. Maybe some readers would prefer more variety, but how does one tell without trying it out? And then it might be too late to change back!



Fairchild 220 mono cartridge, a model that was coveted by many users of the earlier magnetic models because of its high compliance and excellent response.

With the acquisition of *AUDIO* by North American Publishing Company last June, several changes have been made. New type styles, providing better readability, have been employed, and the practice of continuing articles to the "back of the book" has been superseded by the policy of completing each article before going on to the next. This often complicates make-up, but it does result in easier reading. The increased facilities of a multiple-magazine publishing house are gradually resulting in better distribution, increased readership, and—we fully expect—thicker magazines as the months go by.

The Solid-State Revolution

Although the first article in *AUDIO ENGINEERING* about transistors appeared in July 1947, causing a complete remake of the issue after it was practically ready to go to press, it was not until May, 1960, that the first all-transistor amplifier, the TEC-25, appeared in advertisements, and it was followed in March, 1962, by the Omega 1600. Others joined the trend gradually, usually with the transitional step of hybrid arrangements which em-



Fisher AM/FM tuner, showing the elegance in appearance which has become the hallmark of the company's products.

ployed tubes in conjunction with transistors, then with Nuvistors (usually only in the FM front end), and transistors, and finally with transistors throughout the circuit. The next step, introduced by Scott in November, 1965, was to use FET's—field-effect transistors, with their extremely high input impedance—in the front-ends, eliminating the principal problem of the solid-state FM tuner section—cross modulation. And with barely a year to digest FET's, Scott again hit the headlines with the IC—integrated circuits—which provided tremendous gain in a single package which consisted of as many as ten separate transistor junctions in a new configuration which made for improved selectivity, a much simpler construction for the i.f. strip, and a higher capture ratio. The IC's are just now becoming more common in top quality equipment, and we expect to see them in general use before the year is over.

1962 Onward

The innovations which came after our 15th anniversary include some marvelous improvements in kit packaging, starting in June, 1962. Harman-Kardon used some pretty fancy cardboard-box con-

Happy Birthday, Audio

20 distinguished years of reporting the news in sound



from H. H. Scott, Inc.
celebrating 20 years of making the news in sound

Scott . . . where innovation is a tradition



SCOTT®

Partners in Progress —

20th A ~~15th~~ Anniversary Salute

to **AUDIO** from

Bozak

20th The publication of the first edition of Audio Engineering exactly 20th years ago might well be considered to mark the beginning of high fidelity as an industry. Until that time only a handful of audio pioneers were manufacturing quality sound equipment, and users learned about new developments largely by word of mouth. There was no means of mass communication directed toward families seeking to improve the quality of music in their homes.

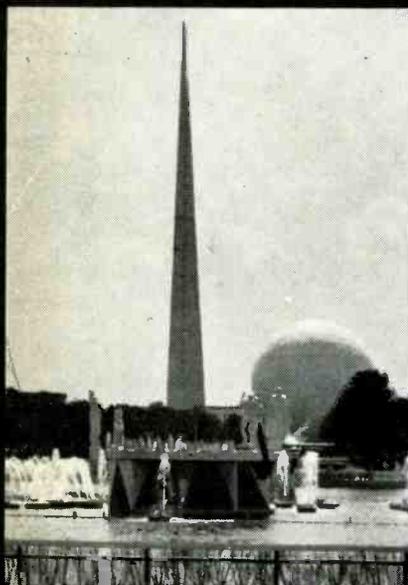
Recognizing a rapidly growing interest on the part of the public in better sound, the far-sighted founders of Audio Engineering stepped into the communications gap with their May, 1949, issue—"the first magazine about high fidelity."

From that moment on, high fidelity manufacturers could direct news of their product progress to the readers most interested in high fidelity; at that moment, high fidelity stepped from the laboratory into the living room.

The first Bozak speaker system available to the music loving public was introduced in the pages of the infant Audio Engineering in May, 1949, and Bozak has continued ever since to use Audio to deliver news of its continuing program of loudspeaker improvement to the opinion leaders in the world of high fidelity.



R. T. Bozak, audio engineer, high fidelity pioneer for three decades and president of The R. T. Bozak Manufacturing Company, manufacturers of the world's finest speaker systems.



1939 Then chief engineer for the Cineadograph Company, manufacturers of the forerunners of all modern high fidelity speaker systems, R. T. Bozak designed the 27-inch, 250-pound woofers used in the speaker system for the Lagoon of Nations at the New York World's Fair. This was the first public stereo installation.



1949 First product of the newly formed Bozak company was the Model B-201, aptly named the "kettle drum" from its 32-inch hemispherical steel infinite baffle enclosure. Its honest frequency response from 40 to 13,000 cycles would do credit to many modern systems.



1949 The first fine furniture enclosure by Bozak was this housing for the kettle drum speaker. Its size can be judged from the fact that it contains a 32-inch-diameter hemisphere. Bozak's continuing research and development program today permits equivalent performance from a bookshelf speaker only 14 inches high.



1953 Bozak introduced the first single-cabinet stereo speaker system using end doors as sound reflectors.

Introducing

MODEL B-201 LOUDSPEAKER

A two way direct radiator system

THE ONE ABOVE
ALL OTHERS
IN

Full and Natural Bass
Freedom from Resonances
Clarity of Reproduction
Naturalness of Highs

SPECIFICATIONS:

- Response 40-13,000 cycles
- Input Power 12 watts
- Impedance 8 Ohms
- Enclosure—32" diam. Hemisphere

R. T. BOZAK

90 Monrose Ave.

Buffalo 14, N. Y.



May, 1949 This first advertisement for Bozak loudspeakers appeared in the infant Audio Engineering magazine.

P.S. The words on the preceding page were written five years ago on the occasion of AUDIO's 15th anniversary.

They are still true today on AUDIO's 20th anniversary.

AUDIO continues to fulfill its mission of bringing the public the latest information on advancements in the art of sound reproduction.

BOZAK continues its position of leadership in applying scientific advances to provide the most natural reproduction of music possible. The photos on these pages are merely highlights taken from the forward steps made every year at Bozak.

Music lovers benefit from both our efforts.

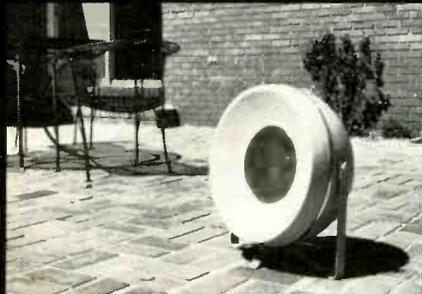


1965 Another New York World's Fair benefited from the quality of Bozak speaker systems. AUDIO described the Bozak-equipped Vatican Pavilion as "extremely good sounding and looking — our vote for the best music sound at the Fair." The Vatican exhibit was only one of many using Bozak speakers.



1966 Furniture stylings and construction by Bozak has helped bring high fidelity music systems out of the "game" room and into the living room.

1961 Bozak's early experience with hemispheric baffles permits the development of the Bard — the world's finest outdoor speaker for home music systems — a completely weatherproof unit.



1965 Increasing demand for quality sound reinforcement systems by large musical groups caused Bozak to develop a line of electronic mixers and amplifiers compatible with Bozak speaker systems. Today most commercial systems using Bozak speakers also employ Bozak electronics for "the very best in music."



1965 Bozak's pre-eminence in the field of music reproduction was accentuated by the selection of Bozak reinforcement systems for use by major symphonies, such as the New York Philharmonic, shown here in Central Park.

20 Years of AUDIO

tainers which made it easy for the novice to identify the parts in the order in which they were to be used. Scott led with instruction books in which the actual colors of the wires appeared in the diagrams. Fisher's innovation appeared in the form of a soft plastic bag packed with a number of bits and pieces which would be used for the steps on a given page of the instruction book. If you didn't have enough of a particular part or if you had any left over when you finished the page, you had made a mistake.

It was in June, 1962, that Joe Benjamin, of Benjamin Electronic Sound Corp. in a letter commenting on our 15th Anniversary issue, suggested that possibly the 30th anniversary issue might just be on a roll of tape. We still have ten years to go—it could happen. In the same month, the Leak Sandwich speaker was introduced.

FM Stereo had started in the summer of 1961, and by the middle of 1962 there were complete Multiplex tuners and receivers, although there were still many MX adapters—not everyone had junked his previous tuner for one of the new ones; for good reason, too—there still weren't all that many stereo stations.



Gray 108B transcription arm, first introduced early in 1952.

Audio still kept on with do-it-yourself projects as a regular thing—in July, 1962, readers were told about an 18-in. woofer, with a 30-lb. magnet, which the author claimed anyone could make in his home workshop. About the same time, cooling fans began to make their appearance—just as the heat-producing tubes were on their way out—although some early transistor amplifiers had to use them.

By August, 1962, many hobbyists had begun to find out that a poorly filtered FM tuner output caused some interaction with the bias oscillator in their tape recorders, resulting in a continuous 3769-Hz (or something similar) whistle in everything they recorded off the air. So the manufacturers began to put in better filtering for the 76-kHz second harmonic of the 38-kHz switching frequency in the multiplex circuitry.

In September, 1962, Heath advertised their first transistorized integrated amplifier, the AA-21, which was quite an innovation for then. Prior to that, the assembly of high-power solid-state amplifiers was something considered best done by experts with adequate testing facilities. In the same month, however, we profiled the Knight-Kit KX-60, which means that it too was on the market as a high-power kit—also 50 watts. The all-transistor Sony 777 tape recorder was adver-



The well remembered Magnecord PT6-JA, comprising the recorder, together with amplifier and speaker.

tised that same month by Superscope, presaging high-quality transistorized tape recorders.

The Citation "A" solid-state preamplifier was introduced by Harman-Kardon in October, 1962. With its frequency response flat from 10 Hz to 100 kHz (by our measurements) and a claimed performance of flat from 1 Hz to 1 MHz, the transistor was proved as a low-level device, for distortion was virtually unmeasurable—being below the residual of our equipment. Today, of course, power amplifiers are similarly flat, and distortions of the order of .05 per cent or less are now reached at full output. But that has taken a few more years of development.

A new breed of tuner began to be discernable with the introduction of the Fisher Broadcast Stereo Monitor, and the market now offers several top-grade tuners which followed the Fisher in point of time. It was also in the Fall of 1962 that ADC introduced the rectangular woofer, and the idea was broached that right and left earphones did not properly convey stereo information to the listener. Along with it was the solution—a controlled cross feeding of the signals in a prescribed manner.

In 1963, considerable interest in FM antennas began to be apparent in the wake of poor reception of stereo signals due to multipath distortion. So now we have as much effort spent in developing FM-band antennas as formerly was spent only on TV sky hooks. This little problem is not yet solved by every listener, but the "hardware" is available. The listener has only to buy it and install it in practically every instance.

Transistorized test equipment began to appear in construction articles in 1963, as well as transistorized tape recording and playback amplifiers. JBL introduced the solid-state energizer/transducer combination which employed a transistorized amplifier with facilities for correcting fre-



Concertone 1401—the early goal of many a recordist who wanted 10-in. reel accommodation.

quency response to complement the characteristics of the loudspeaker with which it was used. This practice was common with tube equipment in the 30's for theaters, but this was the first such application to home-type equipment.

Our authors—three of them—began to investigate the Class D transistor amplifier, and while it appeared to have some advantages in theory, it now seems as though conventional transistor power amplifier circuits have been perfected (practically) so the Class D circuit may never become popular. Transistorized r.f. condenser microphones appeared on the market, eliminating the need for high polarizing voltages, and we even had an article on the construction of a condenser microphone, although not of the r.f. type. The year ended with the introduction of the Citation "B." Harman Kardon's 80-watt power amplifier—transistorized, of course—a kit which matched the Citation "A."



Livingston dual-cartridge arm, designed to play Cook stereo records which were recorded on two concentric spirals, one for each channel.

1964

We started 1964 off by presenting to our readers a stereo loudspeaker system comprised of horns for both highs and lows, both made of concrete, and weighing a total of a "Ton and a Quarter," which was the title of the article. We followed this in April by commencing Norman Crowhurst's series on Commercial Sound.

Empire introduced the Grenadier series of loudspeaker systems in February, starting a new era of decor in loudspeaker housings. Elliptical styli became the rage in the Spring, with both Ortofon and Shure introducing them; JBL brought out the "Graphic Controller" in August, using straight-line controls for the first time in home preamps.

The entire industry was shocked to learn of the passing, on August 15, of Ray Pepe, JBL executive and IHF president. He had served the Institute well during his tenure, and he is missed by all of us.

In the Fall of 1964, British Industries brought out the Lab 80, a turntable which had, among its many features, an anti-skating device on it. They also showed a complete line of lesser turntables. At the same time Marantz unveiled the straight-line turntable, in which the stylus traveled on a radius of the record, eliminating the need for anti-skating devices, and solving a problem which had occupied engineers for some time. Norelco introduced the 150, a miniature recorder using a cassette of 0.150-in.-wide tape playing at a speed of 1 7/8 ips. More about this elsewhere in this issue. McIntosh—long a holdout against transistors—gave in with a vengeance in



Better, Clearer, More Natural Sound...

TEAKWOOD LOUDSPEAKERS: 1 & 2. Mini-Speakers—large speaker performance in a small size. 3. Model 9—16½" L x 8¼" H x 5⅞" D. 4. Model 112—20½" L x 10¼" H x 10" D. 5. Model 114—27½" L x 13¾" H x 11" D. **TAPE RECORDERS:** 6. Solid state stereo—4-track; 3 speeds. 7 & 8. Monaural units. 9. Stereo tape deck—3 speeds; freq. resp. 30-20,000 cps @ 7½ ips. 10. Professional, solid state portable with speed accuracy ±0.2%. 11. Endless loop cartridge. **RADIOS:** 12 & 13. Teakwood table models—the ultimate in reception with exclusive intercom system built in. 14. Portable—for car and home use; teak cabinet; fully transistorized; FM-AM-LW-SW bands. **INTERCOMS:** 15. Stentocom—"hands free" conversation by both parties; up to 200 master stations. **DISC RECORDING:** 16. Professional disc cutterhead used by leading studios the world over. **ACCESSORIES:** 17. Reverberation unit—designed for professional use. 18. 3-channel mixer. 19. Carry case for tape recorder. 20. Slide synchronizer. 21 & 22. Headphones. 23. Microphone transformer. 24 thru 26. Microphones. 27. Foot pedal. 28. Telephone pickup. **LANGUAGE LABORATORIES:** 29. Console installed at such distinguished universities as Harvard, George Washington and many others.

Write for Complete Literature on All Reeves Equipment Products.



REEVES EQUIPMENT

Division of Tandberg of America, Inc.
P. O. BOX 171, 8 THIRD AVE. PELHAM, N. Y. 10803

Check No. 129 on Reader Service Card.

www.americanradiohistory.com

20 Years of AUDIO

the form of the C-24 preamp, which had excellent performance characteristics.

1965

Early in 1965, the long-awaited Marantz 10-B tuner was finally put on the market. The first run was snapped up so quickly that it was off the market in about a month, but it came back, of course—one doesn't keep a good tuner down.

One of the real audio pioneers, C. J. LeBel, passed away on April 13. He was the guiding hand that started the Audio Engineering Society, and after serving as its first President, remained as Secretary for some 15 years.

H. H. Scott, Inc. was well along the road with transistorized equipment even by the first of the year, and introduced



Browning RV-10A FM tuner, introduced in 1951, and one of the models capable of long service and excellent performance.

the first FET tuner in December, as mentioned previously. Video tape recorders for home, school, and industrial use were offered by Sony and Ampex, and at prices that put them nearly in reach of anyone interested. Sony was the first on the market, and their price was the lower of the two. Others followed in 1966, as might be expected.

1966

Starting off the year was the first of a series called "Audio Measurements Course," by Crowhurst. The series still continues, but is nearly over. Electro-Voice announced a full line of tuners, amplifiers, and receivers, all transistorized, and in neat compact styles. In the same issue was described the Electro-Voice 635A microphone, an improved version of the old standby, the 635. Fisher announced an AM-FM-SW hi-fi tuner, the first of its kind from an American manufacturer. Marantz announced the 7T, its first transistorized preamp. Sherwood was already established as an all-silicon receiver manufacturer. ADC announced a cartridge using some elements costing \$49,000 per pound—the stylus assembly.

United Audio came out with the Dual 1019, an updated 1009 with anti-skating provision and some other desirable features. Dynaco introduced its first transistorized product, the Stereo 120, a dual 60-watter. We started a four-part series on FM-stereo antennas—long needed.

In September we featured another "color organ," a device which seems to have



Rek-O-Kut disc recorder, with its amplifier in a separate case. This model enjoyed considerable use in schools.

a perennial interest to the hobbyist. Sony announced a line of components, including an integrated amplifier, a stereo power amplifier, a turntable, arm, and cartridge. The turntable was driven by a slow-speed d.c. motor, servo controlled. And for the home builder, we presented a "Quarter H.P. Stereo Amplifier"—possibly the last of the tube amplifier articles we will run.

British Industries took up 16 pages in our October issue to tell about the new Garrard line of automatic turntables, and 6 more to tell all about a fabulous new line of Wharfedale speaker systems.

November brought a host of goodies—a receiver which approximates the traditional "black box" when off, showing its dial only when turned on—the Harman-Kardon "Nocturne." The same month brought an announcement of Marantz' 120-watt solid-state power amplifier—one of the new breed of ultra-low-distortion amplifiers represented so far only by JBL, Marantz, and Sony. And in December, our cover was graced by movie star Harold Lloyd's famous Christmas tree as a backdrop for a dis-



H. H. Scott 214B remote control noise-suppressing amplifier—one of a long series of suppressing-type units which were so popular before the advent of LP's.

play of tape recorders, signifying our usual December tape recording issue. It was also the occasion of the first installment of a column for the beginner who feels he is not able to understand all of AUDIO yet—Audio Fundamentals.

The January, 1967, issue presented the details of the first IC FM tuner circuit introduced to the market—a section appearing in three separate Scott receivers. Everybody was aware that the engineers were working on IC tuners, but this was the first one to be described with details and circuit diagrams. In March we were able to present details of the Seeburg 50-record changer—the predecessor of a unit which will be available for the serious record-playing hobbyist in the near future, allowing the programming of as much as 33 hours of music without handling the records at all. And just last month we were proud to have Maestro Eugene Ormandy on our cover, along with a loudspeaker of our own design—a unit which doesn't look like a loudspeaker at all. And that brings us up to date—our 20 years of AUDIO having been completed.



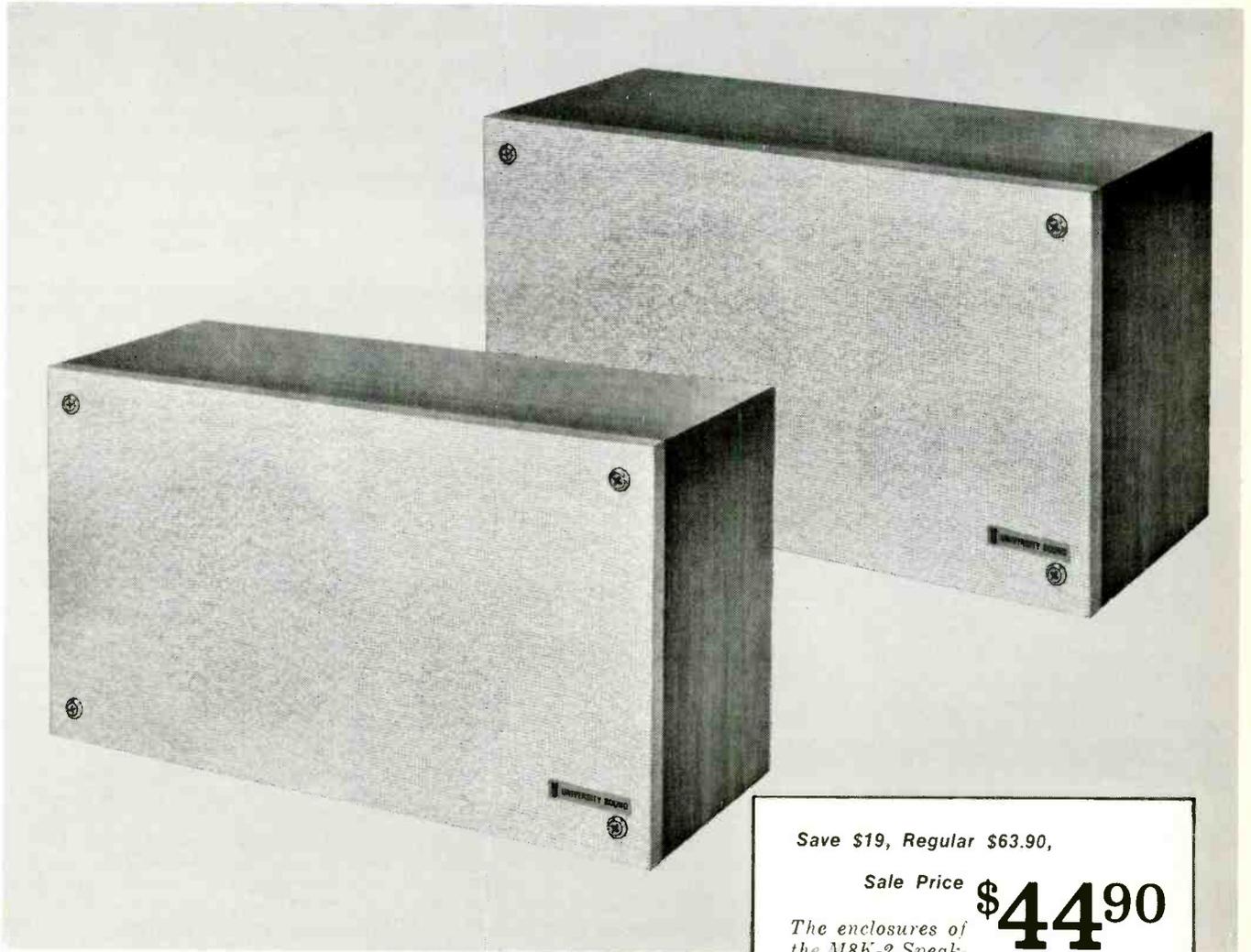
One of the early Harmon-Kardon AM/FM tuners. Remember the copper front panels?

Covering the Field

The gentle art of high fidelity comprises more than equipment. Not only are amplifiers and turntables and tape recorders and loudspeakers all parts of the whole system, so also are the sources of music or sounds that are played through them. Thus from the first issue of AUDIO ENGINEERING in 1947 to the present, considerable space has been devoted to record reviews. This year we have increased this space to at least double what we had before, and we have added some new reviewers to the staff, although most of our older ones are still with us. On the classical turntable is Edward Tatnall Canby, who has been the mainstay of the reviewing staff for twenty years, and who is still our chief classical reviewer. He is also fairly typical of the non-technical audio buff. He has an intense curiosity about equipment and he also has ten thumbs—as he so often says. But he is a good guinea pig for new ideas—and if they are musically good, he is one of the first to espouse them. Bertram Stanleigh first joined AUDIO ENGINEERING in December, 1947, and continued for nine months before leaving, but he's come back now as Jazz reviewer. Chester Santon, a dignified announcer over the air, is an enthusiast for the "listenable"

SAVE \$19!

Buy a stereo pair of UNIVERSITY[®] Mustang M-8 Speakers... and, get 2 enclosures* for less than the price of 1!



Save \$19, Regular \$63.90,

Sale Price **\$44⁹⁰**

The enclosures of the M8K-2 Speaker System are unassembled and easy to put together — only a hammer and screwdriver are needed. Fine textured grille cloth, non-resonant panels with rich oiled walnut finish. No finishing necessary. Just assemble and connect to your system for the liveliest sound ever.

Own a stereo pair of the fabulous MUSTANGS in heavy duty enclosures for only \$44.90. Compact, they fit anywhere — oiled walnut finish on all 4 sides. True high quality reproduction — ideal for extension speakers or as starter speaker systems. The Mustang Model M-8 has an extended range response of from 50 to 12,000 Hz . . . handles 30 watts. Enclosures are heavy duty 1/2" non-resonant panels with a silky smooth oiled walnut finish. Yes! This is a brand name speaker. Even the University nameplates are included.

© 1967



LISTEN—UNIVERSITY[®] SOUNDS BETTER

UNIVERSITY[®] SOUND
A DIVISION OF LTV LING ALTEC, INC.

P.O. Box 26105, Oklahoma City, Okla., 73126

For complete information write to desk E-73

LISTEN TO THESE OTHER GREAT UNIVERSITY[®] SPEAKERS AT YOUR UNIVERSITY DEALER



UNIVERSITY MODEL 312
3-Way Speaker — World's Largest Selling Hi-Fi Speaker



UNIVERSITY MODEL 6201
2-Way Speaker — Most Popular Top Quality Speaker Ever Made



UNIVERSITY MUSTANG MODEL M-12T
3-Way Speaker — Slim Profile For Wall and Ceiling Installation



UNIVERSITY MUSTANG MODEL M-12D
Dual Cone — High Performance — Excellent for Extension Speaker System

20 Years of AUDIO

type of music. He is now aided by a few of our new staff members so as to provide a greater coverage of the "light music" field.

Joseph "AUDIOCLINIC" Giovaneli builds his own "ham" equipment, repairs radio and TV sets for friends, and runs a recording studio of modest proportions, using tape and disc equipment of his own construction, and turns out masters for record pressing. Herman "TAPE GUIDE" Burstein is an economist when he's working and a tape hobbyist when he's not. Norman Crowhurst is a fairly regular contributor. He is a former engineer who decided writing was better than working, and has put his tutorial talent to good use, currently in his *Audio Measurements Course*.

Harold Weiler is the author of *High Fidelity Simplified* and *Tape Recorders and Tape Recording* who has graduated to the promising field of the video recorder. He contributes the SOUND AND SIGHT column each month.



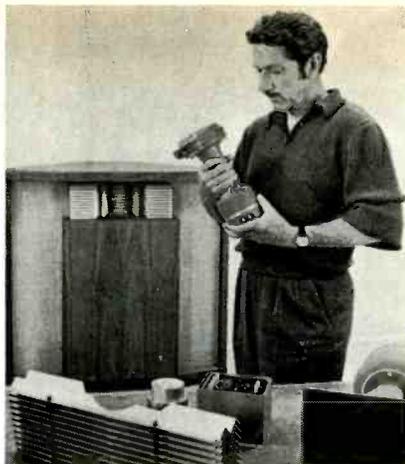
Radio Craftsmen RC-8 AM/FM tuner. Many of these are still in service.

Industry Relations

AUDIO recognizes its responsibility to the entire high fidelity industry. We feel that the hi-fi press should be fair to the reader in its presentation of new ideas—if they are actually something different. Ideas that are just gimmicks should, in our opinion, be brushed off in keeping with their real importance. On the other hand, the press should co-operate with manufacturers and their organizations whenever and however possible—opposing when it is believed necessary—but always offering a solid front to the public eye. If we do not always acclaim something as the greatest thing since the invention of the automobile, for example, it may be because we firmly believe it isn't. And that is our basic policy—if the reader is served honestly and well, the entire industry will benefit. And we believe also in co-operation between the members of the industry—exemplified by the Institute of High Fidelity. 'Way back in 1953 we proposed the formation of an Audio Council. Nothing happened then, but in 1955 the IHFM came into being, later changing its name to its present IHF.

Our Supporters

No magazine can exist without the support of a loyal group of advertisers—subscribers and newsstand buyers alone can't make it go. A perusal of the Advertising Index of each issue month by month gives one a capsule history of the



Bill Hartsfield putting the finishing touches to a JBL speaker system that bears his name. Note use of acoustic lenses.

audio industry from its humble beginning. Even if AUDIO can be credited with starting the industry, it is only that it brought manufacturers and buyers together at the proper time. And even if AUDIO is 20 years old, it is not the oldest organization in the industry. The roster of advertisers in the first issue included such names as Electro-Voice, Reeves Soundcraft, Racon, RCA, Amphinol, and Sylvania, to name a few. There were others, some of them retailers, some who make only laboratory equipment, some transformer manufacturers who feel that now there is little market for the audio buff who built his equipment from scratch. Now he builds largely from kits, and both kits and factory built equipment are now likely to be better than the home-grown variety.

Electro-Voice must be credited with an assist, certainly enough, since Al Kahn, the company's president, agreed with us that there would be a market for a magazine on the subject of audio, even before the first issue. And in reading the Ad Index month after month, Electro-Voice has long been our most consistent advertiser.

Telex joined us in July, 1947, and now its subsidiaries Magnecord and Viking keep up the record. Magnecord, at that time an independent company, joined on its own in November, 1948. Rek-O-Kut, now a part of Koss Elec-



One of the few pickup "arms" which carried the cartridge along the radius of the record so as to avoid tracking error. Marantz is now the only one on the market which enjoys great acceptance.

tronics, first appeared in August, 1947, along with Brook, one of the first manufacturers of amplifiers for the home user. Pickering was in AUDIO ENGINEERING for the first time in September, 1947. Audio Devices, Fisher, and Shure Brothers first appeared in January, 1948; University Loudspeakers—now University Sound—in February; and Allied Radio Corp., Altec Lansing, Bogen, and Jensen were in the March issue. H. H. Scott, Atlas, and UTC "joined up" in May, 1948, Fairchild in December, and Hartley and JBL came in with the new year of 1949, a year when Bozak, Ampex, Lafayette, McIntosh, Newcomb, and British Industries Corp came into the book.

Acro became apparent in February, 1950, and its successor, Dynaco, is still with us. Partridge and Savage, both British transformer manufacturers, appeared in March, 1950, with Heath making its first appearance in April of that year.

And so it goes—some companies are founded, last a few years, and then either go out of the business or are absorbed into other, larger organizations.



Compact Brociner amplifier—one of the first of the "integrated" type on the market.

Others grow and prosper, still maintaining their own identity, shifting with the demands of the marketplace when necessary, but still the bulwarks of the entire industry.

And when we speak of being 20 years old, we must not overlook the fact that our first supporter, Electro-Voice, was already 20 when we started, and they are still going strong, obviously. In other pages of this issue, many of our industry's pioneers have found it in their hearts to say a few kind things about us along with their prognostications about the future. This is our opportunity to say a few nice things about our supporters, the advertisers who make this magazine possible month after month. May they continue to prosper for our next 20 years, and for as long thereafter as they continue in business.

The Last Words—of the 240th Issue

High fidelity is a serious hobby to those who pursue it (and a serious business to the industry's manufacturers). These audio buffs put a lot of time and money and heart and soul into it, and they expect a lot of satisfaction in return. We at AUDIO have the same hobby, really, and we enjoy being of whatever help we can to our fellow hobbyists. So we pledge for the next 20 years to carry on in the same vein—improving whenever we can, but always trying to help the reader—and in so doing, ourselves.

Æ

one
of our competitors
calls the
four-layer voice coil
new...

we've
been making them
for 15 years!

University developed the four-layer voice coil at the turn of 1950 — by 1952 high fidelity enthusiasts and music lovers everywhere were enjoying the superior performance and economic benefits of this exclusive University development.

Hasn't it always been this way?

For more than 30 years, University has been ahead of competitive manufacturers . . . we have pioneered as innovators of new and superior developments in the speaker field — a fact attested to by more than 40 patents for meaningful inventions. Moreover, many University developments not patented are today's standards for the industry. As to quality — University holds the singular distinction of producing the world's top ranking most popular and larg-

est selling high fidelity multi-speakers — the renowned Models 312 and 6201.

For superior performance — for quality and sensible prices — for developments years ahead of competition, University has been the choice of the knowledgeable, discriminating high fidelity enthusiast and music lover.

Doesn't it make sense for you to have the best money can buy — first from University, and . . . at a price you can afford? See your University Dealer today, listen — and you will know why University does sound better.

For complete information write to desk E-73



LISTEN—UNIVERSITY SOUNDS BETTER

UNIVERSITY SOUND
A DIVISION OF LTV LING ALTEC, INC.

P.O. Box 26105 Oklahoma City, Oklahoma 73126

... "I Was Raised on Red Seal Records"

An Interview by Larry Zide

Robert Preston is popularly thought of as a late blooming actor. However, our interview reveals that the ample talent he displays on the Broadway musical stage is the result of a lifetime of training and preparation.

"I Do, I Do" is the title of a delightful musical currently running (and likely to stay put for some time) on New York's Broadway. It is based on the now-classic "The Fourposter." The plot is synoptically stated in the *Playbill* in two sentences.

"Time: The story covers fifty years of a marriage, beginning just before 1900. Place: A bedroom."

On the surface this can produce a pretty dull theater evening. After all, it's a one scene play, with only two actors, a man and his wife. There is no other support on stage.

I can say that "I Do, I Do" is not dull; rather it is one of the more pleasurable theater evenings I have experienced in time. The reasons can be laid to three dynamic people: stars Mary Martin and Robert Preston, and director Gower Champion.

With only two people on stage almost all the time (on occasion, only one will be on—a few times both are actually off stage but dialog goes between them) talent, or its lack, will quickly come across. Both Miss Martin and Mr. Preston possess talent in abundance—it is in evidence throughout the performance. Both are working hard; this is a fast-paced show. Those few moment that one of them is off stage is entirely taken up with changes. Only the intermission offers any real rest.

I spent sometime talking with Robert Preston after a Saturday matinee. He was a tired man, yet our conversation bubbled with his enthusiasms. Preston is a man that always gives his all; it is obvious on stage, it was equally clear in his dressing room. His style on stage is swift-paced; he hustles from place to place. His hands, his face are always in motion. Regular theatergoers will appreciate the little bits of *business* he is always presenting.

This frenetic style contrasts sharply with Mary Martin. Hers is easy-flowing, supremely professional to be sure, but everything she does looks so *easy*. I asked Preston about this: "We are both used to working in a tempo, this play is practically under-scored. Even our fast changes (and there are plenty of them) are done to music. The first change I make is on stage; there is shirt-off music, pants-down music, picking-up-nightshirt music—Phil (show orchestrator Philip J. Lang) scored it that way on purpose. Everything the orchestra does is all scored to fit. While it plays, on go the pants, at the right moment I reach the collar button."

The whole production gives the impression of one carefully choreographed, a not unexpected situation when you remember that director Gower Champion is also a dancer. Yet Preston feels that the choreogra-

phy came about naturally; the show just choreographed itself.

It used to be commonplace in the theater that with two important stars in the same play, a sort of competition grows up between them. Each tries to outdo the other. That does not happen here. Preston and Martin are extraordinarily complementary toward each other. Preston told me why. "This business of competition is old school. I think that went out with old-style musical comedy. There is no room for that here. It's pure selfishness. The only people who use it in the new school of the theater are the kids who have been taught *abuse* of the Method, and not the *purity* of the Method, not what it originally was.

Preston's acting skills, and they are considerable, stem from a long career. He is, of course, best known for the many films he has been in—mostly as a "heavy," the villain. His first film was "King of Alcatraz" made in 1938. Up to the moment, his official biography lists 38 films. Of the early films, Preston is proudest of the 1947 production of "The Macomber Affair." But we must add excellent portrayals in "Beau Geste" (1939), "Northwest Mounted Police" (1940), "Reap the Wild Wind" (1942), and "The Sun-downers" (1950). But, by and large, he was a victim of type-casting.

He is best known, of course, for the role of "Professor" Harold Hill in "The Music Man," a part he essayed for two and a half years. His portrait on our cover pays service to his now permanent title of "Mr. Music Man," a kind of type-casting in its way, too.

"Music Man" was his first musical. In all the Hollywood years he had never done one. "I was at Paramount, where they had Hope and Crosby. I was in a film with Mary Martin called "New York Town" back in 1941. It was a straight dramatic role for both of us. They hadn't yet discovered that *she* could sing."

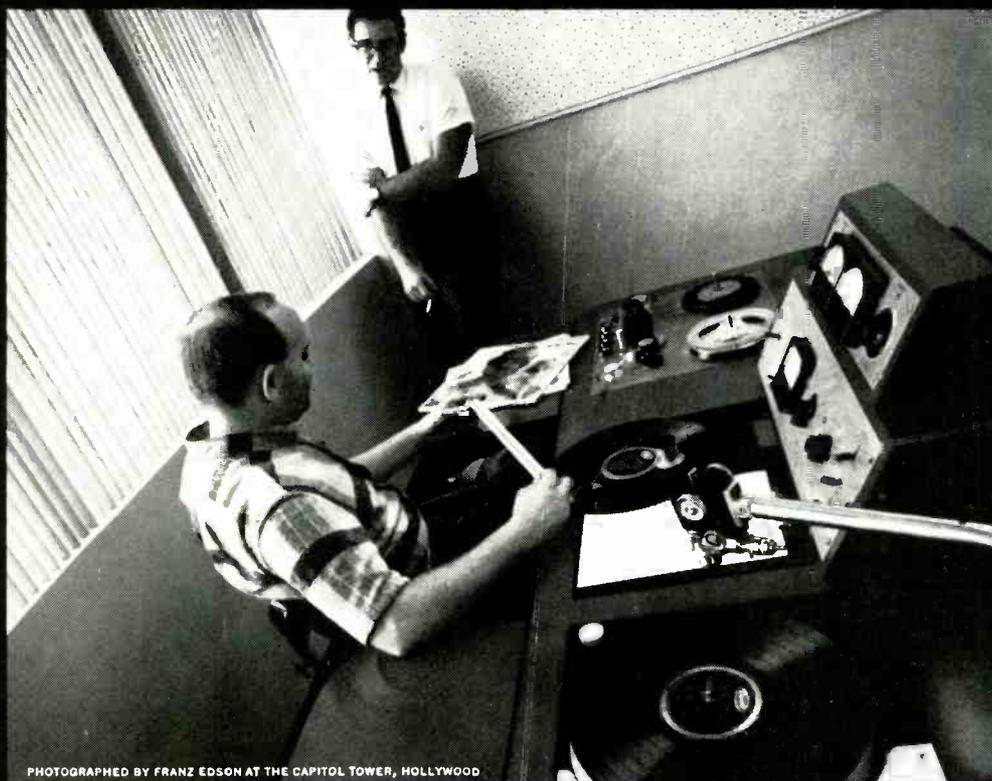
Preston himself is a trained musician. As a child of seven he was active on the piano, and in his youth he earned extra money as a trumpeter. He even flirted with band playing as a profession, before acting beckoned.

At the same time, he doesn't classify himself as a singer. The producers of "Music Man" originally offered the part to a well-known song and dance man but he wanted 15 minutes in the



Robert Preston and Mary Martin in a Scene from "I Do, I Do," now running successfully on the Broadway stage.

When engineers get together,
the conversation turns to pickups.



PHOTOGRAPHED BY FRANZ EDSON AT THE CAPITOL TOWER, HOLLYWOOD

It's an irresistible topic.

Especially since Stanton came out with the 581 Calibration Standard.

That's an engineer's pickup, if there ever was one.

Beautiful curve—within 1 db from 20 to 10,000 Hz, 2 db from 10,000 to 20,000 Hz—and it's certified in writing with each cartridge. Fantastically small and compliant moving system to trace the wildest twists in the groove. Light weight (only 5 grams!)

to take advantage of low-mass tone arms. And, of course, the "Longhair" brush to clean the groove ahead of the stylus. No wonder engineers use the Stanton 581 as a stereo reference standard. And to impress other engineers with their pickupmanship. (Available with 0.5-mil or elliptical diamond; price \$49.50.

For free literature, write to Stanton Magnetics, Inc., Plainview, L.I., N.Y.)





Robert Preston, Mary Martin, and director Gower Champion during a brief offstage rest.

second act to do his own material. Meredith Willson was not about to buy this. After all, what was going to happen to the "Music Man" while the star did his own material. But the star remained adamant, so it was decided to cast about for a replacement.

"... the director said, 'this is primarily a show for an actor anyway, let's get an actor that can handle the rhythm of the thing and do it.' He had seen me the season before in a couple of shows I did in Philadelphia's Fairmount Park. This was before a permanent structure was built; we did it in a tent-in-the-round. One of the plays was "Boy Meets Girl" which had the feel of a musical. I was taking singing lessons at the time just for fun; just to loosen me, so to speak. Certainly I had no thought of ever working in the musical theater.

"But there was this offer to do 'Music Man.' They gave me, as a tryout, what they considered the toughest song in the show, 'Trouble.' Well, they didn't realize that for an actor, this is the *easiest* song because it has a rhythm you *cannot* fall off without breaking your leg. The rest of it is an acting performance. The musicality of that number came during rehearsal. It was originally scored during rehearsal for a drum, just *slam. slam. slam.* And as the musicality of the piece developed in rehearsal, so was it written.

"That kind of song doesn't bother me at all but what I feared was that I might get ballads. Now I feel more at ease because I have been working in four musicals, all good runs except 'We Take the Town,' where I had a difficult role as 'Pancho Villa.'" (It tried out in New Haven and Philadelphia but never made it to Broadway. Preston says today that he is not sad that show did not make it).

He tells an anecdote about the finale to "Music Man" in which Eddie Hodges was supposed to play a trumpet (in the manner a beginning child would). The producers had to redo the scene and take away the trumpet from Hodges because "he was getting better than Berrigan."

When "I Do, I Do" was assured of being a hit, RCA recorded it in an original-cast album. I feel that the album captures the essence of the play rather well, although certain visual happenings on stage are absent-without-understanding on the record.

Robert Preston in front of a recording microphone is the same performer that is on stage. He does not perform differently; there is no change in pace or projection. Even in his recorded performances he is much more concerned with the *acting* of the song, rather than his *singing*. In "Music Man" almost every number was a 'first take'; this is true for the film as well as the recording. On the movie screen, Harold Hill is mouthing the words to a recording that has been made earlier. Said Preston, "By that time, I had done the show 887 times. I'm breathing to the performance I've been giving, and I'm singing to that same performance. I'm not just mouthing on the screen.

"In 'I Do, I Do,' Mary and I have no air between; we must breathe together; if we don't, I know I've made a mistake. But the songs on the recording are done the way they are done in the theater. The stereo recording has us in the same positions we have on stage. As I said, my performance is about the same as it is on stage, unless I am doing something unconsciously that I am not aware of. Mary on the other hand, is at a great deal more ease; it comes from her years of working in front of micro-

phones. She knows what she is doing in front of a microphone.

"About the only difference between the recording and the stage performances is that the orchestra has been somewhat augmented for the recording in order to give it a richer sound. Also, it was spread out over a larger area."

Robert Preston is not a high-fidelity component fan, though he certainly is aware of the sonic advantages they offer. He and his wife of 27 years have recently moved to a solid old home in Connecticut. There he has an upstairs sitting room of large dimension that is being converted into a music listening room. It sports a massive stone fireplace and should make a fine music room.

Perhaps the musicality of the man can best be illustrated in this scene from his childhood in Los Angeles. His mother was, at that time, in charge of the record department of a large downtown Los Angeles department store.

"When we were playing the jazz of the day, and she came home after a whole day of it, on went the Red Seals. So we grew up surrounded by good music and we developed an enduring love for it. Once a month, I was called in for monthly inventories at some of the record companies—Decca, Brunswick, Columbia, Victor, all of them because of my mother. I would pick up a little extra money during those high school days, helping with those inventories. And every matrix that was going to be destroyed I'd take home. I had one room that was absolutely jam packed with every piece of music from the Bessie Smiths to Chaliapin. They are still in that house in California; my mom and dad still live out there, and someday I'll transfer them to tape, in as high-fidelity a manner as is possible with those old 78s.

There is always a kind of magic around a popular film and theater star. And certainly, that is what Robert Preston is. As if to accent that theme, at the conclusion of the interview, Ben Washer, "I Do, I Do's" able publicist and I had to push our way gently out through a teen-age crowd that awaited the stars at the stage door.

"Are you the one that did the interview?" asked one pert teen. (How they learned that an interview was in progress is one mystery that must remain unsolved.)

"Yes."

"Gee, aren't you *lucky*," she gushed.

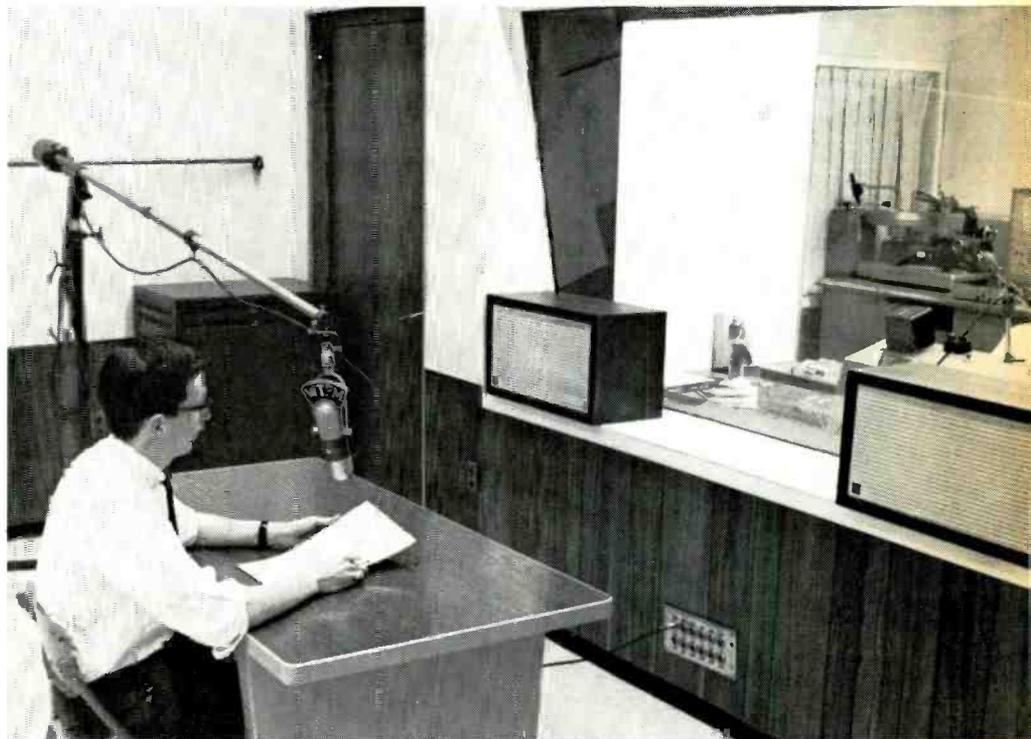
Æ

AR^{INC.}

SPEAKERS ARE CHOSEN FOR CRITICAL PROFESSIONAL USE – BUT THEY WERE DESIGNED FOR THE HOME.

Professional

Studio at WTFM in New York, one of the world's pioneer radio stations in FM stereo. AR-3 speakers monitor the audio quality throughout WTFM's studios and control rooms, as they do at many other broadcast stations. WTFM cannot afford to use speakers that provide false information.



Domestic

Library in the home of Virgil Thomson, distinguished American composer and dean of music critics. The speakers over the bookcases are AR-3's, chosen for their non-electronic, musical sound. Reflection in the mirror is Mr. Thomson watching the photographer.

AR speakers are \$51 to \$225. A catalog of AR products—speakers and turntables—will be sent free on request.

ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge, Massachusetts 02141



**Any similarity between this new \$89.50 automatic
and an expensive Dual is purely intentional.**

When you make a famous and costly product, the most advanced in its field, you're bound to have some imitators.

But we were never quite satisfied with imitations of our \$129.50 and \$109.50 automatic turntables. They all lacked a certain touch.

Ours.

So we decided that if we wanted to see a perfect imitation of a Dual at a lower price, we'd have to do it ourselves.

Then it would be a genuine Dual. With genuine Dual performance. (After all, we had inside information.)

That's how the new 1015 came into being. The only automatic under \$90 that can be realistically compared to the top-priced Duals.

Same low-mass tonearm design with dynamic balance. Same low-friction bearings. Same 1/2-gram tracking. Same dead-accurate anti-skating control to assure equal force on both groove walls. Same auto/manual cueing system for gentle stylus placement on any part of the record. Same Dual precision throughout.

Then why does the 1015 cost less?

We are using a new platter, a new kind of counterweight, and a slightly different motor. And we have omitted the fine-speed adjustment and the rotating spindle, luxury features that nobody else has anyway. You can't have the ultimate Dual for only \$89.50.



But you can have a strikingly similar one. Our engineers did it intentionally.

United Audio Products, Inc., 535 Madison Ave., New York, N.Y. 10022

Check No. 126 on Reader Service Card.

what the industry's leaders expect in the next 20 years



WALTER O. STANTON

*President, Institute of High Fidelity,
President, Pickering & Company, Inc.*

That the past 20 years have constituted an explosion in the electronics industry is, of course, obvious. The boom in electronics for industry and business has been accompanied by equal progress in electronics for the home—a fact that is obvious to consumers, from the teen-ager with the transistor radio plugged into his ear to the classical music buff who turns a knob on his component system at home to hear a symphony that sounds almost as if he were in the concert hall.

Manufacturers have predicted that in the next 20 years, the home electronics industry will grow to rival and perhaps surpass even the automobile industry with its \$24 billion market. At its current growth rate (\$5 billion in 1966), the home electronics industry, which has doubled in the last five years, could develop into a \$30 billion market by 1987.

Sales volume in the component-high-fidelity industry has been increasing at an average rate of 20 per cent a year for the past decade. Last year sales reached \$140 million, or 2.8 per cent of the total home electronics field. If the component industry maintains this rate of increase, sales in 1987 will reach \$6 billion—20 per cent of the total market.

Why? Reasons are not hard to find? Back in 1850, an industrial employee worked 66 hours a week—the equivalent of 11 hours a day, six days a week. Today, all industries have a 40-hour work week, and some have already whittled the week down to 35 hours. Even the four-day week and month-long vacations are becoming a real possibility. With this increase in leisure time will also come an increase in income as our economy continues to expand.

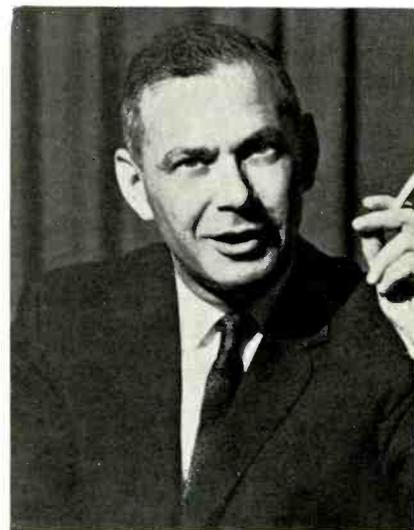
All of this indicates that the consumer will spend more time at home and will spend more money to enjoy his leisure activities. It has been estimated that homes of the near future could contain as much as \$10,000 worth of electronic equipment, including a complete component home entertainment system, devices such as electronic ovens, television-telephones, and other gadgets to lighten chores for the lady of the house. He may even be able to program a small, fairly inexpensive home computer to command his electronic world.

Chances are that controls for all the equipment will be located in one place—built into a wall, perhaps, or in a console that will double as a coffee table or other piece of furniture. Each room, however, will have its own remote control unit.

The use of tiny integrated micro circuits (large-scale integration) will allow component equipment to be smaller and even more flexible. Sound and power sources (tuners, amplifiers or multiplex units may be as small as a cigarette box through micro-circuitry.) Some speakers may hang flat against a wall; made of a foam plastic material, they may be rolled up like window shades when not in use. Companies whose achievements in sound reproduction were undreamed of a decade ago are still researching new techniques, so that we can look forward to even better sound reproduction in 1987.

Engineers will be able to produce more music on less tape; wide tapes containing as many as eight or ten tracks, and playing at slow speeds, will provide hours of continuous music or other programs. (Most engineers agree, however, that records are here to stay, chiefly because they are easy to mass produce and handle.)

Thus the houses of 1987 may include stereo speaker walls; television that uses a new photographic process called holography to produce realistic three-dimensional images on a large wall screen; videotaped programs for replay at will; facsimile newspapers; information available at the touch of a computer, and, of course, a library of music with sound that is very nearly live. With two-channel stereophonic systems installed in just fewer than half of all consumer homes equipped with high fidelity today, the component-high-fidelity market is wide open. The past 20 years have been but a prelude to the future. The next two decades will bring changes that will make the components of two decades ago seem like the Wright brothers' airplane compared to the SST.



JOSEPH N. BENJAMIN

*President, Benjamin Electronic
Sound Corporation*

Congratulations on completing twenty years of leadership in the high fidelity field. It might be in order to say that the first twenty years are the hardest, but in this fast moving age I believe that the next twenty years will see an acceleration of all phases of high fidelity.

Today's equipment, in appearance, in sophistication of design, in performance, is certainly a far cry from the high-fidelity components marketed in the late 40's and the early 50's. There is no doubt that the trends that we have seen in the last half dozen years will continue into the 70's and 80's. To predict that components will be integrated into home decor, that designers will swing to more recent developments in transistors and integrated circuits, and that there will be increasing use of tape and tape cartridges in the home, goes without saying.

We have seen many controversial changes in phonograph-cartridge design, but the proof of the value of some of these changes is their acceptance by the consumer. In turn, improvement in phonograph cartridges has demanded improvement in record-playing equipment, and this is a cycle that is mutually stimulating. We expect developments in low-mass tone arms on record-playing equipment to enable the use of lighter and more compliant cartridges with corresponding lower tracking force. However, these developments will come about gradually. No significant breakthrough should be anticipated, but we know that the record playing equipment of twenty years from now will result in longer life of records and all-around improved performance.

Chances are that many of your favorite FM stations are not the ones closest to where you live. Their signals are a bit weaker and subject to blanketing by stronger signals from a nearby station. Thus, all the advantages of a high-priced, highly sensitive tuner can go down the drain if performance on weak stations is marred by interference from strong local signals.

The new Sony FM stereo tuner is highly sensitive (2 microvolts) so that it can pull in the weakest stations. For all its sensitivity, the ST-5000W is unusually insensitive to cross-modulation. An ingenious new cadmium-sulfide (CdS) bandpass RF attenuator prevents cross-modulation caused by weak stations being blanketed by strong signals. This automatic and continuously variable attenuator reacts appropriately to the strength of the signal coming down the antenna lead and simultaneously refuses to pass any signal outside the FM band.

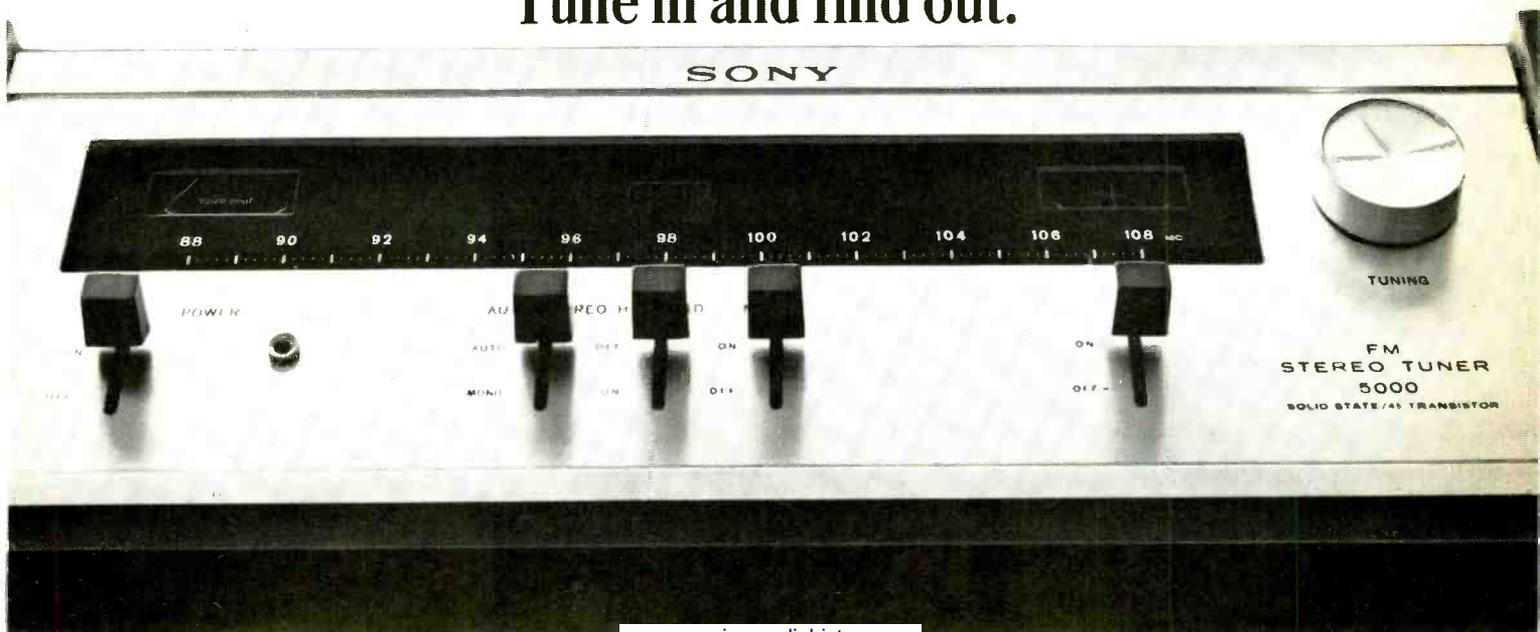
There's so much to recommend the ST-5000W. 45 transistors and 30 diodes are employed—Sony transistors. Double-tuning IF transformers at all 8 stages of the IF sec-

tion reject spurious signals and noise. A 5-gang, high-precision, silver-plated tuning capacitor contributes to excellent selectivity and accurate tuning. The slide-rule dial, probably the longest and most accurate used in any tuner, is absolutely linear. When you dial 96.3, you're on 96.3. And the center of any channel can be pinpointed visually with the tuning meter. Another meter helps adjust the antenna for maximum signal pick-up. A stereo switch automatically selects the correct mode—stereo or mono. There's also a foolproof stereo indicator light. An adjustable CdS muting switch suppresses interstation noise, but not weak stations. A hi-blend switch assures good stereo reception, even on stations with weak, noisy signals. An AFC circuit can be switched in under extreme operating conditions.

Hear why the sensitive Sony ST-5000W is so insensitive. Tune it in at your favorite dealer. The supreme pleasure of owning this fine instrument is well worth \$399.50. (Suggested list.) For details write: Sony Corporation of America, Dept. H., 47-47 Van Dam Street, Long Island City, N.Y. 11101.

SONY®

**How can such a sensitive FM stereo tuner be so insensitive?
Tune in and find out.**





HASKEL A. BLAIR

President, University Sound
Division LTV Ling Altec, Inc.

On this eventful occasion we take personal pleasure in congratulating *AUDIO* magazine on its 20th Anniversary. When we join with *AUDIO* in celebrating this achievement, it brings back memories of the early days of High Fidelity and a remembrance of the accomplishments of our Industry which were documented so thoroughly by *AUDIO* and its distinguished editor, C. G. McProud, over the past 20 years.

No science or industry can exist or grow without a common means of communication—without a medium to report and document the interchange of ideas and progress. In my opinion, the singular honor for this vital contribution to the science of sound and the industry that makes its products should be bestowed upon *AUDIO* magazine. Its first issue—in May, 1947, under the title of *AUDIO ENGINEERING*—began a chronicle of remarkable progress contributing unstintingly to the art and growth of the High Fidelity Industry. Through the years, *AUDIO* magazine has carried, debated, and aired every significant scientific subject from the development of the LP record to the most recent breakthrough in solid-state electronics, IC's or Integrated Circuits. More important, however, are the consistently questioning minds of *AUDIO*'s editorial staff in their constant search for the prime, basic objective of the art: *The true, natural quality of sound and music reproduction.*

When we look back over the years, we first begin to appreciate the contributions made by the pioneers of our Industry and *AUDIO* magazine stands out in the forefront of this group. In the early years the high cost of components for high-fidelity systems was of great concern. The potential market for component-high-fidelity products was little enough at that time, and high costs didn't help any to expand this market. Just about the time *AUDIO* magazine was readying its first issue, engineers at University Loud

speakers, who had been pioneering in sound since 1935, were completing the development of the Model 6200, a revolutionary extended-range-high-fidelity speaker, and University's first entry in the field of High Fidelity. The original Model 6200 not only outperformed comparable makes of speakers at that time, but its new process of manufacture enabled University to market it at just about half the price of any equivalent unit of that day.

This was a significant breakthrough in this new industry. Shortly thereafter, at the first Audio Fair in 1949, University unveiled the Model 6201, a true coaxial multi-speaker that sold for less than \$50. It quickly grew to be the world's most popular and largest selling 12-in. high-fidelity speaker. Even today University's Model 312—a 12-in. three-way speaker with a fantastic response range from 20 to 40,000 Hz is ranked as the finest and most popular 12-in. loudspeaker in our Industry and still sells for only \$75. These are just a few of the University contributions which we pioneered and are justly proud of.

In the years that followed many manufacturers, such as Jensen, Fisher, Bogen, and Scott—to name a few—contributed to the development of higher quality and more realistically priced component-high-fidelity products.

But what of tomorrow? No matter what scientific breakthrough—no matter what new development comes out of an engineering laboratory, the past will always be a part of the future. Solid-state

technology will bring new and revolutionary conveniences and refinements to stereo high fidelity. We have yet to enjoy the benefits of wireless stereo systems with microcircuits permitting remote control in any of a number of rooms. A complete control center in a tiny wall panel, or a hand held control set no larger than a pack of king-size cigarettes. Tuning by body capacitance with a change of stations possible from any room in the house. Sets that turn on and off automatically. Remote speakers that come on when you enter a room. Even the main speakers, as well as remote extension speakers, will actually be the activated walls of the room. As a matter of fact stereo-high-fidelity developments, will undoubtedly reach a level of such fidelity that concerts of the future will be recorded both audibly and visually and we will be able to reproduce the concert in our homes as if it were live, audiovisual in color—and undistinguishable from the original—yet recorded to be enjoyed at home anytime of the day or night.

Nonetheless, the past will always be there reflecting the solid foundation built by the pioneers of sound as exemplified by *AUDIO* magazine. Thus, the future will be a mirror of the past. No matter what the future offers—stereo high fidelity will still mean a *true, natural quality of aural and visual reproduction*—the masses will be served *because prices will be realistic*—and, without question, stereo high fidelity—*Sound and Sight*—will *delight the lady of the house decoratively.*



R. T. BOZAK

President, Bozak Mfg. Co.

While we in the audio industry can take great pride in the fact that the reproduction of sound today is many times as realistic as it was 20 years ago, we must constantly guard against becoming too complacent.

As good as the best sound equipment of today is, it is not perfect. In the forth-

coming 20 years, we must continue to strive toward that goal of perfection, knowing that we may never achieve it.

As it has been in the past, progress will be painfully slow—a tiny step at a time. Often improvements will be so minute that they hardly will seem worthwhile. Yet we must not discard them merely because at the moment they don't seem "commercially" feasible. It is only after a number of years that we can look back and see how these little forward steps add up to represent giant strides of progress.

In every link in the audio chain, there is still room for major improvement. There is a tendency to think that the electronic portions of the system are nearing perfection and that any major improvements in sound reproduction depend on improved loudspeakers. It just isn't so. Our laboratory tests have convinced us that amplifiers have as much room for improvement as transducers do.

It is my personal hope that the industry will continue to provide as much news of progress during the next 20 years as it has during the past. I know that whatever is new in sound reproduction will be reported in the pages of *AUDIO*, the first magazine in our industry.

Check No. 127 on Reader Service Card→

*Congratulations on your
20th anniversary, Audio*



*... we like to think
that we're partners in your progress!*

McIntosh
LAB, INC.
6 CHAMBERS STREET
BINGHAMTON, N. Y. 13903



LEONARD CARDUNER

President, British Industries Corp.

Like everyone else, I have some pet opinions on what the next 20 years will bring. Looking into the crystal ball, I can see a trend toward computerization and miniaturization. Everything will be smaller—records, record players, speakers. Eventually the entire set up will be so compact it will fit into a small case which can be carried anywhere. It will be operated by powerful, long-lasting miniature batteries.

I am confident that the present trend toward lighter tracking forces will continue to where there is no force left at all—in other words, that cartridges some day will scan the record grooves electronically, something like sonar or radar.

Dust, of course, has always been an archenemy of records. As cartridges and tonearms become more sensitive and tracking force decreases, there will be a need for more effective ways to clean a record of dust and other particles, unless a new material is found which is dustproof. For example, there may be a new kind of cleaning chamber. Just before playing, the record would be passed through, or in front of, an ultra-sonic device and then onto the turntable.

Records and record players are, of course, due for considerable advancement over the next 20 years. Since it would appear that tonearms and cartridges will have less and less mass, turntables and motor assemblies can also be expected to change. I would not be surprised if the turntable will no longer be driven directly but will “float” in a controlled whirlpool . . . a centrifuge of oil or mercury. No wow or rumble will be possible.

It's interesting to speculate on these developments . . . and it's certainly exciting to work on them, as we are already doing. You ought to try it, too—but I'd suggest you do so while you are enjoying a good “old-fashioned” 1967 music system.



ERIC DARMSTAEDTER

Tandberg of America, Inc.

I would like to break this down into two sections: 1) what will probably happen in the next ten years; 2) what may happen eleven to twenty years from now.

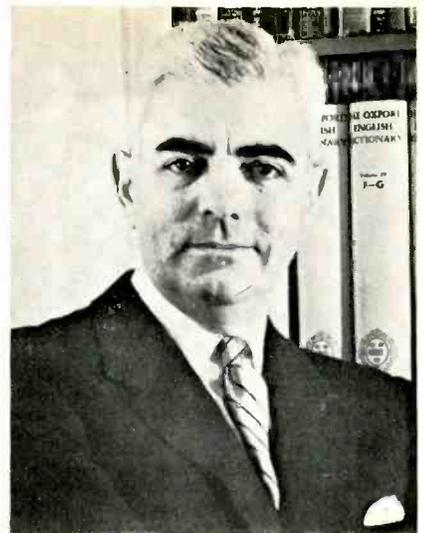
1. In tape recording, the trend to slower speed and smaller size will continue. The speed of $1\frac{5}{16}$ will be used more and more. Tapes will be on the market with which it will be possible to record at a speed of $1\frac{7}{8}$ and possibly $1\frac{5}{8}$ with the same fidelity we now record on $7\frac{1}{2}$ and $3\frac{3}{4}$, and some years ago at 15 and 30 ips.

Tape recorders will be much lighter and smaller due to the use of micro-electronics in the years to come. Integrated circuits and the art of controlling the speed electronically rather than mechanically will be used more as time goes on.

I believe that we will also see a major change in the development of loudspeakers. We already have a trend toward smaller speaker units. This will prevail, in my opinion, and many companies are already producing speakers with less depth.

2. Now I would like to conjecture about the next eleven to twenty years. The combination of video recording with sound recording may be the development after ten years or even sooner. Many hi-fi systems will have picture-recording and reproducing in color, just as we now have the sound recording and reproduction. The average price of a hi-fi installation, including the picture in color, will not be much more than the present cost of a hi-fi installation.

Many new developments are ready for introduction on the market, such as recording and reproduction of color television by amateurs. I believe the trend of spending many millions of dollars on every new step will continue. The tape recorder industry and the Hi-fi industry have a solid future certainly for at least the next 20 years.



AVERY FISHER

President, Fisher Radio Corp.

The other day I had occasion to inspect some of the high fidelity equipment produced by our company thirty years ago. In spite of my long and obvious familiarity with these units, I was amazed anew at their ponderous size. The tuner, amplifier, and power supply were constructed on three separate chassis. Their combined weight was of the order of 65 to 70 pounds, yet the power output was only 25 watts. Today, a typical Fisher receiver, such as the 700-T, occupying far less space than its grand-daddy and weighing perhaps one-third as much, produces five times the power. In many other respects, the 700-T, a 1967 concept of what a high-fidelity receiver should comprise, is technologically as far ahead of our original 1937 receiver, as a Conway fan-jet is of an early radial aircraft engine. It is true that they both perform the same function, but what a difference!

If, in our predictions of what may come in the next twenty years, we use as a point of reference the explosive rate of invention in the decades just ended, then almost any development, however “far out,” must be considered a real possibility.

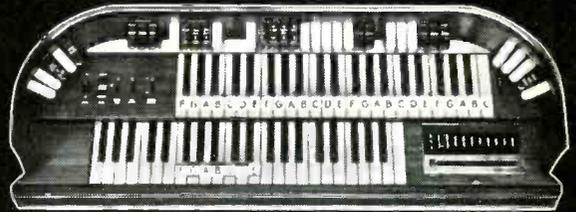
The next ten years will certainly bring many new and important developments by our engineers, in some cases utilizing techniques evolving from our country's space efforts. This will occur particularly in the areas of miniaturization, increased compactness, improved performance, large-scale integration of key circuits, and the gradual disappearance of separate transistors. The trend away from separate high-fidelity components and toward centralization and compactness, will continue.

One thing is certain—high-quality stereo equipment is no longer the private domain of the knowledgeable high-fidelity addict. It has become, as it should, an integral part of every home in which music is recognized as an indispensable element of daily living.

NEW Heathkit®/Thomas "Paramount" Transistor Theatre Organ



Kit TO-67
\$995.00



Professional Horseshoe Console Plus Color-Glo Keys . . . a beautiful array of multi-colored stop tablets at your fingertips for convenient selection of all 19 organ voices. Plus famous Thomas Color-Glo lighted keys so you can play complete songs the first time you try it . . . even if you've never played an organ before!

19 Voices, 200 Watts Peak Power, Chimes, 2 Speaker Systems, "Stereo" Sound And Full Professional Features At Over \$500 Savings!

All Genuine Thomas Factory-Made Components With Easy Heathkit Assembly And "Do-It-Yourself" Economy. That's the new deluxe Heathkit version of the Thomas "Paramount" Theatre Organ. And yet you don't have to be an "electronics wizard" to build it, nor a professional organist to play it. Famous "Heath Engi-nuity" reduces assembly to simple steps that require no special skills or knowledge. You even tune the organ with a pretuned tone generator. And instant-play Color-Glo starts you playing complete songs on your very first try. Combines a wide array of professional features with a luxurious horseshoe console and cool solid-state circuitry to make it a truly outstanding instrument you'll be proud to have in your home.

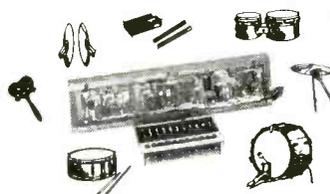
15 Manual Voices; 4 Pedal Voices . . . all at the flip of a tab. For solo work . . . diapason 16', bass clarinet 16', trumpet 16', English horn 8', oboe 8', violin 8' and tibia 16', 8', 5 1/8', 4'. For accompaniment . . . diapason 8', saxophone 8', French horn 8', oboe horn 8' and cello 8'. And now, *four* pedal voices . . . diapason 16', major flute 8', bass clarinet 8' and string bass 8'. And you'll soon learn voice combinations to produce the sounds of a Spanish guitar, zither, bagpipes, calliope. Plus other rhythm and voice variations for every musical mood. Rock & roll. Classical. Show tunes. Even religious music.

Two Separate Speaker Systems . . . a built-in 2-speed rotating Leslie plus a main system with two 12" speakers that can handle the 200 watts peak power delivered by two separate amplifiers. You can even create "stereo" sound, since the Leslie also acts as a second standard channel.

Luxurious Hardwood Cabinet And Bench . . . handcrafted and hand-rubbed with a lustrous walnut finish . . . ready for the sub-assemblies as you complete them. Cabinet measures 40" H x 48" W x 25" D.

Other Professional Features Include two 44-note keyboards, 28 notes of electronic chimes, 13-note bass pedals, keyboard and pedal sustain, reverb, selective repeat percussion to produce realistic xylophone, mandolin and marimba sounds; selective attack percussion; manual balance; timbre mellow to emphasize the warm character of orchestral voices; variable vibrato; pedal percussion and volume; expression pedal; stereo headset outlet and 5-year warranty on plug-in tone generators. Liberal credit available, too. Get all the details by sending for your FREE Heathkit Catalog!

Kit TO-67, organ & matching bench, 250 lbs. \$995.00



Optional Band Box Percussion

Adds 10 percussion voices to the music you play . . . Bass drums, two bongos, castanets, brush & crash cymbals, claves, blocks, snare drum and drum roll. May be added to all other Heathkit®/Thomas organs with TOA-67-2 drawer and slides @ \$35.

Kit TOA-67-1, 8 lbs. \$145.00

Like To Hear It Perform?

Then send for organ demonstration record TOA-67-3 (7", 33 1/2 rpm). Listen to the beautiful voices, true organ tone and professional capabilities of this superb instrument. For GD-325B organ below, order record GDA-325-1. Enclose 50c for postage & handling.



Low Cost Heathkit®/Thomas Color-Glo Organ . . . \$394.90

- All transistor circuit • 10 organ voices
 - 13-note bass pedals • Repeat percussion
 - Instant-play Color-Glo • Two 37-note keyboards • 50-watt peak power
 - Vibrato • Matching preassembled walnut cabinet & bench • 5-year warranty on plug-in tone generators.
- Kit GD-325B, 172 lbs. \$394.90**



HEATH COMPANY, Dept. 41-5
Benton Harbor, Michigan 49022

- Please send FREE Heathkit Catalog.
- Enclosed is 50c. Please send organ demonstration record no. _____
- Enclosed is \$ _____, plus shipping.

Please send model (s) _____

Name _____

Address _____

City _____ State _____ Zip _____

Prices & specifications subject to change without notice. CL-284



JULIAN GORSKI

President, United Audio Products

It's always a pleasant occasion to give thought and congratulations to an old and respected friend, even if it reminds us that twenty more years are behind us.

Twenty years ahead is a long time for anyone to look, except perhaps for an astronomer. In any other enterprise, such a long view is at best precarious.

In audio it would be especially risky, considering how the past few years have seen so many developments . . . from tube to transistor to integrated circuits, for example.

From our narrow end of the United

Audio—Dual telescope, where we focus upon the stylus in the groove, our product development is necessarily dependent upon what happens with those two pre-conditions.

As long as there are records, we can assume there will be cartridges. And considering the world-wide investment in this over-all principle of music reproduction, it's only realistic to assume a long life for it.

At this time, the theoretical limits of light tracking have just about been reached. With cartridges now capable of tracking under a gram, there isn't very far to go in that direction.

Rather, the most immediate need would seem to be the solution of various problems that either come about because of light tracking or that take on increased significance because of it.

One of these problems, for example, is that of skating. Engineers differ as to the seriousness of skating, and this is reflected (or perhaps dictated) by the products with which they are associated.

The point here is not to argue this question *per se*, but only to identify it as just one of those which are related to the "outer limits" of stylus-groove interaction. Whenever forces are interrelated, a development in one area almost invariably points to the need for development in the others. (Another is the prosaic one of cleanliness.)

The temptation is to speculate further. But there are engineers in Dual's laboratories now dealing very specifically with the future. Prudence cautions against anticipating their next blueprint.



LAWRENCE LeKASHMAN

Vice President-Sales, Electro-Voice, Inc.

Future developments for the reproduction of sound, in an era marked by achievements that have equaled the total accomplishments of civilized man to date, dictate caution when making an all-encompassing prediction of what the next ten or twenty years might hold for an industry.

Reproduction of sound must start with the pickup, acoustical or mechanical. Sound is converted into electrical energy by transducers, amplified, and the increased electrical energy converted back into sound. Perhaps at an airport, or as background music; or perhaps, into mechanical force for the cutting of a record or into magnetic forces for the making of a tape. Sound quality has improved because the techniques of picking it up have improved. In the future, we see still further refinements. As a major manufacturer of transducers, we have seen one development after another—each more sophisticated, until today we have cardioid microphones which offer uniformity over the entire polar pattern that was absolutely impossible before. It is safe to say that the general purpose microphones of today are vastly superior to the so-called "professional" microphones of a decade ago, and this upgrading will continue.

Better microphone pick-up and better electronics have placed a demand on the speaker manufacturers to produce wider-range, lower-distortion transducers, and at the same time permit the user in the home the convenience of smaller size because of the need for two or more systems for good stereo reproduction. This challenge has been met, also. Improvements have been comparatively sophisticated and not nearly as obvious as the transition from tubes to semi-conductors. The sum of these small changes, however, has been most significant and the sound of today's small systems rivals, in many instances, their larger counterparts of ten years past. But, the laws of physics have not altered, so larger, more efficient systems with



HERB HOROWITZ

President, Empire Scientific Corp.

The most significant thing I see for the near future is the video disc, which is sure to open a whole new area of home entertainment combining the scientific advances of TV and Hi Fi.

A black and white video disc should be appearing within the next three to five years, followed by full-color video discs a few years later.

The state of the art of disc recording and playback today is only inches away from this development.

I believe the future will see a practical solution to the volumetric requirement of speakers for effective bass response. Some day we hope to make speakers very, very tiny and still maintain adequate bass and efficiency. I look forward to small portable radios or phonographs that you can really hear loud and clear outdoors.

I like the idea of self-cleaning records and turntables that play both sides of a record sequentially, (after all, the other half of your album is usually on the other side).

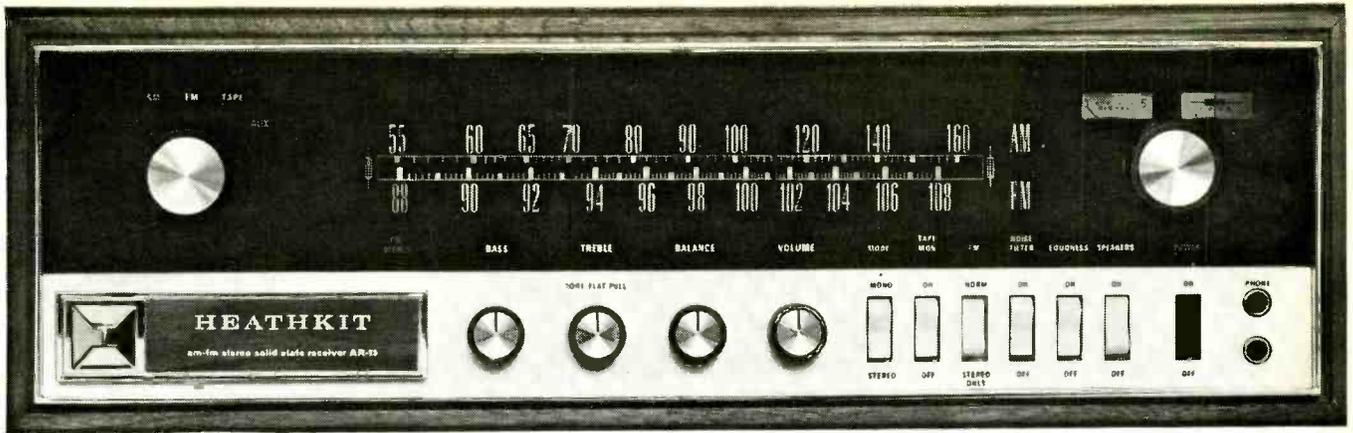
Why not a complete home electronic center with Hi Fi, TV, burglar alarm, fire alarm, and even a small computer for household usage.

We should see a great built-in antenna for F M tuners and TV sets as well as greater sensitivities, eliminating the need for rooftop arrays.

Equipment will get smaller—IC's and transistors setting the pace—with corresponding line or rechargeable battery inputs for complete portable or home operation for all devices.

Hi Fi will not only have to play under water but even on the surface of the moon. And when we've accomplished all of that, there will be other and more magnificent mountains to climb.

World's Most Advanced Stereo Receiver...



New Heathkit® AR-15...150 Watts...AM/FM/FM...\$329.95†

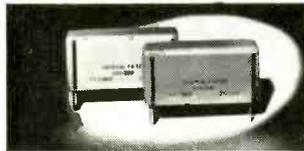


"Black Magic" Panel Lighting

A touch of the power switch and presto!... The black magic panel lights up with a slide-rule dial for easy tuning, and instant identification of all controls.



Integrated Circuits... two are used in the IF amplifier for hard limiting excellent temperature stability, increased reliability. Capture ratio is 1.8 db. Each IC is the size of a tiny transistor, yet each contains 10 transistors, 7 diodes, and 11 resistors.



Crystal Filters... two are used in the IF amplifier to replace the usual transformers... Heath hi-fi exclusive. Provide near-perfect bandpass characteristics, (70 db selectivity) yet no adjustment is ever needed!

AR-15 SPECIFICATIONS — AMPLIFIER SECTION: Dynamic Power Output Per Channel (Music Power Rating): 8 ohm load; 75 watts. Continuous Power Output, Per Channel*: 8 ohm load; 50 watts. Power Bandwidth For Constant 0.5% Total Harmonic Distortion*: 6 Hz to 25 kHz. Frequency Response (1 watt level): ±1 db, 6 to 50,000 Hz. ±3 db, 4 to 70,000 Hz. Harmonic Distortion: Less than 0.5% from 20 to 20,000 Hz at 50 watts output. Less than 0.2% at 1,000 Hz with 50 watts output. Less than 0.2% at 1,000 Hz with 1 watt output. Intermodulation Distortion (60 Hz: 6,000 Hz=4:1) Less than 0.5% with 50 watts output. Less than 0.2% with 1 watt output. Damping Factor: 45. Input sensitivity: PHONO; 2.2 millivolts (overload 155 mv). TAPE; 200 millivolts (overload 4.5v). AUX; 200 millivolts (overload 4.5v). Hum & Noise: Volume control at minimum position; —80 db. PHONO; (10 millivolt reference); —60 db. TAPE & AUX. (200 millivolt reference); —65 db. Channel Separation: PHONO; 45 db. TAPE & AUX.; 55 db. Output impedance (each channel): 4, 8 & 16 ohms. Tape Output Impedance: 100 ohms. Input Impedance: PHONO; 51 K ohm (**RIAA equalized). AUX., TAPE & TAPE MON.; 100 K ohm. Tape Output: 0.17 volt. FM SECTION (Mono): Sensitivity: 1.8 uv*. Frequency Response: ±1 db, 20 to 15,000 Hz. Volume Sensitivity: Below measurable level. Selectivity: 70 db*. Image Rejection: 90 db. IF Rejection: 90 db minimum*. Capture Ratio: 1.5 db*. AM Suppression: 50 db*. Harmonic Distortion: 0.5% or less*. Intermodulation Distortion: 0.5% or less*. Hum & Noise: 65 db*. Spurious Rejection: 100 db*. FM SECTION (Stereophonic): Channel Separation: 45 db or greater. Frequency Response: ±1 db, 20 to 15,000 Hz. Harmonic Distortion: Less than 1% at 1,000 Hz with 100% modulation. 19 & 38 kHz Suppression: 55 db or greater. SCA Suppression: 50 db. AM SECTION: Sensitivity: 12 microvolts at 1,000 kHz. Image Rejection: 60 db at 600 kHz. 40 db at 1400 kHz. IF Rejection: 70 db at 1,000 kHz. Harmonic Distortion: Less than 1.5% at 400 Hz, 90% modulation. Hum & Noise: 45 db. Power Requirements: 105-125 or 210-250 volt 50/60 Hz AC. Dimensions: Overall, 16 7/8" wide x 4 3/4" high x 14 1/2" deep.

*Rated IHF (Institute of High Fidelity) Standards.

The New Heathkit AR-15... Crowning Achievement Of The World's Most Experienced Solid-State Audio Engineers! There's nothing like it anywhere in the transistor stereo market place. Besides the use of space-age integrated circuits and exclusive crystal filters in the IF section, it boasts other "state-of-the-art" features like these:

150 Watts Dynamic Music Power... 75 IHF watts or 50 RMS watts per channel... the highest power output of any stereo receiver. Delivers the coolest, most natural sound you've ever heard.

All-Silicon Transistor Circuitry... a total of 69 transistors, 43 diodes and 2 IC's for maximum reliability & stability.

Positive Circuit Protection... four Zener diodes and two thermal circuit breakers protect the driver and output transistors from overloads and short circuits of any duration.

Field Effect Transistor FM Tuner... cascode 2-stage FET RF amplifiers and an FET mixer provide high overload capability, excellent cross modulation and image rejection. Sensitivity 1.8 uv. Features a 4-gang variable capacitor and 6 tuned circuits for extreme selectivity under the most adverse conditions. Completely shielded... completely assembled for best performance.

Two Calibrated Tuning Meters... a signal strength indicator tells you when you receive the strongest signal — doubles as a VOM for check-out during or after kit construction. A special "Center-Tune" meter puts you on exact station frequency.

Tone-Flat Switch... bypasses tone control circuit for completely flat response.

Automatic FM Squelch... noise and AFC operated to hush between-station noise before you hear it.

Stereo Only Switch... silences all mono when you wish to listen to stereo broadcasts only. An added tuning convenience!

Super SCA Filter... removes SCA and noise frequencies above 57 kHz for clean, quiet listening.

Massive Power Supply... for low heat and superior regulation — electrostatic and magnetic shielding for lowest hum and noise.

Electronic Filter Circuit... provides power supply with exceptionally low ripple and excellent regulation.

Adjustable Phase Compensator for Station Differences... so you can be assured of the best stereo.

Wide Range Magnetic Phono Inputs... extra overload characteristics (98 db dynamic range). All inputs adjustable from front panel. Plus automatic switching to stereo, transformerless design, filtered outputs and a host of other deluxe features for the discriminating audiophile. An assembled wrap-around walnut cabinet with a vented top is available at \$19.95. Liberal credit terms also available.

† Kit AR-15 (less cabinet), 28 lbs. \$329.95
AE-16, assembled walnut cabinet, 7 lbs. \$19.95



HEATHKIT 1967

FREE!

World's Largest Electronic Kit Catalog

Contains full descriptions and specifications of AR-15 and over 250 easy-to-build kits... stereo/hi-fi, color TV, electric guitars & amplifiers, organs, AM-FM-shortwave radios, test, marine, CB and ham radio. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.



HEATH COMPANY, Dept. 41-5
Benton Harbor, Michigan 49022

Please send FREE Heathkit Catalog.

Enclosed is \$ _____, plus shipping.

Please send model (s) _____

Name _____

Address _____

City _____ State _____ Zip _____

Prices & specifications subject to change without notice. HF-202

PROGNOSTICATIONS

their advantages have been improved also. Sound reproduction available off a distributor's shelf now covers the range at a distortion level which was only a laboratory curiosity in the past. These have not been scientific breakthroughs, but rather the careful application of new materials and manufacturing technologies as evidenced by the massive 30-in. woofer diecast by Electro-Voice with a polyurethane foam and other materials that simply were not available. And so, the future continues to bode this kind of improvement—selective, step-by-step—which will make products perform slightly better, or equally well at lower cost.

Magnetic cartridges, of course, have undergone subtle and significant improvement in all of their parameters, and it is likely that this development, already at a very high state of the art, will see no radical improvements. Not to be overlooked is a fantastic improvement, paral-

leling these developments in magnetic cartridges, in ceramic phonograph cartridges, of which millions are sold each year. The performance of today's comparatively inexpensive production ceramic cartridge in every measurable category—compliance, response, channel separation, and IM distortion—equals the finest so-called high-fidelity cartridge of five to ten years ago.

Will this same pattern be repeated in the next twenty years? Of course it will. Fortunately, for the users of audio equipment, unlike many other scientific and technical devices, the improvements will be sufficiently subtle that overnight they are not likely to obsolete whole segments of our industry.

But all of these developments are going to be evolutionary, not revolutionary. It is comforting to contemplate that the boundaries are nowhere in sight, while our investments are unlikely to be obsolete.

The magnetic disc, similar in shape to today's phonograph record, will play an important role in audio and video recording. Once the limitations as to recording time and other problems are solved, the disc will offer many advantages. It's economical to manufacture in quantity and relatively easy to handle. The discs will be capable of producing sight and sound almost anywhere. Sony already has shown prototypes to the trade of a TV disc recorder that records on a high-speed magnetic disc, rather than on conventional magnetic tape, permitting short-time interval color and monochrome signals to be stored and played back.

Hardly any home, business and institution, school or laboratory will be without video recording facilities within the next decade, just as high-quality audio equipment has become an integral part of the American home and the broadcast industry, so also will video recording.



DR. S. MABUCHI

*Vice President-Engineering,
Sony Corporation of America*

Video tape recording, the blending of audio and video technology, will emerge as an integral part of the home and of business, science, and education. During the next decade, the professional performance and capabilities of today's broadcast-quality video tape recorders will be embodied in compact equipment that is economical in both initial cost and up-keep. This development will have far-reaching effects in home entertainment and in education and training of students, business management, labor, and those in the medical profession.

At Sony, where we are active in both the fields of audio and video taping, we have the opportunity to observe developments in both sound and sight on a day-to-day basis. We see many improvements in materials, components, and techniques that will contribute to a vast improvement in the state of the audio and video arts.

In the field of video tape recording, we see dramatic changes in both design

and concept. Audio performance will be improved to a point where it will compare favorably with what is considered to be high fidelity.

Standardization of tape speeds and tape widths will also be a tremendous benefit in stabilizing this field and the ultimate emergence of the best possible product at the lowest possible cost.

Another economy is the capability to use any standard TV receiver as the off-the-air recording source and playback unit for a video tape recorder. Simple, inexpensive r.f. adapters are nearly ready for the market. These units will connect easily to any standard TV set.

The video camera of today is the instant-movie camera of the next decade. Sony already has a prototype of a three-piece portable VTR system consisting of a video camera with built-in monitor, video tape recorder with battery pack. The entire ensemble weighs about 15 pounds. This type of set-up will permit the user to take home movies anywhere—indoors or outdoors—and actually see the composition and the quality of the movie he is taking on the view-finder monitor built into the camera.

Almost as important as the breakthroughs in equipment will be the improvements in the recording tapes. An analogous situation is the continuing improvement of photographic film, the result of constant research and development. With video tape, the same dedication to research will result in similar progress. This is where the greatest advances will take place.

The use of chromium dioxide which is the latest development in this field as a coating material can result in a major step forward in video tape performance and durability. This coating will permit slower tape transport without loss of frequency response. We envision VTR machines operating at a speed of 1½ ips using this new coating producing the same results as present-day machines using magnetic tape operating at a speed of 7½ ips.



SAUL B. MARANTZ

President, Marantz Company

In 1947, had AUDIO asked me to predict twenty years ahead in our industry, I probably would have answered that the greatest improvements would be made with transducers; but I was wrong. The greatest relative advances have occurred in the electronics end of the field. Loudspeakers, while greatly improved over their 1947 forerunners, still need much inventive development. New principles, hopefully, will be devised whereby they will more faithfully follow the electrical signals which drive them. Amplifiers were available, even in 1947, which had less than one per cent distortion over the audio band, and it would not have taken much foresight to predict a notably higher order of performance. However, in 1947, the transistor had not yet matured. It was not possible for us then to visualize the incredible advances in performance we have achieved today. Distortion, now measured in the hundreds and thousands of one per cent, is no longer a serious consideration. Today's amplifier bears little resemblance to its 1947 an-

Check No. 131 on Reader Service Card—>



**We were making
fine microphones
back when high fidelity
meant an electrical
recording of "Ramona"
on this splendid
old console.**



**But in almost
40 years
microphones
and high fidelity
have come a long way.**

For example...

STUDY THIS BRIEF PROGRESS REPORT FROM *Electro-Voice*[®]

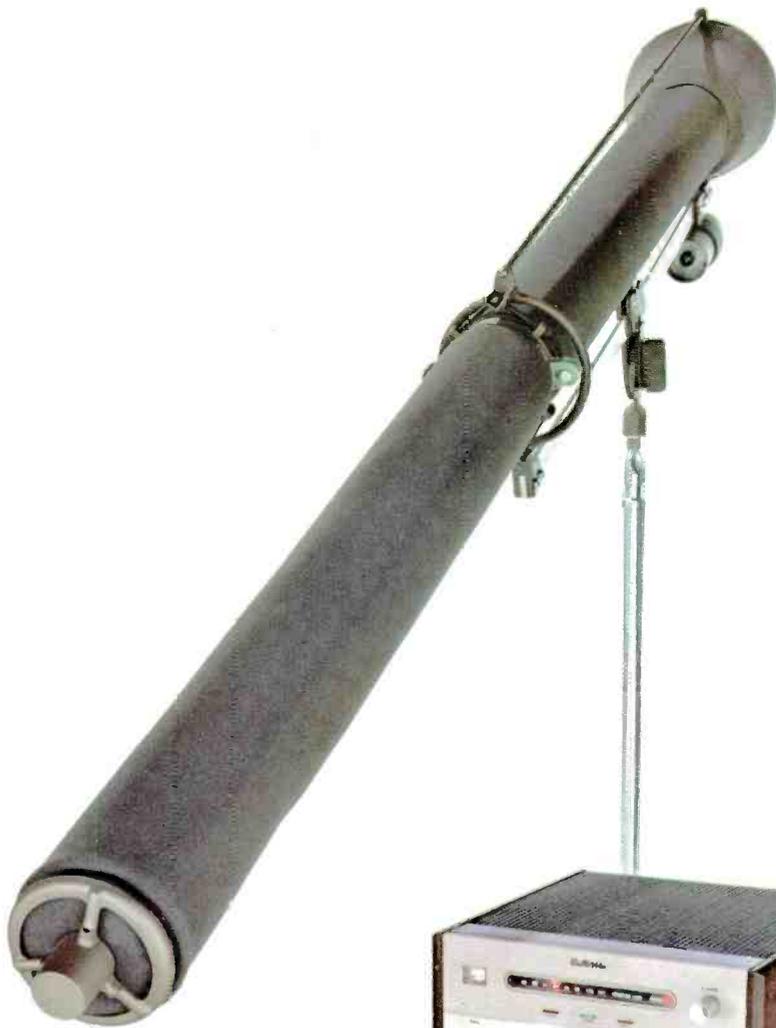
THE MICROPHONE

We've gone to unusual lengths to extend microphone "reach". Seven feet long in the case of the E-V 643 which picks up sound at enormous distances. This highly directional "shotgun" microphone is widely used in motion pictures and TV, where you'll find it at football games, news conferences . . . wherever distant sounds must be heard. \$1,560.00 list.

THE HIGH FIDELITY COMPONENTS

On the left the handsome 65-watt* FM stereo receiver is our Model 1177 . . . one of the smallest around. Solid state of course. \$280.00. Underneath it, a genuine breakthrough - the new E-V FIVE-A with a four-layer voice coil to insure better bass at lower cost. Just \$88.00. Or choose an old favorite, the SP12B for installation anywhere. \$39.00. On the right our newest receiver, the E-V 1179. 55 watts* of FM stereo for only \$223.00. Add the big sound of the tiny E-V SEVEN for just \$66.50 each. You'll save enough to put pairs of LT8 3-way speakers in every room of the house. \$33.00 each.

*IHF output at 4 ohms.



THE MICROPHONE

A rare view of the E-V 668 dynamic cardioid microphone . . . normally just out of sight above your favorite TV performer. Chosen by TV and film engineers because it offers 36 different response curves, plus outstanding directional pickup. \$495.00 list.

THE HIGH FIDELITY COMPONENTS

Side-by-side on the left, the perfect team: an E-V 1144 65-watt* stereo amplifier (\$125.00) and E-V 1155 FM stereo tuner (\$160.00). Each no bigger than this page—no taller than a coffee cup! They rest on the E-V FOUR, our finest compact, a three-way system with 12" woofer. \$138.00. Or build the versatile 12TRXB into any existing cabinet. \$69.00 each. On the right, the cool E-V 1178 with AM/stereo FM and 65 watts* of solid-state power. \$315.00. Just below, the highly regarded E-V SIX that bridges the gap between big speaker sound and compact convenience. \$333.00. Or go custom with the finest 15" dual-cone speaker anywhere . . . the SP15. \$88.00 each.

*IHF output at 4 ohms.



THE MICROPHONE

This deceptively simple-looking microphone can make a major improvement in your tape recordings. The Model 674 is a Continuously Variable-D[®] dynamic cardioid model, equipped to eliminate rumble, reject interfering noise, and control poor acoustics. And quality control is so rigid, any pair is exactly matched for stereo. \$100.00 list.

THE HIGH FIDELITY COMPONENTS

On the right, a handsome stack of electronics with 65 watts* of stereo power (Model 1144, \$125.00) plus a sensitive AM/stereo FM tuner (Model 1156, \$195.00). Easy to use—even easier to listen to. And below, one of the biggest loudspeaker systems of them all—in every way—the fabulous Patrician 800. Choice of two styles, three finishes, \$1,095.00. Just look at what's inside: a 30-inch diameter woofer for sound you feel as well as hear, a 12-inch speaker solely for mid-bass, plus two sophisticated horn-loaded drivers for treble and high frequencies. Patrician components only, \$597.00.

*IHF output at 4 ohms.



Electro-Voice® SETTING NEW STANDARDS IN SOUND

high fidelity speakers and systems • tuners, amplifiers, receivers • public address loudspeakers
microphones • phonograph needles and cartridges • organs • space and defense contracts

ELECTRO-VOICE, INC., Dept. 574A, 602 Cecil Street, Buchanan, Michigan 49107

PROGNOSTICATIONS

cestors, either physically or electrically.

By the same token, even the sophisticated techniques just appearing on the scene today will be "old hat" in 1987, long supplanted by devices and methods yet unknown.

By this time, good music reproduction will be as much a part of a home as its walls and furniture. The general public will have become much more discriminating about sound quality. It will expect and demand the highest standards of performance. Traditionally dedicated to advancing the state of the art in improving his products, the component manufacturer will have gained the larger share of the market, most of them supplying a demand for complete systems of superior quality and reliability.

While it may seem that improving technologies should tend to diminish quality differences between brands, it is my belief that there will always be a few dedicated manufacturers turning out products which are indeed superior. To this belief we dedicate the future growth of our company.



HERMON HOSMER SCOTT
President, H. H. Scott, Inc.

Congratulations to AUDIO, the first publication of its type, on its Twentieth Anniversary. As for the next twenty years, progress in technology and packaging will continue at an ever-more-rapid pace. Twenty years ago, when our previously established business was incorporated in its present form, I was surprised at the number of consumers who wanted to buy the 210 Dynaural Amplifier which we had developed primarily for professional customers. Since then, we have presented numerous developments culminating in the Field-Effect Transistor and Integrated Circuits.

There is one factor, however, which I expected many years ago and which is just now coming into being, namely integrated systems of professional component quality. I am referring, of course, to the trend toward the sale of true high-fidelity systems, whether as components, compacts, or consoles, which perform according to the highest standards, because

Check No. 131 on Reader Service Card

the entire system is designed and produced or selected by a single responsible manufacturer. For instance, regardless of how good an amplifier may be, the overall system performance will be limited by the speakers, pickup, and so on. Only when all of the elements of the system maintain the same standards of performance can the over-all performance provide the degree of high fidelity envisioned by the manufacturer of the electronics. For this reason, we are vitally interested in all of the elements of the system. When we first started business more than twenty years ago, we supplied lists of recommended accessory equipment. Now, to ensure the highest quality, we design and manufacture most of the system ourselves. Only in this way can we be assured that the customer gets our standard of quality.

Through the years we have tried to provide the most advanced and enlightened engineering. We must never forget, however, that the most important factor is the over-all performance of the system to which the customer listens.



STEPHEN F. TEMMER
President, Gotham Audio Corporation

The audio industry, as a tributary of the mainstream of entertainment, will doubtlessly reap the benefits of reduced working hours and greater leisure time which the future seems to hold for all of us. I foresee an ever-closer tie between audio and video as the economics of video reproduction permits us to supply the missing pictures for much of the audio-only material we now produce. I can see the record, far from being displaced by tape, take on ever-more important roles. Not too many years hence your turntable will be connected to the back of your color TV receiver bringing you 3-D picture and stereo sound from a groove at prices comparable to today's phonograph record.

To operate a recording studio will require many times the knowledge that it does today, and the cost of equipment will make the "price of admission" into the recording business staggering in today's terms. In short, we will see a further shift of expense away from the entertainment consumer and toward the talent packager, as it really must be if the market is to expand rapidly. I believe that audio *per se* will get a smaller share of the market but will be highly integrated with the world of video. It's

high time, too! I'd like to see some knowledgeable audio added to the world of video.

JOSEPH S. TUSHINSKY
President, Sony/Superscope

"This is the President of the United States speaking to you from a space capsule over 300 miles above the earth." This statement from President Eisenhower in 1958, was taped and sent hurtling into space to be replayed on command to both an amazed and attentive world populace. It launched the space age, and tape was there.

We are promised a landing on the moon before 1970. By 1987 there will undoubtedly be regular scheduled flights to not only the moon, but exploration trips to other planets in our galaxy.

We are told that in less than six years airliners capable of transporting over a thousand people from New York to Los Angeles in just over one hour will be commonplace. Into this expanding future, we must now project what the tape recorder industry of 1987 will be like.

It seems fairly evident that within the next three years integrated circuitry will be replaced by thin-film technology that will deposit within minutes complete electronic circuits, including both the passive and active components. The next step is miniaturization of the tape recorder to almost electronic "dust". The final shapes of the 21st Century tape recorder will predictably be, from a hardware standpoint, a multitude of all forms and sizes, depending on the function it is called upon to perform.

Today's tape recorder forms the basis of all highly sophisticated computer systems, and it seems more than likely that tape will gain an even larger and more important role in industry, government and the sciences.

A typical example is safety. A tape recorder system in the future will undoubtedly be used to issue voice warnings and cautions in all industrial operations. A taped voice will also likely explain operating processes for vending machines and give personalized directions for mass transportation.

Medicine, too, will be greatly influenced by the tape recorder. Patients can be monitored constantly for more careful diagnosis by a doctor without spending time in a hospital. Medical histories can be compiled, in the patient's own voice, for subsequent and immediate read-out of the patient's entire medical history by the doctor or laboratory assistant.

Many scientists envision the day when practically anything we say will be recorded automatically through some sort of tape system that will be available for immediate recall. If this comes to pass, the tape recorder of the future could even affect man's morals.

Where should we draw the line between fact and fiction? Twenty-years ago, who would have believed in Flash Gordon? If we multiply the yearly growth of electronic discoveries by twenty to the twentieth power, we may come closer to visualizing the future of tape recorders in the year 1987.

PROGNOSTICATIONS

EUGENE G. VAN DEVEER

V.P. Marketing, Jensen Mfg. Div./
The Muter Co.

Congratulations to AUDIO, its publishers and editors, on the 20th anniversary. AUDIO's editorial substance and quality place it in a unique position in our industry, as one of the publications that has played a significant role in the growth and development of the fascinating and fabulous electronics industry.

Today, we take for granted electronic devices which were regarded as fantasies just twenty years ago. Tiny transistors and the growing family of other solid-state technology make possible remarkable microminiaturization. Whole complex circuits are packaged in paper-thin slivers no bigger than the tip of your fingernail. Each new development allows the industry to bring the consumer more in smaller packages and at less cost.

In the audio segment of the electronics industry, progress has been equally spectacular. Audio equipment has undergone radical improvements, including tweeters, mid-range, and woofer loudspeakers which have been developed and refined to a high degree of efficiency and quality. Coaxial and triaxial loudspeakers have been developed to provide fine sound. Today, every home can have a sound reproduction system that was beyond the realm of imagination twenty years ago.

Progress during the past twenty years has been impressive. It will be even more impressive during the next twenty years. We in research, development, and marketing will play an important role in innovating for the future. We look forward to working with AUDIO in its vital role of evaluating and communicating progress to the consumer.



EDGAR VILLCHUR

President, Acoustic Research, Inc.

In the early days of high fidelity, some people thought that the main difference between high-fidelity design and the commercial approach to sound reproduction was in integration. The commercial unit

was sold as a single package that you plugged into the wall; a high-fidelity system had to be assembled with separate cartridge, arm, turntable, turntable base, tuner, preamplifier, power amplifier, speakers (woofer and tweeters separate, and often of different make), crossover elements, and speaker enclosure.

We have now come at least halfway round the circle. It is generally recognized that certain components which work intimately with each other—speaker drivers, crossover, and enclosure, or tone arm and turntable—are better sold as a unit. In the overwhelming majority of cases, they are. I don't know whether we will ever come full circle, but I think that the integration will continue. The separate preamplifier, tuner, and power amplifier will give way almost universally to the combined receiver, particularly in view of the space saving allowed by transistors. The integrated arm-cartridge will also become the rule rather than the exception. The basic component system will thus involve three or four purchases: a receiver, a record player and/or tape machine, and a set of speakers.

While old-timers sometimes become nostalgic over the good old days when real hi-fi buffs assembled their own systems from nuts and bolts, the integration in today's components has resulted with-

out exception, I believe, in a significant improvement of quality. For example, speaker-system design, by which I mean the design of crossover circuitry and the combining of drivers and enclosures, is a strictly professional practice. The most talented and knowledgeable amateurs have neither the training nor the test equipment for this job. If a home-designed speaker system turned out as well as a competently designed professional unit it would be an accident.

Along with integration I would expect quality to continue to climb, size to continue to shrink, and price to continue to fall, this latter in spite of the historical tendency towards inflation. I believe that more efficient design will stay ahead of cost increases.

I expect that speaker design will continue in the direction of improved treble dispersion, to recreate better the sense of space that one gets in a live performance. Although this has been the major emphasis of my company since we brought out the AR-3 in 1959, I freely admit that we have not gone far enough. We must approach closer to the ideal of the pulsating sphere (referred to in an article of mine in this magazine in October, 1958), without sacrificing other qualities such as smoothness of frequency response and low distortion.



A. A. WARD

President, LTV Ling Altec, Inc.

ALTEC LANSING congratulates AUDIO magazine and its staff on their 20th Anniversary in the publishing field and for the contributions they have made to the industry. The next twenty years will undoubtedly bring both progress and change within the broad area of sound reproduction and electronics. The last two decades have brought tremendous improvement in sound reproduction but bear in mind that this span began with the advent of High Fidelity. Today, high-fidelity sound systems—properly designed, manufactured, and installed—provide a high degree of realism. Therefore, we suspect that the next twenty years will probably not match the past twenty in significant gains in audio quality.

More than forty years ago, the writer—like many others—toyed with the early "solid-state" devices, germanium, silicon, and galena crystals, when radio broadcasting was in its infancy. The word "electronics" had not yet been coined and the do-it-yourself radio hobbyist could purchase all the parts for his needs at the local five and dime store. Then, quite suddenly, the De Forest audion vacuum tube changed everything. Now, silicon, in the form of transistors, is back on the scene again, vastly improved to be sure, with the threat of eventually eliminating the vacuum tube.

We believe the immediate future will see Altec's "Acousta-Voicing" process become a standard method for sound improvement, both in difficult commercial sound installations and possibly in the home. With this unique process, it is possible to maximize a sound system which is used in less-than-perfect environment.

The fact that all such devices require less voltage and current than tubes, may see much equipment designed for use with batteries or fuel cells. So once again we may go back to batteries, quite different of course, from the old, bulky "B" batteries that kept dad's Neutrodyne receiver functioning well enough to hear KDKA or WJZ.

Altec Lansing has these memories and vast experience for a most significant reason. We have been pioneers in this business from the earliest days of commercial sound. It is our policy to keep abreast of the state of the art and provide our customers with reliable, progressive, trouble-free equipment styled for the discriminating user.

This ad is supposed to give you a reason for listening to the Fisher 700-T solid state receiver. We decided to give you several:

Amplifier section:

Tuner section:

Music power (IHF)	
4 ohms	120 watts
8 ohms	90 watts
Harmonic distortion (1 kHz)	
At rated output	0.8%
3 db below rated output	0.3%
IM distortion (60:7000/4:1)	
At rated output	0.8%
3 db below rated output	0.3%
Frequency response 10-70,000 Hz	+0, -1 db
Hum and noise	
Volume control (min.)	-80 db
Phono input (6 mV ref.)	-55 db
Aux. input (400 mV ref.)	-65 db
Input sensitivities	
(at 1 kHz, for rated power at 4 ohms)	
Phono (low)	3.5 mV
Phono (high)	10 mV
Tape Head	2.5 mV
Auxiliary (low)	200 mV
(high)	400 mV

Usable sensitivity (IHF)	1.8 μ V
Harmonic distortion	
(100% mod. and 400 Hz)	0.4%
Stereo separation (400 Hz)	40 db
Signal-to-noise ratio	
(100% mod.)	70 db
Selectivity	
(alternate channel)	50 db
Capture ratio (at 1 mV)	2.0 db
Spurious response rejection	
(100 M Hz)	90 db

PRICE, \$499.50 (CABINET \$24.95). FOR MORE INFORMATION, PLUS A FREE COPY OF THE FISHER HANDBOOK, WRITE FISHER RADIO CORPORATION, 11-22 45th ROAD, LONG ISLAND CITY, N. Y. 11101.



The Fisher

No ad man can do it justice.

FISHER RADIO CORPORATION, INC., 11-22 45TH ROAD, LONG ISLAND CITY, N. Y. 11101 OVERSEAS AND CANADIAN RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N. Y. 11101

Check No. 132 on Reader Service Card.

Professional Tone Controls

ARTHUR C. DAVIS and DON DAVIS

Covering the use of filters, the various applications of passive controls, and the use of level diagrams in the planning and layout of a control system.



Fig. 32. Typical filter set providing eight cutoff frequencies for the high-pass section, and eight for the low-pass section. It is capable of producing response curves like those shown in Fig. 33.

NOTE:

The first two parts of this article appeared in the February and March issues of this year. Copies may be obtained by writing to AUDIO, 134 N. 13th St., Philadelphia, Pa. 19107, enclosing 60c for each copy desired. No stamps, please.

Use of Filters

Once equalization is accomplished, consideration should then be given to the filters desired to maintain the integrity of the passband of interest to the user. A tremendous source of distortion and overload in audio systems lies in building the system to *try* to eliminate frequencies of no use to the program material actually desired. (This is not to be confused with the concept of designing very-wide-range components in the effort to minimize phase shift in the passband of interest, but refers to final total system response.

In a quality system it is foolish to feed a well designed loudspeaker high-amplitude signals below its lowest rated frequency. When there is doubt about source material (turntable rumble cut into the record, eccentric record due to misplaced center hole, and so on) a high- and low-pass filter set, in this case, at the input, saves the system from amplifying, controlling, and attempting to reproduce gross defects.

Figure 32 shows such a filter set with multiple choices of cut-off frequencies. Such filters can also be constructed as fixed type units, but are obviously not as flexible in use.

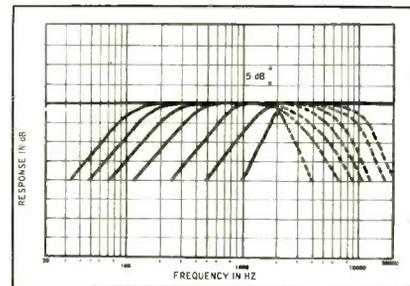


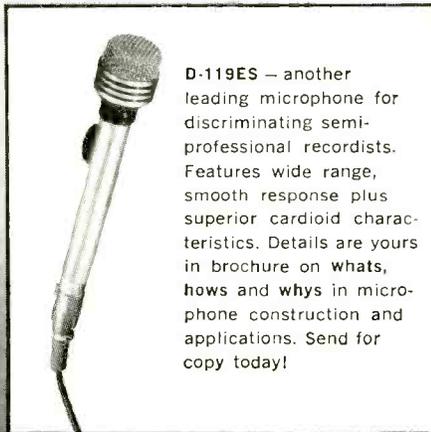
Fig. 33. Reponse curves available from the filter shown in Fig. 32. A wide variety of effects can be created with this type of filter.

Figure 33 shows the various cutoffs obtainable with different control settings. The high-pass curves are shown solid, the low-pass ones dashed. The overlap of the cut-off frequencies at each end of the spectrum allow the unit to be used as a simple form of bandpass analyzer. Here, once again, the circuit is a series of bridged-T, constant-k, passive 600-ohm networks wired to precision rotary switches in order to permit variable choices.

Filters are characterized by no insertion loss until their cut-off. F_c by definition is the point where the amplitude response has fallen 3-dB and these filters follow that convention.

AND NOW... THE NEW NORELCO D-707 MICROPHONE

MADE IN AUSTRIA BY AKG



D-119ES — another leading microphone for discriminating semi-professional recordists. Features wide range, smooth response plus superior cardioid characteristics. Details are yours in brochure on **whats, hows and whys** in microphone construction and applications. Send for copy today!

The D-707 is the latest addition to the quality line of Norelco microphones, recognized leader in the Recording, Broadcast and Entertainment Industry. ■ The D-707 is a cardioid dynamic microphone featuring strong anti-feedback characteristics. Its frequency range covers the entire audible range with an exceptionally smooth response. ■ Suitable for a variety of applications, whether it be music, vocalist or speech transmissions. ■ Particularly capable of handling high sound pressure levels without overloading or distortion, while still reproducing sound naturally. ■ Its attractive styling is based on the Norelco D-24E, the ten year old "star" of screen and television, which has brought about a revolution in microphone design. ■ The D-707 may be used directly into any high impedance input and is provided with an on-off switch. ■ Delivered with SA-11 Stand Adapter, 15' of cable and case, and attractively priced. Ask your dealer about it!

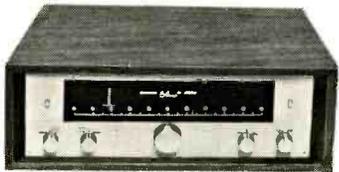
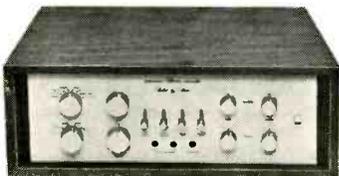
Norelco[®] PROFESSIONAL
SOUND PRODUCTS

NORTH AMERICAN PHILIPS COMPANY, INC.
Professional Products Division, 100 East 42nd St., New York, N.Y. 10017

1-67



Marantz components are too good for most people.



Are you one of the exceptions? For the most astonishing set of specifications you've ever read, write "Exceptions," Marantz, Inc., 37-04 57th St., Woodside, New York 11377, Department A-17.

marantz
A SUBSIDIARY OF SUPERSCOPE, INC.

The Marantz components illustrated, top to bottom: SLT-12 Straight-Line Tracking Playback System • Model 15 solid-state 120-watt Stereo Power Amplifier • Model 7T solid-state Stereo Pre-amplifier Console • Model 10B Stereo FM Tuner

Check No. 134 on Reader Service Card.

Summary

It is obvious that the professional audio engineer has a much wider choice of components than the home user. The components are also of higher quality and usually of far greater accuracy and re-setability. Best of all, as the years pass the old equipment isn't discarded. The basic quality components can be expanded or re-arranged to meet new requirements.

It is hoped that the dedicated sound-system designer will consider stepping up from high fidelity components to the use of professional passive-control/fixed-gain playback systems with their advantages of better performance, longer life, and lower cost. AE

Bibliography for further study.

1. "Motion Picture Sound Engineering." Research Council of the Academy of Motion Picture Arts and Sciences: D. Van Nostrand Co., Inc. 1938.
2. Frederick Emmons Terman, "Radio Engineer's Handbook." New York: McGraw-Hill Book Co., Inc. 1943. (Particularly the chapter on Circuit Theory, where the phase-area theorem is discussed.)
3. "Reference Data for Radio Engineers." 4th Edition. International Telephone and Telegraph Corp.
4. Robert W. Landee, "Electronic Designer's Handbook." New York: McGraw-Hill Book Co., Inc. 1957.
5. Howard M. Tremaine, "The Audio Cyclopeda." Indianapolis: Howard W. Sams, Co., Inc. 1959.
6. Howard M. Tremaine, and George K. Tefreau. "Attenuators, Equalizers, and Filters." Indianapolis, Ind.: Howard W. Sams, Co., Inc. 1956.
7. Howard M. Tremaine, "Passive Audio Network Design." Indianapolis: Howard W. Sams Co., Inc. 1964.
8. Julian L. Bernstein, "Audio Systems." New York: John Wiley & Sons, Inc.
9. Hendrik W. Bode, "Network Analysis and Feedback Amplifier Design." Princeton, J. J.: D. Van Nostrand Co., Inc. 1945. (Chapter XI portion on Minimum-Phase-Shift Networks, and Chapter XII, Topics in the Design of Equalizers.)
10. James Moir, "High Quality Sound Reproduction." New York: The Macmillan Co., 1958. (Contains data from paper on "Auditory Perspective" Symposium by Bell Lab. Engrs. *Electrical Engineering*, Jan. 1934.)
11. Oliver Read, "The Recording and Reproduction of Sound." Indianapolis: Howard W. Sams & Co., Inc.
12. John G. Frayne and Halley Wolfe. New York: John Wiley and Sons, Inc. 1949.

Reference to these works and the further bibliographies they contain will provide a good conceptual view of design requirements pertinent to passive attenuators, equalizers and filters.

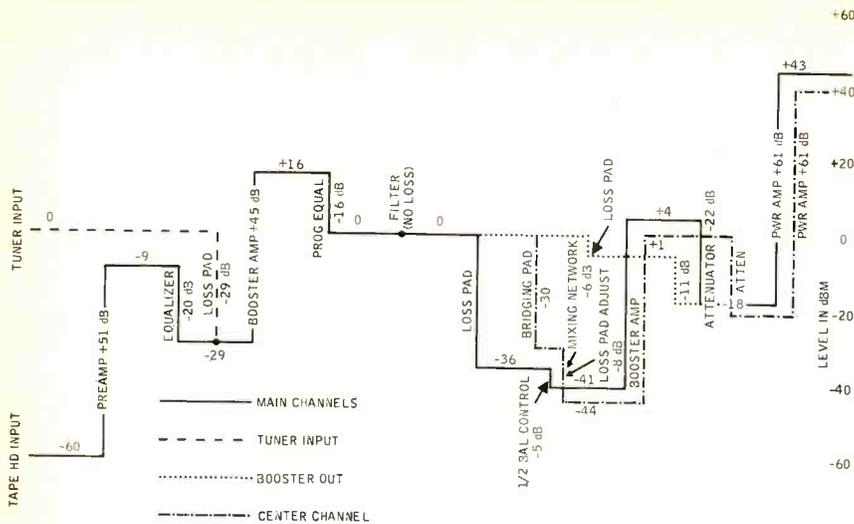


Fig. 35. Level diagram of the circuit of Fig. 34. This type of diagram gives an immediate picture of the various levels throughout the system—of greatest importance in the design.

At this point another adjustable loss pad is encountered which enables the center channel to be adjusted 3 dB lower than the two side channels. (Acoustical mixing of the two side-channel speakers provides a substantial acoustical middle-channel signal. If the physical middle-channel speaker is set to a level equal to the two side channels, its output plus the side channels gives an apparent output from the center that is too high.) The presence of adjustable loss pads in each channel allows for any gain balance desired or required under difficult room environments, or to allow different-channel gain balances to suit individual ears. Once the system is properly adjusted for a given space and use, the variable controls provide more than sufficient day-to-day and source-to-source adjustment.

Wiring & Grounding the System

Although this subject could easily fill a large book, a few suggestions may be helpful.

All wiring in audio systems of this type should be done with two-conductor shielded cable (usually with a solid shield wire in addition to the shield), and with the shield insulated. The low side of every network is carried through on one of the two conductors to the *single* system ground. All grounds are connected at the same spot. Shields are grounded at one end only and each run between components should be made with only *one* end of the shield being grounded. The other end of the shield is left *disconnected*. Even with these precautions, the wiring in such systems is relatively straightforward.

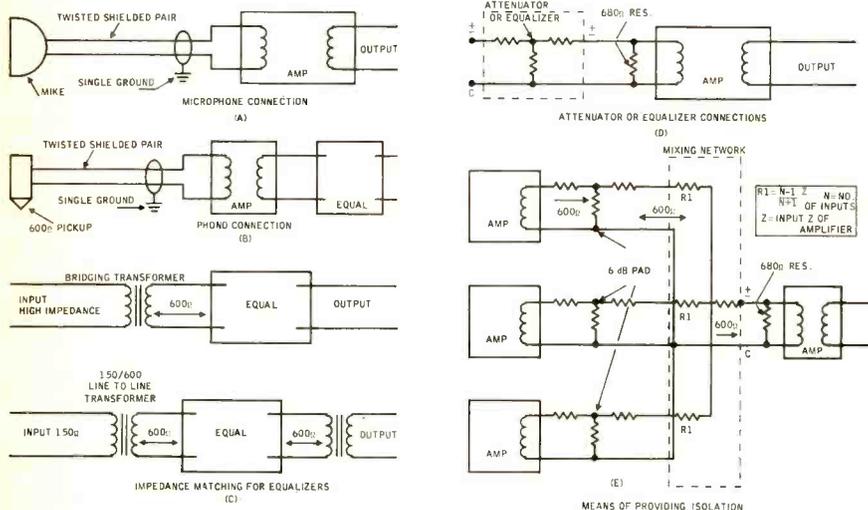


Fig. 36. Several acceptable ways of connecting passive equalizers into a system, and methods of providing isolation between circuit elements which might interact to cause response irregularities.

How to be a Hero...



With impeccable sound reproduction, flawlessly recorded — everytime. The Sony solid-state 350 offers you all the features of professional recording with its three-head design. Simply connect the Sony 350 stereo tape deck recorder with your other stereo components and you're ready to monitor as you record in full stereo or to make sound-on-sound recordings. The solid-state stereo 350 includes every feature to make your recordings medal winners. Two speeds. Vertical or horizontal operation. Stereo recording amplifiers and playback pre-amps. Dual VU meters. Binaural monitor. Frequency response 50-15,000 cps ± 2 db. S.N. ratio better than 50db. Flutter and wow under 0.15%. Handsome gold and black decor with luxurious walnut-grained low profile base. All this for less than \$199.50!

See the "Hero-making" Sony 350 at your local Sony/Superscope dealer or write for information to Sony/Superscope, Sun Valley, California, Dept. 17.



AMERICA'S FIRST CHOICE IN TAPE RECORDERS



If you want to add portability, choose the Model 350C, in a smart dark gray and satin-chrome carrying case for less than \$219.50.

Check No. 135 on Reader Service Card.



Automotive Tape Cartridge Systems

The three tape cartridges shown together to compare sizes. Note lead pencil in foreground for reference.

What about tape cartridges? How do they work and how well do they work. A serious presentation of the characteristics of each of the three types which compete in the automotive field.

For as long as tape has been available there have been dire predictions of how this recording medium would replace the disc as a carrier of music. Well, it doesn't take a keen observer to note that this has not happened yet. Reel-to-reel tape is coexisting nicely, however, but it has not been able to prove itself either as economical or as convenient to use as a long-playing disc.

Almost as long as there have been tape recordings there has been talk of placing tape into a cartridge and thus making it palatable to the "mass-market buyer" of music.

We at AUDIO have sat back as these systems have developed partly because we have felt that none of them is sonically attractive enough to warrant

the attention of the serious audio buff. It has become increasingly clear over the past twelve months that the automotive industry has succeeded where the audio sales field has failed. They have put cartridge tape players on the map. The automobile is perhaps a "natural" for a tape cartridge player. Disc players on involved gimbal mounts have not attracted the automotive accessory buyer, and car manufacturers could not market them though they have tried.

But tape in a pre-threaded carrier presents no mechanical problems to car installation. They can be made compact and d.c. operated drive mechanisms of reasonably accurate speed are not hard to design.

The tape cartridge did not start with

the car, to be sure. There have been famous (and infamous) attempts to place cartridge systems before the public. Most of these have involved the placement of reel hubs into a carrier that could, in turn, be easily inserted into a player or recorder. The broadcast industry has long been familiar with closed-loop cartridge systems that could make spot announcements and the like. In fact, one of the present day systems is an outgrowth of a broadcast machine.

This is the Fidelipac system. For professional application there are several sizes of cartridges, each holding a maximum quantity of tape—controlling the maximum playing time. Of course, broadcast versions are full-track player/recorders of sophisticated

We've looked at the other ads and now we think you ought to know about the Celestion range of high fidelity speakers



(They're British — — and you find them in all the best stately homes!)

The name Celestion may be new to you, but in the U.K. it goes back over 40 years. Celestion are both specialists and perfectionists: their speakers are used by the BBC and professional sound engineers, as well as by a vast critical listening public. Now they are to be distributed in the U.S; study the specs., compare the craftsmanship—and listen to the sound! Superb.

The Ditton 15 and Ditton 10 — a revelation in 'compacts'!



The Ditton 15 (21 x 9½ x 9¼ in)

The latest product of Celestion research—a three element, 30 watt peak, full range compact loudspeaker enclosure. This system incorporates a new Celestion design concept—the ABR (auxiliary bass radiator) giving outstanding distortion-free bass down to 30 c/s. In addition there is a long throw 8" loudspeaker plus the HF1300 Mk.2 high frequency unit. Impedance: 4 ohms. Finish: Satin walnut or oiled teak.

The Ditton 10 (12¾ x 6¾ x 8¼ in)

This represents the most advanced and sophisticated design yet seen in mini systems. The high frequency unit is developed from the HF1300 already in use by major broadcasting authorities, including the BBC, and the 5" long throw bass unit gives solid lows down to 35 c/s. Power handling capacity: 20 watt peak. Impedance: 3-4 ohms and 15-16 ohms. Finish: Satin walnut or oiled teak.

Co-axial loudspeakers

A full range of co-axials providing truly professional quality. Power handling capacities to 40 watt peak. Standard impedance: 3-4 ohms and 15-16 ohms.



CX2012
co-axial

High Frequency and Bass Units

HF1300 Mk. 2 High Frequency Unit: Precision built high frequency unit of professional performance.



Separate Bass Units with cabinet designs are available.

also:

The Power Range of Guitar and Organ loudspeakers—for the top British pop sound. 12", 15" and 18" speakers as used by leading pop groups.

*Something special?
We will make to your design requirements.*

We are looking for area agents throughout the U.S.A. If you would like to add the superb Celestion range of loudspeakers to your high fidelity lines, get in touch with DENIS BOND, our General Sales Manager.

Celestion

loudspeakers for the perfectionist

Rola Celestion Ltd., Ferry Works, Thames Ditton, Surrey, England. Cables: Voicecoil, Thames Ditton.

Please send me full details of the Celestion high fidelity and power ranges of loudspeakers.

NAME _____

ADDRESS _____

design, wide-band response, highly accurate and repeatable playing time, and outstanding durability.

It was not much of a trick to standardize on one size of cartridge (the smallest available) and convert the players to four-track operation in stereo. These Fidelipac cartridges are re-entrant type systems. That is, the tape is on a single hub; it is caused to move past the heads by pulling from the *inside* of the hub and placing it back on the *outside* of the same reel of tape. *Figure 1* illustrates a current Fidelipac-tape cartridge.

This sort of cartridge can be played only in one direction. While it can be played at fairly high speed—thus making it possible to have a fast-forward mode—you cannot play backwards. It just is not possible to pull from the edge of the tape reel and replace tape at the hub end. This necessitates the obvious need to place the two pairs of stereo channels in the same direction. Since we are dealing with an endless loop of tape some method of switching the head scanning from one set to another must be available. In practice this is not too difficult to achieve and has not been a problem of tape cartridges. What is a problem is finding a selection that is buried somewhere within an endless tape that has no identifiable beginning or end. *Figure 2* shows the track configuration that is standard on these tapes.

The real boom in tape cartridge players did not come until the introduction of the Lear-Jet system. With the cooperative efforts of Lear-Jet (which makes personal jet aircraft as a side interest), Ford Motor Company (which makes automobiles), and RCA (which makes practically everything the other two do not), the Lear-Jet system took off. Basically, this is also a re-entrant cartridge similar in many respects, including size, to the

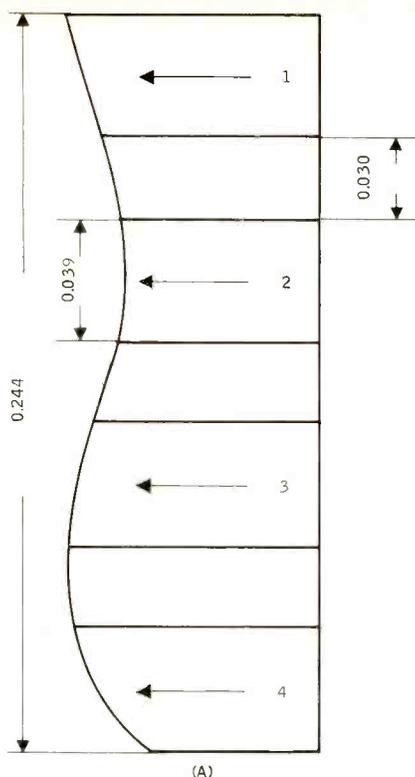


Fig. 2. Track dimensions and direction of tape travel for the Fidelipac four-track cartridge used in automobile tape playback systems.

Fidelipac system. It differs, however, in two important areas. First, as *Fig. 3* indicates, it contains a built-in idler and second—and by far more important—it has eight tracks of information side-by-side on the tape. Thus it offers four pairs of stereo programs—just double what Fidelipac can do on the same tape. Of course, the tracks are squeezed closer together making head design and mounting considerations that much tougher. In *Fig. 4* can be seen the track layout on these cartridges.

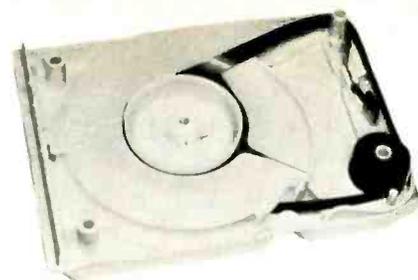


Fig. 3. The Lear-Jet type of cartridge, showing the built-in idler, which contributes to smooth operation. This is an eight-track cartridge, using conventional 1/4-in. tape.

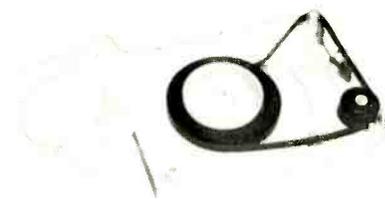


Fig. 4. Same cartridge as shown in *Fig.*, except with tape guiding disc removed.

Track Layout Compared

Figures 2 and *5* compare standard four- and eight-track configurations. Note that in stereo performance on four-track tapes, tracks one and three comprise one stereo pair while two and four are the other. With the eight-track tapes it gets a bit tricky. Tracks one and five, two and six, three and seven, and four and eight are the stereo pairs.

With such close track proximity, crosstalk can become a serious problem. But careful attention to detail can hold separation between channels to 35 dB according to Alfred E. Dusey and Robert A. Wolf of Motorola writing in the January *Journal of the Audio Engineering Society*. Low frequencies are poorer in this respect, of course, but separation can still be held to 30 dB.

Environmental Conditions

One does not often think in terms of environment for a tape player but when one considers the atmosphere that can exist in a car quite a wide range must be accommodated. "The storage temperatures encountered in automobiles in the continental United States range from -40°F to $+185^{\circ}\text{F}$. Automotive radios (and tape cartridge systems—Ed.) must withstand these conditions, must recover, and must operate over a -20°F to $+140^{\circ}\text{F}$ range.

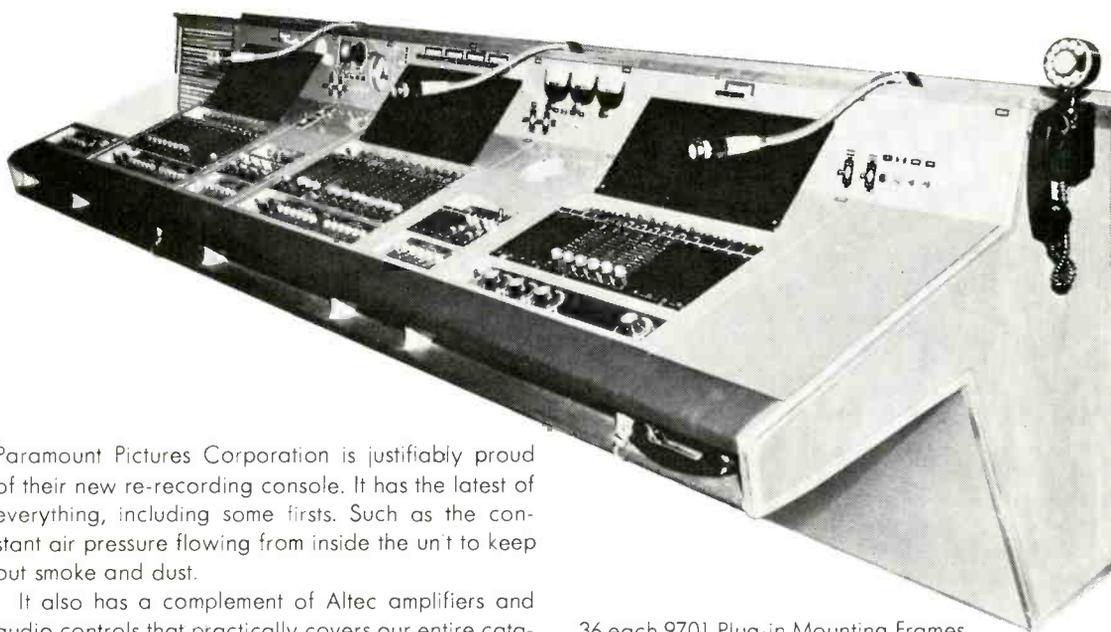
"Automotive electronic equipment must withstand 40 g impact, 5 g vibration, and operate well during 1 g vibration. In addition, the equipment must



Fig. 1. The Fidelipac tape cartridge with cover removed.

Three months of competitive 'in use' tests is the reason Paramount chose Altec Audio Controls for their new solid-state console.

Good Reason.



Paramount Pictures Corporation is justifiably proud of their new re-recording console. It has the latest of everything, including some firsts. Such as the constant air pressure flowing from inside the unit to keep out smoke and dust.

It also has a complement of Altec amplifiers and audio controls that practically covers our entire catalog. With good reason. Bruce Denney, Paramount's Assistant Sound Department Head, took three months to test competitive products under actual use. The end result is rewarding.

Here's the list of Altec products used:

- 36 each SM8272-01-GG Straight Line Mixers
- 36 each 9611 Escutcheon Plates
- 4 each RA8400-01 Unbalanced Calibrated Attenuators
- 30 each 9470A Preamplifiers
- 5 each 9550A Power Supplies
- 30 each 9850A Trays
- 5 each 9852A Trays
- 6 each 9800A Rack Mounting Frames

- 36 each 9701 Plug-in Mounting Frames
- 4 each 7160 VU Meters
- 1 each 9060A Microphone Equalizer
- 5 each 9061A Program Equalizers
- 7 each 9073A Graphic Equalizers
- 6 each 9069A Variable High Pass Filters
- 2 each 9068B Variable Low Pass Filters
- 4 each 9066 Fixed Filters
- 60 each LP8004-00 Fixed Loss Pads
- Monitoring and playback speakers:
- 3 each A4X "Voice of the Theatre"® Systems
- 1 each custom monitor with A7-500 system components

Our components were supplied by California Sound Products, Inc., an Authorized Altec Distributor. There's an Altec Distributor in your area who would be happy to discuss your custom-console needs with you. Give him a call, or write Dept. AD-5 for our complete Audio Controls catalog. There are lots of good reasons to do it now.

A Division of **ALTEC** Ling Altec, Inc.
Anaheim, California 92803



operate over humidity ranges up to 95 per cent relative, and d.c. supplies of 11 to 16 volts. It must not be affected by the interference generated by the electrical systems of the vehicle." This is excerpted from a discourse on adapting tape to the automotive environment, written by John P. King of the Ford Motor Company's Radio Engineering Department, in the *AES Journal*.

The Question of Friction

Both the Fidelipac and Lear Jet cartridges work by pulling the tape out from the center hub. This creates friction problems that are different from those encountered in reel-to-reel operation. Now there is a strong *sideways* pull across two surfaces of tape as it is withdrawn from the hub. A speck of dirt introduced on the tape could scratch the emulsion surface during this withdrawal. So it can be seen that cleanliness is vital. Cartridge end covers are supplied but we must wonder how often they will be used, particularly in the less-than-clean conditions that occur in the usual family car.

From the *AES Journal's* report on cartridge systems, "Friction within the tape loop is all-important for correct operation of the cartridge. Excessive friction can cause speed variations and ultimate jamming or seizure of the loop along its path. Insufficient friction can cause similar problems by preventing transmission of rotational energy from the center of the slack loop to its outer periphery, thus resulting in a lack of tape-up tension at the downstream side of the operating loop. With proper design of tape and cartridge this seemingly paradoxical situation can be resolved, so that the take-up function will proceed smoothly without inhibiting supply. . . .

"The action whereby the tape is continually extracted from between a neighboring inner turn and the hub is perhaps the most severe mechanical abuse to which the tape is subjected anywhere in the loop. The geometry of extraction is most difficult to analyze or optimize, but experienced cartridge designers seem to have developed a tape path imposing the least possible torture on the tape. The hub-flange combination is driven by the act of tape removal, the tape driving the hub as a belt drives a pulley. Thus, the outside surface of the hub moves at a linear velocity equal (except for slippage) to that of the tape; the flange, fastened to the hub and moving at the same rotational velocity, has linear speeds at any distance from the center of rotation depending on the radius at that point. For full (400-

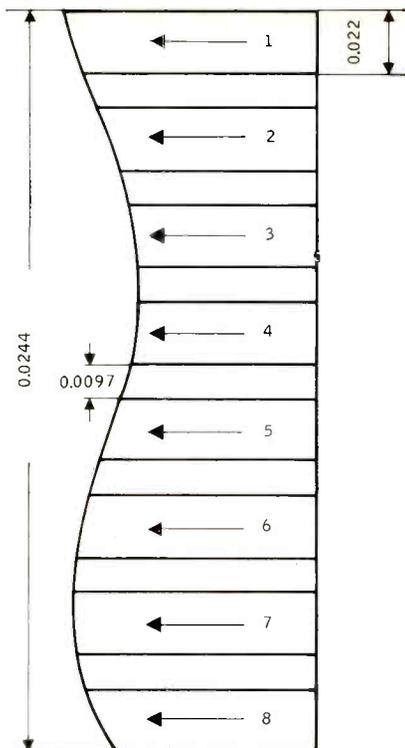


Fig. 5. Arrangement and dimensions of tracks on the Lear-Jet type of cartridge. Note that all tracks travel in the same direction, since the cartridge can not be turned over, just as in the Fidelipac type.

foot) cartridges of the type considered here, the ratio of linear velocity of the platter (at a radius of about 1¾ in.) to that of outer turns of tape is about 2 to 1. . . .

"The force of friction between tape edges and the face of the flange is the means by which the rotational velocity of the flange is imparted to the slack loop, where it provides most of the initial take-up force. The fact that the flange is overdriven with respect to tape velocity also results in a significant force which tends to separate the turns of the tape pack. This force, of course, is also transmitted to the tape from the flange by means of tape-edge friction.

"Any appreciable frictional drag on the tape along its path from the pressure roll to the outer periphery of the slack loop tends to inhibit the take-up function. It is also reflected into the slack loop, where it appears as a part of the back tension at the input side of the capstan.

"From these considerations it is readily recognized that the cartridge and tape function together intimately as a system, and that it would be foolish to undertake the design of one without full consideration of the other." Raymond C. Smith and Peter J. Vogelgesang of 3M.

These considerations are, of course, undertaken. However, frictional problems and the attendant flutter and wear do occur in re-entrant cartridges. Their minimization does not obviate the fact that the problem exists. It should be pointed out that while these cartridges do not appeal to the audio buff as a medium of superior performance, they are attractive to and sufficiently durable for the automobile owner seeking programmed music on the highway.

We have avoided any discussion of frequency response simply because these cartridges operate at 3¾ ips. and it has already been shown that this speed is entirely satisfactory for wide-band reproduction of music.

Philips

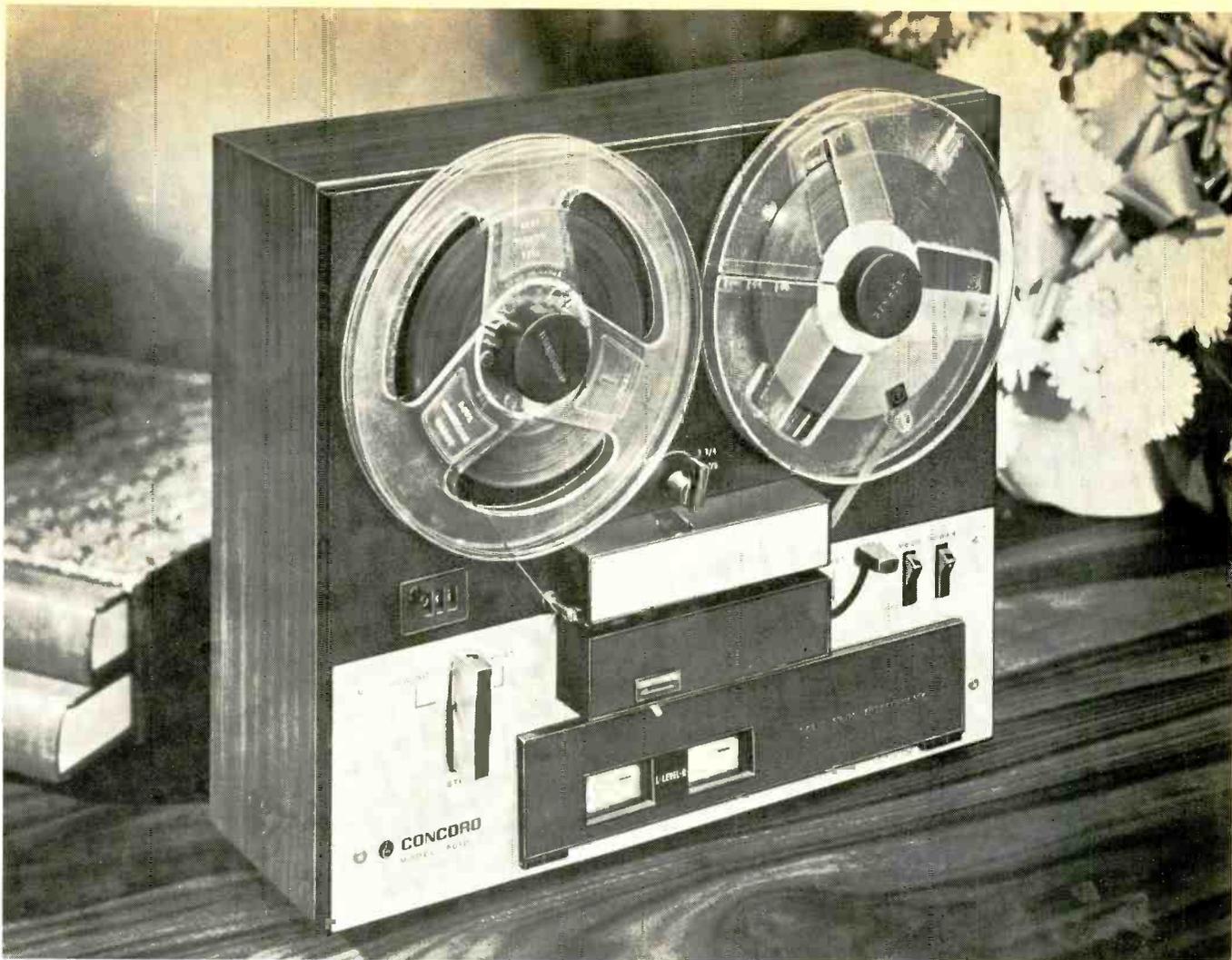
The Philips system, available here under the US logo, Norelco, and a number of licensed manufacturers, differs from the two just discussed in a number of ways.

First, it is a reel-to-reel cartridge. Second, it eschews the usual ¼ in. tape stock to use a tape width of 0.15 in. Third, it operates a speed of 1⅞ ips. There are other differences to be discussed later.

In a reel-to-reel cartridge you can place the hubs closer together if you eliminate the reel flanges. RCA did this in their earlier cartridge, Philips has done the same. Fig. 6 shows the Philips unit (they call it a "cassette" as a distinguishing term) in relationship to the others. As can be seen, it is much smaller. So much so that four cassettes will fit into the plastic carton designed to hold one Lear-Jet unit.

Reel-to-reel operation offers the obvious advantage of fast-forward and rewind modes. This leads naturally to a system that lends itself to recording operation as well as the playback of commercially-recorded tapes. (This publication does not use the redundant term—*pre-recorded*. Something is either recorded or it is not recorded, hence blank.)

Figure 7 shows the track configurations used on these cassettes. Note the fact that tracks one and two are one stereo pair, while three and four are the other. The result is that a *mono* half-track player will scan both stereo channels providing an effective mono signal. (We have not experimented with this as yet, but we still remember the early days of two-track stereo. As often as not the two channels were out of phase with each other resulting in gross distortion when they were scanned by a full-track head. Whether this problem exists at all remains to be seen.)



News! Concord's first tape deck gives you "TP" ...new Total Performance superiority

Now from Concord, one of the three leaders in the audio and video tape recorder industry, the first Concord Tape Deck. Whether you're getting your first tape deck or stepping up, get acquainted with the new Concord Model 501D. It's a revelation.

Here, for under \$170, features you'd expect only at a much higher price. 4-track, 3-speed operation... smooth, balanced tape transport with automatic shut-off... Trans-A-Track recording... cue lever for professional editing... many others. Yet, features tell only part of the story.

The big difference with Concord is compatible design. Precision design of every component for peak per-

formance individually *and* in conjunction with all other components... for new *Total Performance* superiority. This is the hidden feature that assures outstanding performance combined with dependable, trouble-free operation in all Concord products... and now in the new Concord 501D Tape Deck.

You can't see Concord compatible designing... you have to experience it. Feel free to write for literature, of course... but we urge you to have your Concord dealer demonstrate the Concord 501D Tape Deck for you. Today. That's the way to *know* "TP" can double your enjoyment and satisfaction.

Specifications ——— Frequency Response: 30-18,000 cps. Wow & Flutter: .17% @ 7½ ips., .22% @ 3¾ ips. Three Tape Speeds: 7½, 3¾, 1½ ips. Signal to Noise Ratio: Better than 50 db. Level Indicator: Two VU Meters. Input Provisions: Low impedance Microphone, high impedance line. Output Provisions: Line output. Reel Capacity: Up to 7". Horizontal/Vertical Operation: Rubber-footed brackets for vertical operation included. Dimensions and Weight: 14⅞" W x 12¼" H x 4¾" D. 20 lbs.

The Signature of Quality

CONCORD
ELECTRONICS CORP.

AUDIO TAPE RECORDERS
VIDEO TAPE RECORDERS
CLOSED CIRCUIT TELEVISION
COMMUNICATIONS PRODUCTS

1935 ARMACOST AVENUE • LOS ANGELES, CALIF. 90025

Check No. 138 on Reader Service Card.

It becomes obvious that when you reduce the width of the tape and thus reduce the width of each track you increase the signal-to-noise ratio and you increase the tendency to crosstalk from one channel to the next. If you will recheck Fig. 5 you will see that the track width and distance between tracks on the cassette tapes is similar to the configuration of the eight-track cartridge tapes. There is one important difference, however. On the eight-track tape the adjacent tracks carry different information; any audible crosstalk (and 30 dB down is audible) will be highly objectionable, while the four-track Philips tape only serves to reduce stereo separation somewhat. And 30 dB of stereo separation, even the 20 dB claimed to exist at 200 Hz, is quite good.



Fig. 6. The Philips cassette with cover removed. This is a 4-track cartridge, using tape 0.15 in. wide in a reel-to-reel configuration, permitting play in either direction.

The Philips system seems to be gathering force in home-type and portable equipment while the two cartridge systems move forth in automobiles. Certainly it is our feeling that the cassette with its record facility offers features that the re-entrant cartridge does not.

Recorded Music Tapes

RCA sparked the cartridge wars with their endorsement of the Lear-Jet system (while in no way abandoning their own system which they still promote). Most of the other record manufacturers have followed suit with eight-track cartridges. All along there have been a smattering of Fidelipac cartridges, the amount grows daily. A recent announcement, in fact, states that record giant Columbia is releasing (with caution) some four-track cartridges. (They have been releasing eight-track cartridges.)

The entry of these divergent systems has created a unique packaging arrangement for the record companies. While the major companies are their

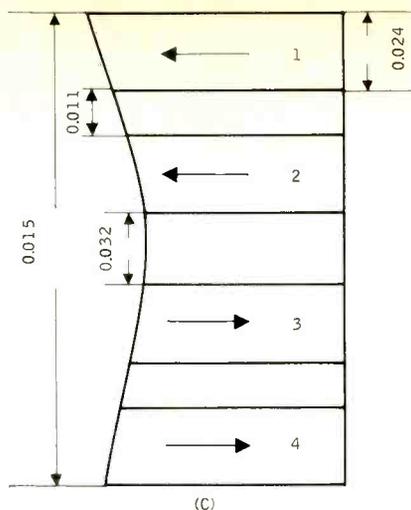


Fig. 7. Track dimensions and direction of travel in the Philips-type cassette. Note that tracks 1 and 2 constitute the right and left channels in one direction, and tracks 3 and 4 in the other. Thus a mono signal can be obtained by using a head which scans two adjacent tracks simultaneously.

own disc manufacturers and even the minor companies will do their own mastering, the tape-cartridge field has spawned a number of independent cartridge tape duplicators. Operating on tape masters supplied by the record companies they process the cartridges and are active in their actual distribution. One of the largest is Ampex, which spews out any number of tapes for any number of companies. But they are by no means alone.

The result has been a less identifiable (by sonic characteristics) product. Of course, the import of this to the consumer is one that the consumer must decide for himself. Another thing he must determine on his own is which of the cartridge systems is the right one for him. (Perhaps none of them is.) Obviously if the record companies cannot decide which system to back, how can the consumer? We should mention that compatible stereo/mono commercially recorded tapes are beginning to appear in cassette form. Mercury Records, the U.S. outlet for Philips, is in the forefront but others are joining in.

Each of the systems has its virtues and vices. Each offers sufficient playing time to eliminate that as a factor. The eight-track cartridge will offer twice that of its four-track brother (up to 400 feet or $\frac{2}{3}$ hour \times 4 or 2). This is continuous play in one direction on a machine that will automatically switch tracks.

The cassette, however, offers a maximum of 60 or 90 minutes of play dependent on which of two types you buy. The differences are in tape thick-

ness. But this time is split because the cassette must be flipped over to play the second track(s) as with any reel-to-reel machine. In time there may be automatic reverse play and record units just as there are with conventional reel-to-reel machines but this is not in the offing now.

It might be inferred that there is no compatibility between systems and this is not far from the truth. It is possible to design Fidelipac/Lear Jet compatible players (and some have appeared.)

Certainly the engineering problems are not formidable since the cartridges are so close in size and design.

But the Philips cassette stands quite alone. It is not interchangeable with any other system and is not likely to stray from that position.

More Confusion

We have only touched on the three systems that seem to have captured the public's fancy—fickle though that is. We don't mean to imply that these are the only systems in existence. The RCA reel-to-reel cartridge using standard tape at $3\frac{3}{4}$ ips and four-tracks is still at hand. So is a 3M system including players that automatically change cartridges. Then there is an Orrtronics system which uses a cartridge much like the Fidelipac unit except that the tape travels at right angles to the hub, while it is traversing the play head. While there are legitimate engineering claims to support this system, we doubt that it will receive general acceptance. Perhaps not because it is (or isn't) better, rather because it is too late.

The battle lines have been drawn. Fidelipac four-track is on one side grappling with Lear-Jet's eight-track system. Philips' miniature cassette sits on the other side fighting with both of them. Who will win?

Prognostications are dangerous things. They are always better made with the advantage of hindsight, something we have not had as yet. But we can make the estimate that this battle will go on for some time to come and we do feel that it is actually drawn as indicated so that the ultimate winners will prove to be one of the two cartridge systems and the cassette system. For each offers specific advantages that the other cannot. And each can be directed at different markets. We see the cassette appealing to the audio buff that wants to do his own recording while the cartridge remains a medium for commercially recorded music. Neither, in our estimation offers a serious threat to the disc as a purveyor of quality music recording. We may eat these words someday, but the table is not yet set. Æ



Fire-Tortured CM Amplifiers Prove Performance, Reliability

Music lovers and audiophiles recognize that two factors are of utmost importance in selecting an amplifier.

First, it must reproduce every possible musical form with absolute accuracy.

Second, it must be as reliable as modern science will permit. An amplifier in the repair shop does not provide much musical enjoyment.

Among the most knowledgeable in audio matters, CM Laboratories control centers and amplifiers are recognized as having both the finest performance and the highest reliability consistent with the present state of the art.

RECONFIRMED

This conviction was reconfirmed recently in a

disastrous fire that swept the studio of recording engineer Reice Hamel in New York City.

The quality of CM's performance is attested to by the fact that professionals, like Mr. Hamel, choose CM amplifiers to monitor their precious tape masters of never-to-be-repeated performances by top stars.

CM's reliability was demonstrated by the fact that all five of the amplifiers involved were simply plugged in, with no repairs of any kind, after the fire and performed to their original specifications.

IN YOUR LIVING ROOM

If you are uncompromising about the kind of audio equipment you install in your living room, you should send for literature on the CM line.

 **LABORATORIES**
575 Hope Street, Springdale, Connecticut

For Performance As High As The State Of The Art Permits

Check No. 139 on Reader Service Card.

sound & sight

HAROLD D. WEILER

Last month's SOUND AND SIGHT described the method of determining the horizontal resolution of equipment employed in video recording and closed-circuit television. We continue with the use of a test pattern, such as is illustrated in Fig. 1, to compare, adjust and determine the over-all performance of equipment.

The horizontal resolution of a video camera is also affected by its operating temperature and the line-voltage variations encountered in normal use. The variation in horizontal resolution of a high-quality camera, should not exceed 20-30 lines when it is operated within the temperature range provided in the specifications, usually -10°C to $+45^{\circ}\text{C}$, or with an ac input-voltage range of 105 to 125 volts.

Before leaving the subject of picture resolution we might add that it is also dependent to a certain degree upon the random noise level of the system. Random noise is a term generally employed to describe a natural phenomenon such as the thermal noise created in resistors, capacitors, transistors, or even the wire or printed circuits employed. This random noise, when excessive, has the effect of degrading the quality of the televised or recorded images.

A small amount of random noise, which can be seen on the monitor when a test pattern is employed, gives the gray background the appearance of movement. It is not normally objectionable since it is rarely noticeable in the average televised picture. When the noise level is higher, the image of the test pattern acquires a noticeable graininess which may best be described as a pepper and salt effect. Noise at this level and higher can mask finer detail and result in an apparent loss of resolution. When the random noise level is excessively high it creates the impression that the scene viewed, in our case the test pattern, is being ob-

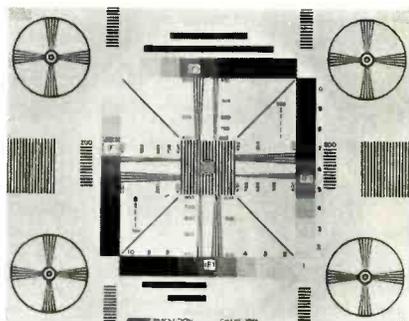


Fig. 1

served through falling snow. This, incidentally, is the reason this phenomenon is known professionally as "snow."

The four bars at the outside edges of the central resolution wedges are called gray scales and reveal a camera's ability to respond to different shades between black and white. This ability is extremely important since it helps bring out the detail in a picture and creates the illusion of depth and substance in the two-dimensional presentation. The gray scales are employed to check or adjust equipment for proper contrast between the black-and-white picture elements and the shades of gray between.

As illustrated at "F," in Fig. 1, each bar is composed of ten squares which cover a contrast range of approximately thirty to one, varying from maximum white to one-thirtieth of this value or maximum black. These squares are arranged in logarithmically decreasing values of reflectance so that the difference factor between adjacent squares is approximately 0.16.

When a video signal displayed on a monitor has the correct distribution of grays it is possible to distinguish all of the ten squares in the gray scales. Loss of distinction among the individual squares is an indication that the gain of

the over-all system is not constant over the full range of input voltages, or that the camera or monitor is not properly set-up, or that the pattern illumination is insufficient.

When the contrast and brightness controls of the monitor are improperly adjusted, i.e., excessive brightness and/or insufficient contrast, the shading squares will appear faded or "washed out." If, on the other hand, these controls are adjusted so that the contrast control is at too high a setting and/or the brightness control is at too low a setting, the shading squares will be obscured and predominantly black. The correct settings of the monitor controls are those which provide the maximum number of individually distinguishable squares on the gray scales.

Incorrect setting of the camera controls will also affect the gray scale rendition. Excessive target voltage will create an image in which the shading squares are predominantly black, whereas insufficient target voltage provides a "washed-out" faded picture with the darkest shade discernable only a medium gray. Insufficient illumination or too small a lens opening, (too high a lens *f*-stop number) will also cause the image to appear "washed out."

The over-all shading of the televised or recorded images should be even. This is most easily determined by observation of the background of the test pattern; it should be an even gray from top to bottom and from one side to the other. The same number of steps should be discernable on all four gray scales. Shading errors will become even more noticeable if the contrast control on the monitor is increased beyond its normal setting.

The shading of the image on the monitor should be uniform when the test pattern is evenly illuminated. Uneven shading under these circumstances is most commonly caused by misadjustment of the vidicon beam alignment—poor alignment will cause uneven shading.

The simplest method of determining correct beam alignment is to move the camera focus control back and forth to either side of its in-focus position. If the picture appears to rotate about its center the beam alignment is correct. When the picture does not appear to rotate about its center, readjustment of the alignment magnets, usually located behind the deflection yoke and around the vidicon tube, is indicated.

Broadcasters and professionals setting up video equipment for critical applications employ a light box such as the one illustrated in Fig. 2 which is manufactured by D-Vel Research Labs of Bedford Hills, New York. The light box is used with photographic test slides to ensure even illumination and obtain better rendition of the gray scales than is possible with a printed pattern. The next article of this series will describe the balance of the tests which may be made with a test pattern and explain the advantages of employing a light box for checking and analyzing video equipment.

Æ

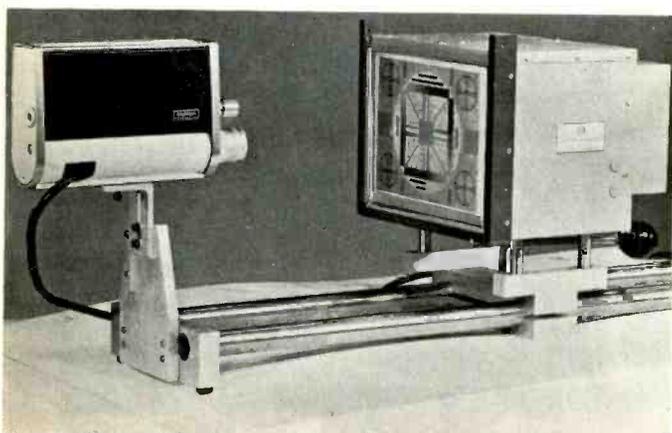


Fig. 2

Congratulations to the oldest publication in the field

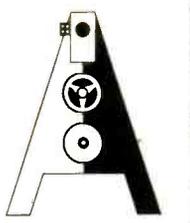
As one communicator to another, we'd like to say well done! For the past twenty years, *Audio Magazine* has played a vital role in communicating the latest advances in sound to its readers. During this same period Sony has been busy innovating audio and video products that have contributed to better communication. Recently Sony has added another dimension to communication: *sight*, as well as sound. The Sony Videocorder. The first quality video tape recorder in a price range that makes it practical for broad application in business, education, science and in the home. Watch the pages of *Audio*, over the next decade. You'll be hearing more about developments in video tape recording and high fidelity from Sony Corporation of America, Long Island City, N.Y. 11101

from the manufacturer of the newest product



SONY®

Check No. 140 on Reader Service Card.



Equipment Profile

Next Month:

Pioneer Stereo Receiver

Pioneer Turntable

Leak Mini-Sandwich Speaker System

Shure Microphone Mixer

HEATHKIT AR-15 SOLID-STATE RECEIVER

Over the past years, we have built and tested many kit amplifiers, tuners, and test equipment, but this is the first receiver to come under our scrutiny, and we might add that it comes close to incorporating the best tuner we have ever encountered, as well as coming close to being the best amplifier we have so far encountered in the area of solid-state

equipment. Let it be understood that we do not judge equipment on the basis of whether it is solid-state or tubed, but solely on its performance. Granted that there are a few amplifiers of the third generation of solid-state design in which distortion has been below .05 per cent. and which are demonstrably better than most tube equipment (in spite of the fact

that some tube equipment checks out at under 0.1 per cent) but they are in the Rolls-Royce category.

We have been satisfied with solid-state amplifiers which measure around 1 per cent THD at full output; but one of the problems of some of the solid-state equipment has been that its IM distortion at normal listening levels has been relatively high, even though the same IM distortion figures appeared at the maximum rated output. Tubed equipment, in general, reached a certain IM distortion figure at maximum output, but was considerably lower at normal levels. All of this discourse is intended to provide a background of what we have found heretofore.

The Heathkit AR-15 must certainly be listed as a third-generation receiver. While we do not normally report on a kit unless we have built it ourselves (on the theory that if the instructions are inadequate, the kit can not be built and aligned by the novice) we do so this time because the unit is so new that we wanted to tell readers about it as soon as possible, and having built color TV sets and sophisticated Lab-type scopes from Heath instructions, we are confident that we could also build this receiver satisfactorily.

The transistor complement of the AR-15 is astonishing in itself—with its total of 71 transistors, of which three are



Fig. 1. Heathkit AR-15 solid-state receiver. When power is off, the upper portion of the panel is black, and dial scale, meters, and legends are not visible.

SHURE AUDIO PREAMPLIFIERS

SOLVE ALL SORTS OF HI-FI PROBLEMS



STEREO LINE PREAMPLIFIER
MODEL M60

This is a general-purpose, non-equalized, vacuum tube pre-amplifier. It provides additional gain for use with magnetic stereo phono cartridges, microphones and tape recorder outputs. In high fidelity demonstration and listening rooms for example, it is ideal for connecting each demonstration turntable to the master audio circuit board without loss of high frequencies due to "line loss" in long cable runs (up to 50 feet). And there's far less danger that the lines will pick up electrostatic hum. Response is flat (within ± 1 db) from 30 to 80,000 Hz!

SPECIFICATIONS:

GAIN: 17 db (7 to 1) 35 mv. output for 5 mv. input. Circuit change information provided to give one-third and two-thirds output.
IMPEDANCE: Input—47,000 ohms. Output—5,000 ohms.
HUM & NOISE: 64 db below rated output.
DIMENSIONS: Length $6\frac{1}{16}$ " ; Width $2\frac{1}{4}$ " ; Height $3\frac{3}{8}$ ".
NET WEIGHT: 2 lbs.
PRICE: \$19.95



TRANSISTORIZED STEREO PREAMPLIFIER MODEL M61†

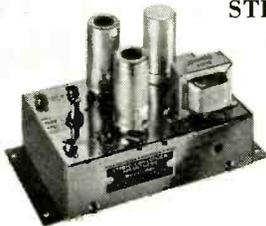
Compact, rugged, transistorized unit with choice of AC line or battery power supply. Slide-selector switch offers three equalization inputs.

- (1) "phono" for conversion of ceramic phono inputs for use with magnetic cartridges;
- (2) "tape" for equalization of tape playback directly from tape head through hi-fi control pre-amplifier; and
- (3) "microphone" for flat amplification wherever a boost in microphone output is required.

SPECIFICATIONS:

GAIN: Phono: 46 db (5 mv input produces 1.0 v. output)
 Tape: 41 db (2 mv input produces 0.225 v. output)
 Microphone: 63 db (2 mv input produces 2.8 v. output)
FREQUENCY RESPONSE: ± 2.5 db of each function's nominal characteristic from 20 Hz to 15,000 Hz
EQUALIZATION: Phono: RIAA equalization (with additional treble boost of approximately 3 db at 10,000 Hz to complement most magnetic cartridges).
 Tape: NAB equalization.
 Microphone: Flat response. ± 3 db from 20 to 15,000 Hz
INPUT IMPEDANCE: Phono and tape: approx. 50,000 ohms at 1,000 Hz
 Microphone: Approx. 20,000 ohms at 1,000 Hz
OUTPUT IMPEDANCE: Low output impedance (less than 1,000 ohms at 10,000 Hz for phono and tape functions).
CHANNEL SEPARATION: 50 db or better at 1,000 Hz.
CHANNEL BALANCE: 2 db at 1,000 Hz (for phono and tape functions).
HUM AND NOISE: 76 db below 10 millivolt input, unweighted.
DIMENSIONS: Length $5\frac{1}{4}$ " ; Width $4\frac{7}{8}$ " ; Height $2\frac{5}{16}$ ".
PRICE: Model M61-1 (for 105-125 v. AC line) \$27.50
 Model M61-3 (30 v. Battery, included) \$26.50

STEREO CONVERSION PREAMPLIFIER MODEL M65 †



Provides same features (except for battery power supply) as Model M61. Utilizes vacuum tubes. Provides equalization with amplification for conversion of ceramic phono inputs for magnetic cartridges. Allows smoother, more natural sound. As an added feature, 60 db of amplification without equalization is also provided. Permits the use of a magnetic cartridge with "package" factory-made "high fidelity" consoles supplied with a ceramic cartridge. Also provides pre-amplification and equalization functions for other sources (phono, tape, microphone).

SPECIFICATIONS:

GAIN: Phono: 44 db (5 mv input produces .76 v. output).
 Special: 45 db (5 mv produces .88 v. output).
 Tape: 40 db (5 mv input produces .50 v. output).
 Microphone: 63 db (2 mv input produces 2.8 v. output).
Frequency Response: ± 1.5 db of each function's nominal characteristic from 25 Hz to 15,000 Hz.
EQUALIZATION: Phono: RIAA equalization (with additional treble boost of approximately 3 db at 10,000 Hz to complement the high frequency characteristic of most magnetic cartridges).
 Special: A Shure-developed magnetic phono equalization circuit for use with high impedance amplifiers normally used with ceramic phono cartridges.
 Tape: NAB equalization.
 Microphone: Flat response. ± 3 db from 20 to 12,000 Hz.
INPUT IMPEDANCE: 47,000 ohms (all functions).
OUTPUT IMPEDANCE: Low output impedance (less than 5,000 ohms at 10,000 Hz for phono, special and tape functions).
CHANNEL SEPARATION: 40 db.
CHANNEL BALANCE: ± 1 db at 1,000 Hz.
HUM AND NOISE: 50 db below rated output.
DIMENSIONS: Length $6\frac{7}{8}$ " ; Width $3\frac{15}{16}$ " ; Height $3\frac{1}{4}$ ".
PRICE: \$24.00

† Also available in 110-220 V. A.C., 50-60 cycle version.

SHURE BROTHERS, INCORPORATED
222 Hartrey Avenue, Evanston, Illinois 60204

Check No. 142 on Reader Service Card.

FET's. The FM front end (factory assembled) employs the FET's and one additional transistor; the AM tuner employs three transistors and one diode; the FM i.f. uses ten transistors, two integrated circuits (each comprising ten junctions), and seven diodes. The phono preamp uses four transistors, the control amplifier ten, the multiplex section 20, plus 16 diodes, each power amplifier requires 7 transistors and 5 diodes, and the power supply uses 4 transistors and 9 diodes to provide four regulated outputs of 50, 27, 15, and 12 volts, as well as the 80-volt unregulated output for the power amplifier stages. In addition to all of this, the FM i.f. section employs two crystal filters to provide the desirable steep-sided response curve which results in an alternate-channel selectivity of better than 80 dB, although specs claim only 70 (as a matter of fact, the entire unit performs considerably better than the published specifications).

Referring to the external appearance as shown in Fig. 1, the large knob at the left is the selector switch with five positions—PHONO, AM, FM, TAPE, and AUX. When the power is off, the panel is completely black—with power on, the legends for the switches, as well as the dial scale and the two meters, are visible, illuminated from behind. The selector switch positions are illuminated in green except for the one in use, which is white. Four small knobs are for bass tone control, treble tone control, balance, and volume. The treble-tone knob pulls out to ensure flat response, completely bypassing the Baxendall-type tone-control stage. Six white rocker switches control the functions—mono or stereo, tape monitor, normal or stereo-only, noise filter, contour, and speakers. A seventh rocker switch, black, controls the a.c. line. Two headphone jacks complete the lower portion of the front panel. The large knob at the upper right is the tuning control, and above it are the illuminated tuning meter and the signal-strength meter—the latter being switchable during the construction to serve as either a volt- or ohm-meter. The small panel at the lower left tilts out to provide access to three knobs—stereo phase, squelch, and stereo threshold, and ten level-set controls, screwdriver adjusted. These permit adjustment of levels for all five inputs—separately for left and right channels. In the presence of a stereo signal, the legend FM STEREO appears in red under the left end of the dial scale, and if you should overdrive the amplifier so that it becomes too hot, another red legend—HI TEMP—appears. The stereo-only switch silences the set on mono stations, so it plays only those which are broadcasting in stereo.

The FM front end employs a four-gang capacitor, and has two FET r.f. stages, an FET mixer, and a transistor

oscillator. Its output is fed through the first crystal filter to a transistor amplifier stage and thence to the first IC. This is followed by another crystal filter—both filters have a 250-kHz band width—and thence to the second IC. (The IC's are very effective limiters). One more transistor stage then drives the diode ratio detector, and this is followed by another amplifier stage and an emitter follower. While most AM-FM receivers employ common i.f. stages, the AR-15 does not. Its AM section is completely independent, and employs one r.f. stage, an oscillator mixer, one i.f. stage, and a diode detector. The MX section has some ele-

ments of similarity to the AJ-43 tuner of a year or so ago, including a means for adjusting the phase of the 38-kHz oscillator for optimum listening quality.

The four output-stage transistors (40411's) are mounted on two separate heat sinks, each with a thermal switch which opens the supply voltage to both stages in the event either heat sink becomes too hot, and when the supply is opened, the HI-TEMP panel light is illuminated. This provides adequate protection as well as a warning to the user. 4000- μ F coupling capacitors are used to keep d.c. off the speaker leads and ensure good low-frequency response.

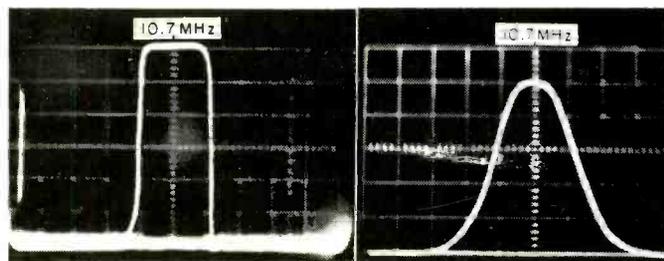


Fig. 2. Steep-sided band pass of the AR-15 at normal signal level (left) compared with the bandpass of a typical conventional receiver (right). The vertical lines are 110 kHz apart.

Performance

The performance of the FM tuner shows up the advantages of the steep-sided crystal filter, (Fig. 2) since when one tunes off a station, it cuts out sharply, with no distortion due to the sloping sides of the response curve. And since the FM squelch derives its signal from between the crystal filters, it acts before the interstation noise is heard. The entire squelch circuitry is complex, and is triggered either by detuning, as indicated by the d.c. at the ratio detector, or by the presence of noise, which is detected by a 100-kHz amplifier, rectified, and fed to the squelching elements. The stereo threshold may be set so that a weak signal too poor for good stereo listening will cause the circuit to switch to mono automatically.

The antenna input will accommodate either a balanced 300-ohm line or an unbalanced 75-ohm line. Sensitivity, measured by IHF standards, is 1.8 μ V, and alternate-channel selectivity is better than 80 dB, which is exceptionally good. 19- and 38-kHz suppression is over 40 dB so as to eliminate any beating with the bias oscillator in a tape recorder, and clean stereo recordings can be made off the air.

The amplifier provides a continuous

average power of slightly better than 60 watts per channel with both channels operating into 8-ohm loads and distortion measuring 0.3 per cent; with 4- and 16-ohm loads, the output at the same distortion measured 54 and 47 watts, respectively. At 50 watts output, distortion is less than 0.2 per cent at 1000 Hz, and less than 0.5 per cent from 8 Hz to 40 kHz; at the 1-watt level, THD is less than 0.1 per cent at 1000 Hz, and less than 0.25 per cent from 8 Hz to 27 kHz. At full output, IM distortion is less than 0.5 per cent, and at 1 watt is only 0.15 per cent. Channel separation is better than 55 dB at 1000 Hz, and better than 40 dB from 10 Hz to 20 kHz. The tone controls provide boosts and cuts of more than 15 dB at 20 Hz and 20 kHz, respectively.

Priced at \$329.95, the AR-15 is not a project for the novice, but for experienced kit builders it is a real bargain. As to its physical characteristics, the chassis measures 16 $\frac{1}{2}$ in. wide, 4 $\frac{3}{4}$ in. high, 14 $\frac{1}{2}$ in. deep over the knobs. The input and output connections are recessed so the unit can fit against a wall. The walnut optional cabinet is the same depth and one inch wider, and is 6 in. high, including its rubber feet. Check 1

We re-invented tape recording

First, Norelco introduced the Compact Cassette in the United States. The cassette took the tangle out of tape. And finally made tape recording easy enough for anybody.

Then we made machines to play the cassette on. There are three re-inventions in all. Together they make up what we call the new 'Norelco Sound System.' The latest member of this new 'Sound System' is the Norelco '450'—the first and only home stereo cassette tape recorder. It's for people who want to keep tape recording easy (just snap in the cassette and push the button) but still want the big stereo sound of a home unit.

The Norelco '450' is designed in beautiful teakwood with two satellite speakers. It's 4 track. Has an automatic pop-out cassette operation. Solid state. Stereo record level control. Tone, balance and loudness controls. 60-10,000 cps. Public address system. Vu meter. Digital counter. And stereo mike.

Other members of the 'Norelco Sound System' are the portable Carry-Corder® '150' and the monaural Norelco '350'—the only monaural cassette tape recorder for the home. Only Norelco has a complete line of cassette tape recorders. We should. We re-invented tape recording in the first place.



Norelco®

the re-inventor of tape recording

North American Philips Company, Inc., High Fidelity Products Department, 100 East 42nd Street, New York, N. Y. 10017

COMPACT SPEAKER SYSTEM UNIVERSITY ULTRA-D 3-WAY

Many home installations require small loudspeaker systems because the homes themselves are small. Granted that a home with a 30 by 50 living room can easily accommodate two large theater-type enclosures, and—because of the volume itself—need larger systems, it must be admitted that the average home is not endowed with that much space. But that is no reason why the people who live in the smaller homes should not enjoy good sound reproduction.

The University "Ultra-D" system embodies all the elements that make for good sound—a high-compliance woofer, a suitable midrange unit, and still another speaker for the very top. And when such elements are properly combined, the results are sure to be pleasing. The

Ultra D employs a 10-in. ultra-linear, high-compliance woofer which covers the range up to 1000 Hz, a 4-in. direct radiator cone which covers the range from 1000 to 5000 Hz, and a 3½-in. tweeter for the high end. The midrange unit has a curvilinear cone which is specially treated to provide a crisp middle, and the tweeter has a rigid-diaphragm cone with a voice coil of aluminum wire for minimum mass. To these are added a 3-way quarter-section L-C network with 6-dB-per-octave cutoffs, and a combined variable brilliance/presence control. The housing is solidly built of ¾-in. plywood, with a chipboard baffle for solidity, and the back is sealed on with an airtight material. The port is nicely calculated for good low-end response. The cabinet is finished in oiled walnut

on all four sides (and is also available unfinished). The unit measures 23¹³/₁₆ x 11⁷/₈ x 9³/₄ in. deep, and weighs 24 lbs.

The brilliance/presence control provides a wide range in the balance between the lows and highs to permit adjustment for the acoustical environment. The frequency range is specified as 35 to 19,000 Hz, though as would be expected from the size, there is some bass rolloff below about 70 Hz. There is no audible doubling down to about 32 Hz, and a slight boost on the bass control of the amplifier results in a more-solid bass without boominess. For its modest price of \$99.50, the Ultra-D will give the listener a quality of reproduction which he is generally accustomed to find only in much more expensive units.

Check 2

SUPEREX ST-PRO HEADPHONES

Over the years since headphones became *de rigueur* in any audio buff's installation, we have—while "living with" one of the earliest stereo headphone sets to appear on the market—listened at shows to most of the others that were being demonstrated, one make that has continually made a good impression is the Superex line—and, in particular their ST-PRO model. But everyone knows that serious evaluation of anything is impossible in the confusion and the

crowds at a hi-fi show. To make a valid judgment, one must listen to a variety of program material over a relatively extended period of time. This we have lately had an opportunity to do, and our snap judgment arrived at at the shows has been vindicated.

The Superex line is in relatively large housings—4¼ in. square by 2½ in. deep (which may account for the excellent low-frequency response). The housings are molded of a high-impact plastic, and removable cushions simply slip over them. The cushions themselves, of a soft

plastic with a foam internal padding to maintain their form, are removable for easy washing for sanitary protection. The band consists of two parallel steel bands covered with an extruded plastic, with a soft foam pad for the top of the head. Each phone is attached to the band by two spring-loaded rods and the usual bails, which ensure the phones being held essentially in a parallel position so as to maintain a good air seal. The Superex phones are two-way using a dynamic woofer and a coaxial ceramic tweeter. Even while wearing glasses, a user may wear them continuously for an hour or so with no discomfort.

The response is smoothly audible down below 30 Hz, and at the other end is measurable to over 21,000 Hz, with no apparent peaks throughout the entire range. While the standard phones are designed to work from the usual output impedance of an amplifier—4 to 16 ohms—these phones are also available with impedances of 600, 2000, 15,000 and 50,000 ohms, which should make it possible to match any impedance likely to be encountered. Some recording enthusiasts have complained that the monitor-phone output on their tape recorders would not drive the usual low-impedance phones, but Superex makes it possible to match most recorder sources.

Another valuable feature is the flexibility of accessories available—boom-mike attachment, 10-ft. retractable cord instead of the usual 7-ft. cord; mono-phonetic wiring, alternate plug terminations for special applications, and even a single-phone model. We have found that these two-way miniature speaker systems will give considerable satisfaction in any listening situation. Price, \$50.00 for the

Check 3



Superex ST-PRO
stereo headphones.

Curl up with a good Bogen.

The new TR100X stereo receiver for homebodies.

Just add speakers, dial your pleasure and relax. Enjoy the magnificent sound that comes from the most advanced design in audio today.

The all-silicon solid state TR100X combines a sixty-watt (IHF) amplifier (flat from 20 to 50,000 Hz.) and a super-sensitive, easy-dialing am/fm-stereo tuner. It offers automatic stereo switching, a Stereo Minder signal light that alerts you to stereo broadcasts, and an oversize meter for precise tuning. Plus four speaker outputs and a speaker selector switch that lets you listen to stereo in either or both of two rooms . . . or through headphones, with speakers silent.

This is a receiver designed to go home with you and stay there. Thanks to the unprecedented reliability born of modular engineering, Bogen style. Virtually all circuitry of the TR100X is contained on six automatically-assembled circuit modules. These modules are interconnected by positive, push-on connectors. Point-to-point hand soldering is virtually eliminated, and so is the margin for human error. For further reliability, the output transistors used are so rugged they can withstand accidental shorting of speaker leads, even at high signal levels of long duration. What's more, they're fused for additional protection.

The striking styling of the TR100X . . . its rich satin gold and warm walnut grain . . . will grace and harmonize with any home.

Best of all, the TR100X is easy to come home with. Only \$249.95.* (The TF100, identical to the TR100X, less AM, is only \$234.95*)

*SLIGHTLY HIGHER IN THE WEST. CABINET OPTIONAL, EXTRA.

BOGEN

COMMUNICATIONS DIV.  LEAR SIEGLER, INC.
Paramus, New Jersey

Check No. 143 on Reader Service Card.



ABOUT MUSIC

Harold Lawrence

The Noise Abaters

IN MY JUNE, 1966, column, FIGHTING THE NOISE EXPLOSION, I reported on the activities of a New Yorker named Robert Alex Baron who organized his neighbors to try to reduce excessive noise in his vicinity. Since then Mr. Baron has given up his job as a theatre manager to devote his full energies to the battle against worldwide noise pollution. Last spring he traveled to Baden Baden, Germany, to address the Fourth International Congress for Noise Abatement. He was the only delegate from the United States, and an unofficial one at that. (His speech was entered in the Congressional Record by New York Representative Theodore R. Kupferman.) Three months ago, Baron rounded up enough concerned citizens to form an organization called Citizens for a Quieter City, Inc., of which he is executive vice president. The purpose of CQC is to create an awareness of the need for the control of city noises and of the means available for noise control. It also aims to stimulate research on the effects of noise on man, psychological as well as physical. In announcing the founding of CQC, its president, Jerome Nathanson, pointed out that many people simply do not realize that noise is as undesirable a feature of city life as air or water pollution: "The city is unnecessarily becoming a twenty-four hour sonic nightmare with its unsilenced jackhammers and air compressors, grinding garbage trucks, and banging garbage cans, illegal horn honking, nighttime sirens, and so on."

Baron began his career as an anti-noise crusader when he bravely set out to fight City Hall. My guess is that he will find it even tougher to arouse the public at large over the issue of noise pollution. Thanks to conservationists like Rachel Carson and Stewart Udall, everyone is aware of what air and water pollutants have done to our rivers, forests, farms, and cities. Cover stories in *Time* and the *Saturday Review* have underscored the menace. Noise is another matter. It lacks urgency, says Baron: "The drama of the air pollution deaths in London made front-page news. As a result of stories like this, priority is given to air and water pollution and hundreds of other problems shouting louder than noise for attention, support, and the limited funds available."

What may bust this problem wide open is the introduction of the super-sonic transport, SST, a needle-fish airplane measuring six feet longer than a football field and designed to fly at more than two and a half times the speed of sound. The SST will produce a sonic boom that will follow the plane as wake follows a ship. Its trail will be 80 to 90 miles wide. According to acoustician Karl D. Kryter, "with the advent of the SST, tens of millions of people will be exposed to a sound that is as noisy or as objectionable as that now experienced under the flight path of jet aircraft within about one and a half miles from an airport." Over half a million people in Oklahoma City were recently exposed over a six-month period to 1,253 sonic booms, courtesy of the U. S. Air Force. The purpose of the tests was to determine whether people could learn to live with the boom. Twenty-seven per cent of the population found the noise intolerable. The figure would probably have been even higher had the tests been conducted over another city; most who live in Oklahoma City work in the aircraft industry.

Boeing has promised to smash through the sound barrier only over the ocean, which would rule out the SST for coast-to-coast flights. But don't count on it. The SST will be able to cut transcontinental flight time from five to two hours and Americans in a hurry will probably persuade Congress to allow cross-country SST.

The first SST is expected to assault the atmosphere in about seven to eight years, providing government support is forthcoming. The airplane manufacturers recognize the built-in noise problem but issue remarkably cool statements about it. It's all very obvious, they say: the larger the aircraft the larger the engines and the more energy you're going to put into the atmosphere; anyway, who ever said you could muffle a sonic boom? The atomic bomb has been the focal point of man's struggle against war; the sonic boom could become the symbol for the ultimate assault against his sonic privacy and his physical and mental well-being.

Meanwhile city noise gets louder and louder. It is estimated that by 1990 four out of every five Americans will be living in cities. Years ago this might have sounded like an attractive prospect. Sounds of the metropolis have been romanticized in novels, poetry, films and

music. Traffic in George Gershwin's *American in Paris* is depicted in bouncing, exhilarating, even comic terms; mid-day along the Strand is something of an Edwardian experience in Vaughan Williams' *London* Symphony; and New York's subway trains are pulse-quickening rhythmic patterns in Copland's *Music for a Great City*. But the recently mounting city noise has all but obliterated the romance of urban sound.

What are some of the worst noises a New Yorker has to put up with? According to a recent survey, garbage collection noises have moved up to first place in a list of the ten most disturbing city noises. The mechanized trucks that crawl through the city produce an average of 100 decibels above the threshold of hearing. The city is planning to add 800 more of these noise-makers to its sanitation fleet. Subway trains roar into stations at 98 dB. Motorcycles reach levels of up to 111 dB. Each year, New Yorkers are subjected to 10,000 demolitions and constructions and 80,000 street repair jobs. The air compressors used on these jobs generate 103 dB, pneumatic hammers about 96. I don't have the figures at hand for the clap-clapping helicopters that shuttle between Kennedy airport and the Pan Am Building, but the effect on people under the flight path of the egg-beaters reverberating in the canyons between the high-rise apartment houses is unprintable.

Doctors and audiologists warn that excessive noise can cause deafness, cardiovascular disorders, mental illness, and just plain interfere with one's peace of mind. Most urban dwellers accept noise as an unfortunate though inevitable part of city life. The noise abaters are quick to point out that some of the noise we now tolerate can be eliminated by having our local governments enforce the noise codes. It is estimated, for example, that half of the trucks and all the buses in New York City are inadequately muffled. New York silences auto horns by law, but just try to stall for five seconds anywhere in the city and an avalanche of hornblowing descends on you for two blocks or more behind your car.

The trouble with noise codes is that they are vague, often subjective documents, hard to interpret and harder to enforce. The United States in this respect is years behind most European countries. Acoustical engineers know that almost every noise source can be properly muffled: silencers are manufactured (mostly abroad) for trucks, air compressors, cement mixers, pneumatic tools, and so on. The state of the art of industrial silencers is so advanced in West Germany that the Parliament has felt free to enact a law prohibiting excessive construction noise.

Unless Americans do something about noise pollution soon, we'll all have to move underground. Then we will have the various hums and vibrations of boilers, air conditioning systems, and ventilators to worry about. But that's another subject. Æ



MODEL CX 711

For the control room where simplicity is the key to accuracy.



MODEL CX 822

For the studio where flexibility means creative productions.

MADE ONLY IN AMERICA

Leadership

**IN QUALITY
DEPENDABILITY
PERFORMANCE**

ELECTRONIC ACHIEVEMENTS

- 👑 Performance as yet unequalled
- 👑 Two years proven Solid State circuitry
- 👑 Extremely low noise electronics
- 👑 Etched circuit modules

TRANSPORT DEPENDABILITY

- 👑 Patented Electro-Magnetic Brakes never need adjusting
- 👑 Complete head accessibility
- 👑 Precision Construction
- 👑 Low Wow and Accurate Tuning



CROWN recorders and players have been designed for continuous perfect performance. Skilled American craftsmen fabricate, assemble and individually adjust each CROWN to give you unequalled recording quality.

Our best salesmen are the studios and control rooms that have been using CROWN year after year. *Ask them!*



CROWN offers 40 models of players and recorders to meet your most specific and exacting requirements.

FOR COMPLETE
INFORMATION
WRITE OR PHONE
JOHN HAINES



BOX 1000, ELKHART, INDIANA 46514 • PHONE (219) 523-4919



MUSIC AND RECORD REVIEW

The Classics

Worth Special Note

ODYSSEY

Note: In spite of Columbia's heavy-handed initial publicity, the new low-priced Odyssey line is excellent. In spite of such platitudinous come-ons as "an adventure for the connoisseur" (yeah, yeah, like those adventures with finer tobaccos, dishwashing detergents, and so on) and "at a surprisingly modest price"—a very un-surprising \$2.49, exactly like all the other low-priced labels—in spite of such soggy slogans as "legendary performances" and "Journey with Genius" (ugh), the fact is that Odyssey in its first batch of releases is the very model of what an honest junior line from a major record company ought to be.

Three of the four stated Odyssey sources are represented (the fourth, brand-new Odyssey-Columbia recordings, is understandably put off for the moment). One source is the ex-limited-edition Max Goberman recordings of Vivaldi, Haydn, and others, long awaiting a courageous purchaser. Another is the Austrian *Harmonia Mundi* line, with familiar French and British connections in Renaissance and Baroque music—a type notably absent on regular Columbia. The third source is the cream of Columbia's older (i.e., "legendary") domestic recordings, very much worth tapping at this point.

In each of these areas the first release offers sensible choices of real musical value, exactly suited to a low-cost line that supplements a higher-priced label. The processing is uniformly good as far as I've sampled; the packaging is precisely the good-looking compromise between "plain Jane" ugliness and

- EDWARD TATNALL CANBY
- OSCAR E. KRAUT
- MARVIN ROTBARD
- LIONEL RUDKO

a too-fancy décor (which might detract from the parent label) that this magazine predicted last fall.

Here are some of the first-release Odysseys.

The Symphonies of Haydn, Nos. 1, 2, and 3. Overture to "Lo Speciale." Vienna State Opera Orch., Goberman.

Odyssey 32 16 0006 stereo

Max Goberman got the idea, some years back, of recording complete sets of earlier works and issuing them in de luxe subscription albums with the miniature scores of each work bound into the album. He produced an interesting set of Vivaldi pieces in New York—very far from all, of course—and then, moving to Vienna, started in on his major opus, the "complete" Haydn symphonies, all 104 of them. (Corelli's dozen concerti grossi Op. 6 were done complete, too, and appear in the Odyssey first release). Goberman died suddenly, and his tapes have been up for grabs ever since. Columbia has had the sense to take them on and the general market will finally sample what has been a very exclusive specialty, at approximately a quarter the original price, though minus the built-in miniature scores.

The first three little symphonies are not in exact order; No. 3 belongs somewhat later and is quite unlike the first two, which are brilliant, busy little string pieces with optional wind parts that may be omitted. These two are from the very early pre-Esterhazy years, yet they show Haydn already fully professional as a musical entertainer. No. 3, more likely nearer to 10, comes after the first Esterhazy works, the now relatively well known trio "Le Matin," "Le Midi," and "Le Soir," Nos. 6, 7, and 8, and has fully independent writing for the winds,

a fugal finale, and a much more demanding content than the first two.

Goberman's Vienna orchestra is somewhat rough here, particularly in the violins, and the "drive" of the music, probably uncomfortable for the Viennese players, is sheer New York in style. But in all other respects the music is carefully and authentically played, with gusto.

Schubert: Unfinished Symphony (including third mvt. sketches); Rosamunde Overture; Magnificat in C. Soloists, Akademie-Kammerchor, Vienna New Symphony, Goberman.

Odyssey 32 16 0010 stereo

Goberman does here what I've hoped for years somebody might try—he gets down on records the precise remaining notes of the third movement that Schubert began for the famous symphony, leaving it unfinished.

In older days, a more Romantic attitude would have persuaded someone to "finish" the music as Schubert might have written it. Mr. Goberman's version is much more interesting. Schubert completed nine measures of the scherzo's orchestration; beyond that, he left a completed piano version of the whole scherzo-proper, then went on with just the melody line for the beginning of the central trio section, as far as the double bar and repeat, the music petering out entirely at that point. What we hear on this record is the orchestral beginning, which is immediately taken up by the piano (Kurt Rapf) without a pause—the pianist playing the rest of the scherzo and the petering-out trio melody, stopping in mid-air exactly where Schubert stopped, no doubt intending (like the rest of us) to get to work on it again tomorrow morning or something. He never did.

The "Rosamunde" overture is a bit too lively here for its marvelous melodies to get through, as the main body of the "Unfinished" is hardly done in an outstanding fashion. Mr. Goberman and his players are much better off playing earlier-type music. But the seldom-heard short *Magnificat*, for full complement of soloists, orchestra, and chorus, is really lovely, reminding us strongly of the more familiar little Mass in G major, one of Schubert's most endearing early works.

Altogether, a record worth twice its "modest" price, the standard \$2.49 list.

Check No. 145 on Reader Service Card→



At \$149.50,
less cartridge and base,
your hi-fi dealer should
be able to demonstrate
the new Miracord 50H
as decidedly superior
to any other automatic.

Insist upon it!

Exclusive features include hysteresis motor and stylus-overhang adjustment plus anti-skate and cueing dynamically balanced turntable and tonearm, and feathertouch pushbutton operation. For complete details, write: Benjamin Electronic Sound Corp. Farmingdale, New York 11736

The most satisfying volume
on anybody's bookshelf...

The New LEAK
MINI-SANDWICH



The world's second distortion-free speaker is here! It's the Leak Mini-Sandwich bookshelf version of the first: the Leak Sandwich Mark II.

At the heart of both—the new Mini-Sandwich and the great Mark II—are the revolutionary SANDWICH® cones of all speaker motors. Fantastically rigid, yet no heavier than conventional paper cones, these unique diaphragms are made of thick polystyrene foam sandwiched in skin-thin aluminum. They respond with piston-like precision to the wave form of the voice coil signals. The rigidity of the Sandwich cone eliminates "cone break-up," the erratic flexing which causes distortion in other speakers.

Both Leak Sandwich speakers are flawlessly balanced systems. Electronic components and cabinet, materials and structural features are all functionally determined and integrated. The rich-grained Scandinavian woods and the changeable grille cloth are chosen not only with an eye to beauty but an ear to acoustical perfection.

Result: a remarkably smooth frequency response, free from violent peaks or troughs, over a very broad frequency band. Transient response is excellent.

And the performance of the new shelf-size Mini-Sandwich is indistinguishable from that of the larger model except in the lowest octave.

If space permits, there is only one choice: The Leak Sandwich Mark II. But if space is a problem, satisfaction is not! Second only to the Mark II, the Mini-Sandwich will meet your most exacting requirements. Ask your Leak Authorized Sound Specialist to let you see and hear both. Look, listen and decide.

Write for literature on Leak Sandwich Speakers; Leak quality components: STEREO control centers (Pre-Amps), Amps and Tuners . . . and name of nearest dealer.

*U.S. Patent #3,111,187



LEAK
MINI-SANDWICH
Speaker
System \$135
18½" x 11" x 7"
(22 lbs.)

LEAK MARK II
Speaker System \$199
26" x 15" x 12"
(49.5 lbs.)

Exclusive LEAK® U.S. Representative Dept. A-5

ERCONA CORPORATION

432 Park Avenue S., N.Y., N.Y. 10016 • (212) LE 2-6560

Check No. 156 on Reader Service Card.

Mozart: Symphonies No. 41, "Jupiter,"
No. 38, "Prague." Royal Philharmonic
Orch., Beecham.

Odyssey 32 16 0023 mono

A generation of us older record collectors grew up on Mozart by Sir Thomas Beecham, as issued mainly on Columbia 78's. Haydn too, not to mention that somewhat doubtful poly-composer, Handel-Beecham. Here are two ever-so-typical oldies out of Columbia's archives, restored for the new label, and it is good to have them around again though I'll have to admit they sound astonishingly dated now in terms of musical performance.

Not seriously dated—just interestingly so. An orchestra that now sounds much too big and thick, a semi-Romantic performance that goes in for more swelling and dying away than conductors now dare, with a good many oddly placed pauses and ritards, similarly taboo these days. But through it all comes the well-remembered Beecham polish, the perfect phrasing and balance of all the parts, the reverence for Mozart himself, that was always Sir Thomas' first consideration.

Technically, the recordings have the familiar 78 sound (I suppose they were 78's, or very early 33-rpm transcriptions or tapes)—a certain slightly metallic ring, a rolled-off high end and a somewhat rattly quality to the loud parts. Silent surfaces, though, and the minor distortion is nowhere really objectionable.

Masters of the Italian Baroque (D. Scarlatti, A. Scarlatti, Fiorenza, Sarri).
Saar Chamber Orch., Ristenpart.

Odyssey 32 16 0016 stereo

The Saar performers under Karl Ristenpart, with their curiously mixed names, part French, part German, are already quite familiar on other labels, notably Nonesuch: presumably the original source of tapes is the same, even though this disc comes via Austria. The sound, too, is familiar—the same dynamic, yet slightly rough-edged string tone, impetuous, moderately old fashioned, yet musically very persuasive. Ristenpart is best in slightly later music—Haydn, *et al*, but the Italian Baroque is far from bloodless under his energetic direction.

These "unknown" little works, for string orchestra and assorted winds, are actually typical of literally hundreds of instrumental pieces of the first part of the Eighteenth century that are only now beginning to be played in quantity. If they are novelties, it is merely due to our own past ignorance. The three short Sinfonias with flute and oboe by Domenico Scarlatti are unlike his keyboard sonatas—they must be earlier works. His father's music is not very different here and equally attractive, a "sinfonia" listed by Odyssey as for two flutes, though it is played by an eloquent pair of recorders, a kind of two-recorder concerto. A very nice work for anyone attached to Baroque.

I suppose that Odyssey's annotator did not have a chance to hear the test pressings of this record, for not only is there the pair of unmentioned recorders, but an obscure composer named Fiorenza, with two works on the record, is described as "quite-essentially Baroque" whereas in the listening he is clearly the one man here whose music sounds post-Baroque, edging into the later *galant* style—in its very oddly moody harmonies and poignant atmospheric, as well as in the tell-tale turns of melody that became stock in the *galant* period. Fiorenza must have been one of those who influenced the new generation of Northerners, men such as Fux, Quantz. Bach's son Karl Philipp Emanuel, for he sounds like them. Very interesting music, as is the little flute concerto by Sarri, yet another unknown.

Yep, at last Columbia has its Odyssey toe in the international Baroque business. Good thing, and about time. E.T.C.

Mahler: Symphony No. 4. Desi Halban, sopr., New York Philharmonic, Bruno Walter.

Odyssey 32 16 0025 mono

This recording, out of Columbia's own home-town operation, was indeed a famous and perhaps "legendary" performance of the Symphony as conducted by the finest of the Mahlerites, Mahler's personal friend and follower, Bruno Walter. Since Mahler died in 1911 and Bruno Walter, now also dead, made this well before his final period with Columbia, the musical "connections" run straight back to the original. The performance shows it, too. A superbly natural, relaxed, thoughtful, expressive playing that gives Mahler the best chance he will ever have for musical immortality. Desi Halban sings the folk-like last movement.

(Note that a portion of this music as played on the piano by Mahler himself has recently been issued in one of Telefunken's Welte Mignon piano roll transcriptions on LP. Sounds remarkably like this version by Bruno Walter.)

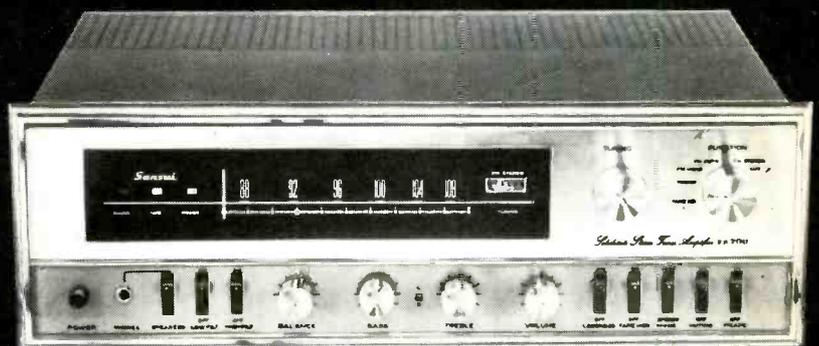
78-style sound here, but modernized as satisfactorily as possible with low surface noise and only minor distortion. There are plenty of highs for full intelligibility. E.T.C.

Robert Schumann: Etudes Symphonique Op. 13; Fantasia in C major Op. 17. Vladimir Ashkenazy, Piano.

London LCL 80122 (Ampex Library)
7½ ips, 4 Track, Stereo

Vladimir Ashkenazy has recorded two immense blockbusters back to back for London FFRR. Both the *Etudes Symphoniques* and the *Fantasia in C Major* are from the same period of the composer's life and both require the concentrated effort and stamina of more than 30 minutes each to perform. To clarify further, both compositions are for solo piano. It remains the responsibility of one man alone to create the structure and the effects required by the music and capture and retain the interest of the listener to the end.

Check No. 146 on Reader Service Card→



Model TR-700 — Solid State FM Multiplex Stereo.
Music Power: 60 Watts @ ± 1 dB. FM Usable Sensitivity: $1.8\mu\text{V} \pm 3$ dB (IHF).

Stereofidelity® . . .

now you can listen to a completely new sound . . . Stereofidelity by Sansui . . . a tone quality that soon will be the new standard of excellence . . . Stereofidelity by Sansui . . . available in a choice of FM stereo and AM/FM stereo receivers.

Sansui

For complete information and a list of franchised Sansui dealers, where you can see and hear Stereofidelity by Sansui, write:

SANSUI ELECTRONICS CORPORATION • 34-43 56th STREET • WOODSIDE, N.Y. 11377 • TEL. 446-6300

Sansui Electric Company, Ltd., Tokyo, Japan • Electronic Distributors (Canada) 949 Granville St., Vancouver 2, B.C.

WORTH WAITING FOR!



DYNACO STEREO 120

3 years of intensive development give you all the virtues of transistorized amplifiers with none of the harsh "transistor sound."

The combined distortion of the Stereo 120 and the PAS-3X perfectionist's preamplifier does not exceed 1/10 of 1% from 20 to 20,000 cycles at most useable power levels.

60 watts continuous power per channel; fully regulated power supply; complete electronic protection (no fuses or thermal cutouts) against open or short circuits; impeccable specifications; modular design for easy kit building.

Write for full specifications and detailed test reports.

DYNACO INC.
3912 POWELTON AVENUE,
PHILADELPHIA, PA. 19104

Check No. 147 on Reader Service Card.

Robert Schumann, at the age of 22, was forced to give up a promising career as a concert pianist due to an accident which disabled one of the fingers of his right hand. He had tried to accelerate the development of his finger muscles with a special machine with disastrous results. He had already displayed considerable talent as a composer. As a result of the accident he was now forced to concentrate all his attention to composition. At this point Schumann was an unattached male gravitating around the home of his former piano teacher Friedrich Wieck. Young Robert was already developing a growing interest in Herr Wieck's daughter Clara, then an infant prodigy of about 13 with a growing reputation as a concert pianist.

A new young girl, Ernestine von Fricken, aged 17, came into the Wieck household as a pupil. Schumann promptly fell in love with her and declared himself. Before this romance came to an abortive end, he had already begun writing variations on a theme which eventually became the *Etude Symphonique*, dedicated to his love Ernestine. Before the next year was out, his intense interest in Ernestine von Fricken had waned and Schumann was again pursuing Clara Wieck, now all of 15 years old.

This brief biographical excerpt may give you some idea of what was going on during the creation of first the Etudes and then some two years later (1836) the *Fantasia in C Major*, which bore the original dedication to Clara. The *Fantasia* was actually written when young Schumann thought he had lost Clara Wieck forever. It should be no surprise, therefore, to find the music highly romantic with the typical waxing and waning of emotion. The waxing episodes come on with great passion and force and call for explosive power and plenty of muscle as well as agile fingers.

Ashkenazy catches the spirit of it and does a remarkable job of creating and sustaining the mood in both compositions. The Etudes sound as though they were recorded a little too vividly, since many of the sudden attacks seem to shatter and distort and there are some passages that muddy up and lose clarity. Schumann writes with extremely full harmonic structure making a clean piano technique necessary, as well as a scrupulously clean recording. O.E.K.

Bach: Cantata No. 46, Schauet doch und sehet; No. 65, Sie werden aus Saba. Soloists, Barmen Singers and Chamber Orch., Kahlhofer.

Vanguard Everyman SRV 226 SD stereo

Bach: Cantata No. 4, Christ lag in Totesbanden; No. 182, Himmelskonig sei willkommen. Soloists, Westphalian Singers and German Bach (Instr.) Soloists, Ehmann.

Vanguard Everyman SRV 225 SD stereo

These might appear to be two more or less equal releases in Vanguard's Bach Research Series of "definitive performances," made in German centers of Bach study. In the listening, the first turns out to be absolutely superb, one of the most gorgeous Bach records of its sort to come out in years. The second is merely good, far from outstanding.

The two Cantatas on the first record, No. 46 and No. 65, are beautifully contrasted, one ultra-expressive in a serious way, the other ultra-festive; both are scored with unusual richness for Bach, with the sounds of pairs of recorders, horns, oboes da caccia (an English horn, in effect) plus trumpet—and both solo singers and chorus. For those who are Bach-knowledgeable, the opening of No. 46, a huge big choral movement with long instrumental introduction and a big fugue, will cause astonishment; for halfway through, we hear the complete *Qui tollis* of the B Minor Mass—this is where Bach first wrote the music, later adapting it (with his usual incredible sense of rightness) to the Mass text. In both this and the joyous post-Christmas No. 65 there are superb solo accompanied recitatives, sung to special perfection by the tenor, Georg Jelden, and beautiful arias with obligato accompaniments for the various solo instruments, plus the splendid big choral numbers that knock so many of us over when done in this huge, colorful, expansive, lively style. Great performing, great recording!

The second record is somehow insufficient. For one thing, where the first has a marvelously good chorus, the second's chorus is thin and oddly mixed up with the solo voices—can't tell which is which, and both tend to be overwobbly. There is, too, a curious lack of tension, and of the grand line that sweeps big Bach forward so convincingly. Even the familiar glories of the often-heard *Christ lag*, No. 4, don't make up for the trouble here. Not bad; but not really very good either. Not *all* the authentic German Bach Research is as good as it ought to be. E.T.C.

Bela Bartok: Sonatas for Violin and Piano, Sonata No. 1 in C-sharp minor, Sonata No. 2 in C Major. Andre Gertler, violin and Edith Farnadi, piano

Westminster WST 77098 Stereo

This pair of sonatas were the product of what Bela Bartok called his early period, and as a matter of fact, represent the final works of that period. Like everything that he wrote, the intensity and elemental force of his personality and character is so evident and undeniable that these sonatas might almost be considered performance proof. This is not said slightly of this performance, because Gertler and Farnadi make a great deal of their opportunity, but rather to point up the fact that Bela Bartok never fails to write a piece of music which is a real challenge to the performer on all levels. Not only do they bristle with

technical difficulties, but musically they are equally challenging.

These two sonatas are a case in point, since it is inconceivable that any but two sensitive artists would attempt to perform them. Sonata No. 1 was composed in 1921 and Sonata No. 2 was written the following year. Both were dedicated to the famous Hungarian violinist Jelly d'Aranyi, who first performed them. Probably due to the fact that Bartok was practically adopted by the Aranyi family at the time, the violin part is by far the dominant one, in both sonatas. Both compositions are expressionistic and emphasize various effects in coloration with the impress of Bartok's strong tendency to accented rhythms and sharp dissonances. The first is more lyrical with longer phrases and while the composer considered it to be in the key of C sharp minor, it actually moves around tonally. The violin plays and develops ideas which are complemented by the piano but there isn't the type of interplay found in, for example, Brahms. The violin and piano each go their own way together. The result is a continuous kaleidoscope of color and rhythmic effects which never palls, and yet it all hangs beautifully together. The slow movement and the third movement of the *Sonata No. 1* are suffused with typical figures and rhythms evidencing Bartok's intense interest into Hungarian folk music, begun about twenty years earlier.

The second sonata is in one movement and again the violin has the spotlight with the piano filling in rhythmic figures and supplying, as it were, the canvas on which the violin weaves its effects. There is more the feeling of terse fragments held together by a common idea and the complementing piano part.

The overall effect of both sonatas is that these are the product of a completely free imagination and a man who is not afraid to express himself regardless of what direction his imagination and talent take him. (This long before the advent of psychedelic stimulants.)

The artists, Andre Gertler and Edith Farnadi, both out of the same environment as Bartok, are completely in sympathy with the composer and realize the subtleties of the two works. Gertler, who enjoyed the distinction of performing Bartok's violin compositions with the composer at the piano, plays here with clean intonation and produces a wide variety of colors and tone necessary to make the score come to life. I do get the feeling that Gertler is a little too precise and could've let go in some places to achieve the primitive wild abandon called for in the music. The result is that Edith Farnadi sails into her part and sometimes completely obscures the violin, and occasionally makes his tone seem small by comparison. The recording is robust and clean with perhaps the mike a little too close to the piano. But the rendition is a satisfying one on this disk.

Some years ago, I became familiar with the Bartok Sonatas as performed by Joseph Szigeti, with Bartok collaborating at the piano. The result was an

HOW CAN YOU TELL A GOOD TAPE RECORDER WHEN YOU HEAR ONE?



A lot of Magnecord owners tell us they had to buy and use as many as four different tape instruments before they knew a good recorder/reproducer when they heard one. But we've got an easier and much less expensive way for you to learn what it takes to satisfy a tape recorder owner. Our new brochure waiting for you free at your Magnecord dealer's, tells you exactly what to look and listen for in a high fidelity tape instrument. Just follow the simple suggestions when you shop, and you'll be discerning the fine points of difference between tape recorder/reproducers like an expert in no time! . . . And you know what? The minute you do learn what it takes to tell a good tape recorder, we'll bet you take home a Magnecord!



NEW 8 + REELS A MAGNECORD EXCLUSIVE
THAT INCREASES PLAYING TIME 50%!

NOTE: ASK YOUR DEALER ABOUT THE NEW EASY
FINANCE PLAN FOR MAGNECORD EQUIPMENT.

MAGNECORD
tape recorders
DIVISION OF THE TELEX CORPORATION

9600 ALDRICH AVENUE SOUTH
MINNEAPOLIS, MINNESOTA 55420

OTHER TELEX DIVISIONS
MANUFACTURE TELEX HEADPHONES
AND VIKING TAPE INSTRUMENTS

Check No. 148 on Reader Service Card.

indelible impression the years have not erased, nor subsequent other performances reduced in stature. Vanguard's recent release from the archives (unfortunately only mono) may offer some idea of what can be done with the Sonata No. 2, when you really let go. O.E.K.

Britten: Piano Concerto No. 1 in D Major, Op 13; Frank Martin: Five Preludes. Marjorie Mitchell, piano, NDR Symphony Orchestra, William Strickland, cond.

Decca DL 710199 Stereo

The featured performance here is an instrumental work written by a composer familiar to us mainly for his output of vocal and operatic compositions, Benjamin Britten. His opera *Peter Grimes* was successfully presented by the Metropolitan Opera recently and the newly produced *War Requiem* was most enthusiastically applauded. The *Young Persons Guide to the Orchestra* has endeared Britten to millions of teachers and pupils and is well represented in numerous versions in record catalogs, as are his operas and vocal selections.

The piano concerto takes us back to early Britten, just a year after he broke into the scene as a composer to be reckoned with. Before this, writing music for radio and film occupied his time and helped him to develop his musical muscles. The concerto is an entertaining display piece in four movements. The first movement, a *Toccata*, is more than just a little reminiscent of Prokofiev's *Third Concerto*. The second movement, *Waltz*, sounds like something out of Walton's *Facade Suite*. All the influences of Britten's early life show through in the score of the piano concerto, which is natural and more to be expected than to find the complete, well-developed originality of his recent works. Produced in 1937 and later revised in 1946, it has enough to offer to make enjoyable listening.

The performance is workmanlike on the part of both the soloist and the orchestral accompaniment. The recording of the piano sounds hard and uneven. While the recording is clear, it is recorded on a somewhat subdued level which tends to rob the work of some of its dramatic impact.

The *Five Preludes* by Frank Martin surprisingly come off much better than the featured work. These were originally written for the memorable Dinu Lipatti, whose recordings point up the great tragedy of his early death. Martin is a Swiss contemporary composer and these preludes are out of a set of eight. Margaret Mitchell plays these "encore" pieces sensitively and affectingly, and with greater insight than is evident in the concerto. O.E.K.

Donizetti: L'Elisir D'Amore. Carteri, Alva, Panerai, Taddei. Chorus and Orchestra of La Scala, Milan, Serafin.

Seraphim 1B6001 stereo

Everybody loves a bargain and in this set by Seraphim you really get one. This is one of the releases by Angel records of their earlier recordings at a budget

price. Thanks to the recent decision by most of the record companies to market a low price (anywhere from \$1.98 to \$2.98) stereo record, a horde of inexpensive labels has blossomed in the record market.

While all are not of equal quality, the available catalogue of these labels is so large there are hundreds of outstanding recordings, at budget prices, that are the equal of and at times superior to their higher priced counterparts.

This unpretentious rather corny opera, with its oompah score, as a performance leaves very little to be desired. The recording is excellent, even the stereo separation is good despite its age.

The cast is first rate and in particular, Rosanna Carteri and Guiseppa Taddei. Carteri has an exceptionally fine voice and sings with spirit and finesse. As a matter of fact, it is the spirit of this performance that makes it most enjoyable. Taddei, as Dr. Dulcamara, is a master clown in his role and carries it just far enough.

Serafin, that grand-dad of opera conductors, is also a master at this type of opera buffo and maintains a relaxed control that affords the singers a maximum of freedom.

As a result, this all adds up to lots of fun for the listeners and, at the same time, is a minimal drain on his pocket-book. If anyone has any misgivings as to the quality of a recording based upon its price factor, get rid of them. The best values in recorded history are now available to the selective buyer. L.R.

Dukas: The Sorcerer's Apprentice, New York Philharmonic, Leonard Bernstein, cond.

Columbia MS 6943 Stereo

This is subtitled "Leonard Bernstein plays for Young People," something he does with regularity. In addition to the Dukas, there is the Moussorgsky, *Night on Bald Mountain*; Piston, *Suite from the Incredible Flutist*; and last, but hardly least, the *Finale* from Rossini's *William Tell Overture*.

It hardly needs telling that Bernstein plays everything with spirit and excitement. Perhaps if you compare a *Sorcerer's Apprentice* done by Bernstein and one done by Toscanini you will find that there is a bit more of a frantic nature to Bernstein. He plays as fast as Toscanini, but not as smoothly.

The liner notes are written by Marc Chusid, a nine-year-old. He certainly qualifies as a "Young Person" and, as such can be forgiven the lack of maturity in his writing. Come to think of it, though, with all the plethora of records of this kind (even if this is one of the best) this is the freshest approach to liner notes we have seen in some time.

M.R.

Dmitri Shostakovich: Six Preludes and Fugues (from Op. 87). Dmitri Shostakovich, Piano.

Seraphim 60024 Mono

Bach really started something! The evidence is overwhelming that as far as

composers are concerned, he left marks which earned him the permanent position of No. 1 on the Classical "Hit Parade." His *Well Tempered Clavichord* was in the form of 24 preludes and fugues, each in a different key. Shostakovich paid his respects to Bach on the 200th Anniversary of his death by offering his answer to the same problem. The skill and musical accomplishment of being able to write in this form attests to the discipline and ability of the composer, be it Bach or Shostakovich.

This recording, available only mono, is more a historical record of the composer playing five of the twenty-four which comprise the opus. The Russian pianists Gilels and Sviatislav Richter include some of these Preludes and Fugues occasionally in their programs.

As indicated by this recording the approach was not just to copy Bach except in general outline. Shostakovich makes it plain that these are wholly his own. The material used demonstrates both his wit and his serious side. They are unmistakably Russian and Shostakovich and this adds to their value and interest. They are more than just an item of work by a great composer. O.E.K.

Stravinsky: Petrouchka. Pittsburgh Symphony Orchestra. William Steinberg.

Command CC 11034 SD Stereo

Definitive performances are rare, so this must be construed as a rare record, for Steinberg and the Pittsburghians are definitive in this performance of Stravinsky's classic ballet. Only Stravinsky himself, on a fairly recent Columbia release manages to convey the musical qualities of this work so effectively. Ansermet, so popular with this work, must be dismissed as barbaric by comparison.

Part of this has to do with the versions of *Petrouchka* that are recorded. This example, as with the Columbia, represents a 1947 rewrite. The revision tended to soften the work; make the line of melody flow rather than jerk, so to speak. In any case it does fall better on the ears. (It should be said that Stravinsky revised the score with a second motive in mind. *Petrouchka* had never received an American copyright. What was available on records was a kind of piracy—only it wasn't piracy then. The 1947 version is, of course, fully protected by copyright.) That is what is heard.

This is a most enjoyable discing. Steinberg's phrasing is faultless and his orchestra is faithful to his wants. Command has backed this up with a disc derived from 35-mm magnetic film. The result is excellent dynamics, a virtual absence of tape hiss, and a fidelity that represents the state-of-the-art.

All in all, this is a proud achievement. M.R.

Wagner: Orchestral works from The Ring of the Niebelung. London Symphony Orchestra, Stokowski, cond.

London Phase 4 SPC 21016 Stereo

The banner across the jacket cover reads "STOKOWSKY/WAGNER" and it is not all together inappropriate. It is

the venerable conductor that is the star here. And it is proof of Wagner's greatness that he can survive this. The performances are clearly mannered but interesting enough in a way that is not always objectionable. Stokowsky charges forth and then suddenly holds back with something in mind; perhaps the problem is that his thoughts do not always come across to this listener. The *Ride of the Valkyries* is a diabolical march of Amazon women. The *Forest Murmurs* (from *Siegfried*), *Siegfried's Rhine Journey*, and *Death and Funeral Music* (from *Götterdämmerung*), and the *Entrance of the Gods into Valhalla* (*Das Rheingold*), are performed in the same extroverted manner. This is certainly not bad Wagner, but it is also certainly not Wagner as we are used to hearing him.

London Phase 4 has been known for highly variable sound qualities. This is their very best—and that is good indeed. And we must plug fellow reviewer Robert Sherman's fine liner notes. M.R.

MISCELLANEOUS

Opera in Berlin. Michael Bohnen, Herbert Janssen, Wilhelm Rode. Berlin Philharmonic, Meyrowitz.

Telefunken HT-47

The jacket of this record states that it is a release of historical significance. Unfortunately, there is nothing either historical or significant about it. As a matter of fact, if it wasn't presented seriously it would be the funniest record of the year.

Three singers are featured on this disc, all from the period encompassing the early and middle 1900's. The first, Michael Bohnen, is heard in arias from *Pagliacci*, *Carmen*, *Faust*, etc. All are sung in German and present a strong argument against performing opera in other than its original tongue. The prologue to *Pagliacci* sounds ludicrous in German, and Mr. Bohnen's conception is something to hear. It is a cross between a Viennese beer garden and the Threepenny Opera. The least offensive selection is the *Bartered Bride* duet where at least a few of the golden tones of Josef Schmidt, the famous tenor, offer some small compensation. I realize that these are all old 78-rpm recordings but there is still no reason for cutting off all response above 100 hertz. The voices come through very well, but the orchestra—Oh Brother!

Herbert Janssen is best noted for his lieder and has quite a noted success in this field. It would have been wiser to select something from this repertoire than the *Tannhauser* selections heard here.

As regards Wilhelm Rode, the less said, the better. If the purpose here was to fill out the balance of the record, 'twere better to have left it blank. What a wealth of great German vocalists there once was to draw upon—Rosewaenge, Anders, Volker, Bindernagel, Husch, remember them, meine freunde? L.R.

With a name like Pioneer, you'd expect something new in the SX-1000TA AM-FM Receiver



Well, here are a few somethings

- Unique vertical throw lever controls assure positive, finger-tip switching.
- Separate compensation for 3¾ and 7½ ips tape speeds.
- Special DIN socket accommodates connecting plugs to the outputs of European recorders.
- Separate input jacks provide for two magnetic phono and for ceramic/crystal cartridges.
- Matched grain, oiled walnut cabinet included at no extra charge.
- Plug-in Speaker Connectors instead of conventional terminal strips insure positive contact. Plugs are covered with flexible Neoprene to insure against shorts.
- Operates at 115 volts or 230 volts, A.C. 50-60 cps. The utmost in line voltage flexibility.

The SX-1000TA is the kind of receiver you'd design for yourself. Happily, Pioneer has done it for you. In one handsome unit it incorporates more features, more flexibility *plus* quality. Here are some more outstanding features: • 110 Watts IHF audio output at 4 Ohms; 90 Watts at 8 Ohms. • Transistorized protection circuits for both audio channels. • Direct-coupled audio system, from 20 to 60,000 cps. • Voltage regulation in positive and negative power supplies. • Stereo balance controls. • Gradual contoured volume control eliminates abrupt transition from low level to high level volume. . . . It's the least you could expect to receive from Pioneer, one of the world's largest manufacturers, specializing only in audio products.

You should see and listen to the SX-1000TA. If you desire complete specifications, fill in the publication's reader service card. However, for dealer listings, please write us direct.

PIONEER

PIONEER ELECTRONICS U.S.A. CORPORATION
140 SMITH ST., FARMINGDALE, LONG ISLAND, N. Y. 11735 • (516) 694-7720

Light Listening

Kokee Band: Hawaii and other Movie Themes

Solid State 18010

Anyone for drums, bongos, conga drums, timbales, maracas, bells, vibraphones, xylophones, marimbas, and celeste as recorded with solid-state equipment? The music is really secondary here. As a rule, I find it quite easy to

- RICHARD L. LERNER
- CHESTER SANTON
- ROBERT SHERMAN

condone a recording whose audio interest outshines its musical merits. I am forced to do so in this solid-state release from the United Artists workshops. If you're a dyed-in-the-wool movie-music fan, a Kokee Band (the term is not to be found in a dictionary) won't seem a very logical medium for a cross section of Hollywood fare. Even the presence of pianos,

French horn, an occasional alto sax, and a trombone section doesn't lift these arrangements much above the mediocre. However, anyone curious to hear the above mentioned instruments in the lean, finely chiseled sound that solid-state componentry can give a record will find a lot to occupy him in this disc. C.S.

Leroy Holmes: Violines del Amor United Artists UAS 6568

Occasionally, it pays to read the fine print on the back of record jackets. When this release came in, I was all set to relegate it to the pile of disc of less-than-average interest: background music that's covered when more-sparkling fare is not at hand in a given month. A sampling of the first three bands appeared to confirm my suspicion. Here was a large body of strings working away at the same slow tempo, the sound relieved only by a flute section almost matching the strings in importance in this latin music. Then my eye caught a small legend at the bottom of the list of selections on the back of the cover. At this point, when you expect the plot to thicken—it does. For, there on a UA album, is listed Webster Hall, New York, as the locale of the recording. For years, this hall has been pretty much the province of RCA Victor. Many, if not most, of Victor's top recordings of popular music have been made there. To add further intrigue to United Artists' use of the facilities, the engineer listed for the session is Mickey Crawford. Crawford has worked the recording console at Webster many times in the past in the employ of RCA Victor. Does this album then have the RCA sound that used to come from this hall in pre-Dynagroove days? Not exactly. In the difference lies the interest this disc will generate in audio circles. Theoretically, this new disc should sound quite similar to what Crawford and the hall turned out for Victor since microphones used for pop work are not too different from label to label. While *Violines del Amor* has roomier acoustics than the typical UA stereo release, it stands apart from pre-Dynagroove Victor product, pointing up the divergence in disc processing of RCA at its best and the industry average. This UA release approximates the industry average to an uncanny degree. In total sound, the advantage rests with RCA Victor because the sweetness of the extended highs was a hallmark of the label before Dynagroove came along. Unfortunately for Victor, most record buyers generally deal in the present. Once you apply RCA's Dynagroove process to a Mickey Crawford in Webster Hall, you wind up with a product a peg below what the engineer and hall have turned out here for United Artists. C.S.



The only Theatre Organ available in kit form — for only \$1350.

You've asked for it and here it is — the NEW Schober THEATRE ORGAN that you assemble yourself. For the first time in kit form, a real Theatre Organ with that rich, full, old time theatre pipe organ sound. You create the organ, then you create the music!

For years you've been able to buy organs in kit form from Schober: The Recital (fully AGO), the Consolette II (the best spinet organ available today) and the Spinet (for the most music at the lowest price). Now to join them, we present the Schober Theatre Organ.

The Schober Theatre Organ has the same quality features found on all Schober Organs, and in addition...special voicing, curved console design, two 61-note keyboards, 2-octave radiating pedal clavier, 8 octaves of tone distributed over 5 pitch registers (including a 1-foot register!), 35 speaking organ stops, 8 realistic percussion stops, 4 couplers, and vibrato tablet—48 tablets in all. And all at a truly remarkable low price... you save over \$1,500 (well over 50%) from comparable theatre organs.

Easy Step-By-Step Instructions.

You'll enjoy assembling this authentic and versatile instrument from transistor and miniature components too. Just follow easy step-by-step instructions written in everyday language which anyone can understand. You'll have an unequalled pride when you're finished that only can come from assembling it yourself.

And you'll have an organ you can learn to play easily and quickly—just follow one of the self teaching courses available from us.

The Theatre Organ price starts at \$1,350, depending on the options you select. This price includes a beautiful walnut console (other woods available) or you can save an additional amount by building your own from plans available from us. Options available include combination action, genuine reverberation, percussion, and amplifiers and speakers.

THE *Schober Organ* CORPORATION
43 West 61st Street, New York, N.Y. 10023

A COMPLETE THEATRE ORGAN!

All you do is have the fun of assembling it from kits and detailed, step-by-step instructions.

Includes console, keyboards, bench, pedals, electronics—everything you need except amplifier and speaker system, which are extra—or use your own. Percussions, combination action, and reverberation are options.

Features fully transistorized electronics, regulated power supplies, all printed circuit construction and gold switch contacts.

Combination Action Ten buttons select preset combinations of stops—actually move the stop tablets as in fine pipe organs—to give instant total changes of tonal effects. You can alter the preset combinations any time you like. Action is brand new electro-pneumatic type — silent, dependable.

Percussion Eight percussion stops provide exciting realism. Celesta, harpsichord, piano, mandolin, xylophone, chrysoglott, orchestral bells, single or reiterating, are played just like the real thing—and sound that way — alone or along with regular organ stops.

Uncompromising Organ Quality from Easy-to-Assemble Kits

Free Information. Send today for your free copy of Schober's 16-page full-color booklet—plus free 7" recording—with full information on all Schober Organs, priced from \$550.

The Schober Organ Corp., Dept. AE-21
43 West 61st St., New York, N. Y. 10023

Please send me Schober Organ Catalog and FREE 7-inch "sample" record.

Enclosed please find \$2.00 for 12-inch quality LP record of Schober Organ music. (\$2.00 refunded with purchase of first kit.)

Name.....

Address.....

City..... State..... Zip No.....

Check No. 141 on Reader Service Card.

Roger Williams: Born Free Kapp Tape KTL 3501

If you happen to know someone who is thinking of opening a marketing school that would include a course on the selling of recordings, tell him about this Kapp production. Any well-thought-out course on marketing light music on tape

or discs could begin with this example by Roger Williams devoted to covering all types of customers with a single pop album. If the class will come to order, we'll run down rapidly all the angles that have been included to give this album maximum marketability. (You'll note the immediate recourse to jargon in a class such as this.) Perhaps the first requirement an album must meet these days is the presence of a well known name. Pianist Roger Williams and his orchestra fill that bill admirably. Important though the name is—if you expect record dealers to stock it in the first place—something else is required for ease in marketing. That's a playing style guaranteed not to offend, puzzle, or disturb anyone. In just about any tempo you can name, the Williams' style is so predictable by now that the listener can do only one thing: relax and enjoy the selections without so much as a vagrant thought crossing his mind. The third marketing element—choice of repertory—is the main reason why this album could be considered a primer in our class. It begins and ends with heavy musical artillery from the sound stages of Hollywood—*Born Free* and *Theme from the Bible*. A male chorus appears in some tunes, female voices are heard in others. The Williams ballad style is heard to best advantage in *Strangers in the Night*. The piano gets fancy in *Dark Eyes*, playful in a novelty such as *Jimmy's Train*, and clinches the argument for variety as a marketing aid with a couple of Latin tunes. An alert student of marketing would also notice that Roger Williams includes a Hawaiian piece that just happens to be Hoagy Carmichael's newest composition. A reviewer can find several other matters of passing interest in this release. The setup of the orchestra is a bit different in that percussion instruments are heard in each channel, surrounding the center piano for some interesting effects. For a tape release, the range of sound is excellent with quite-natural highs and only a moderate amount of reverb for a Roger Williams album. C.S.

**Walter Wanderley: Brazilian Blend
Philips 600-227**

Brazil's No. 1 organist (according to Philips) has been making rapid progress in popularity within our own borders. This record, his first for Philip's, should appeal to a wide audience. It may prove particularly interesting to those familiar with the technical workings of the Hammond-type organ. Even if one's knowledge of this family of organs runs only to a comprehensive collection of records by well known practitioners on the instrument, this Wanderley disc is one which must be in the collection. One trait sets him apart from other organists in the popular field. Wanderley's control of the mechanical functions of the organ could well be a source of amazement to anyone who has tried to tame this type of instrument. Talk about linear output throughout the musical scale! Wanderley's sense of tonal balance converts a home-style organ into what amounts to a new form of instrument.

He's all over the lot in the performance of these fresh-sounding arrangements. At one moment he's leading the moderate-size group of players, the next he's conjuring up new effects that serve as accompaniment to the others. Rhythm and guitar are his mainstay for most of the album, though a saxophone section pops out of nowhere when you least expect it. Not the least of the attractions offered in this release is the wide-open uncluttered sound that Philips gives Wanderley in his premiere recording on the label. C.S.

**Astrud Gilberto: A Certain Smile
Verve V6-8673**

For a change of pace, next time you're playing it cool, try to do so with the help of the young Brazilian artists on this disc. Their qualifications are of the first order. The vocalist, Astrud Gilberto, is the wife of the composer of *The Girl from Ipanema*. The small instrumental group accompanying her is the Walter Wanderley Trio. Together they weave eleven tunes into a tonal fabric that carries a conspicuous "Made in Brazil" tag. This is easygoing fare with the spotlight divided between the cool-voiced Astrud Gilberto and Wanderley's organ stylings. It's intimate entertainment in its more relaxed stages. The voice is very easy to take in the typical insinuating style of Brazilian singing. The selection of tunes, *Summer Samba*, *It's a Lovely Day Today*, and *Call Me*, includes ample variety in tempo and style to make listening to the record seem much shorter in time than it is. C.S.

**Connie Francis: Love Italian Style
M-G-M SE 4448**

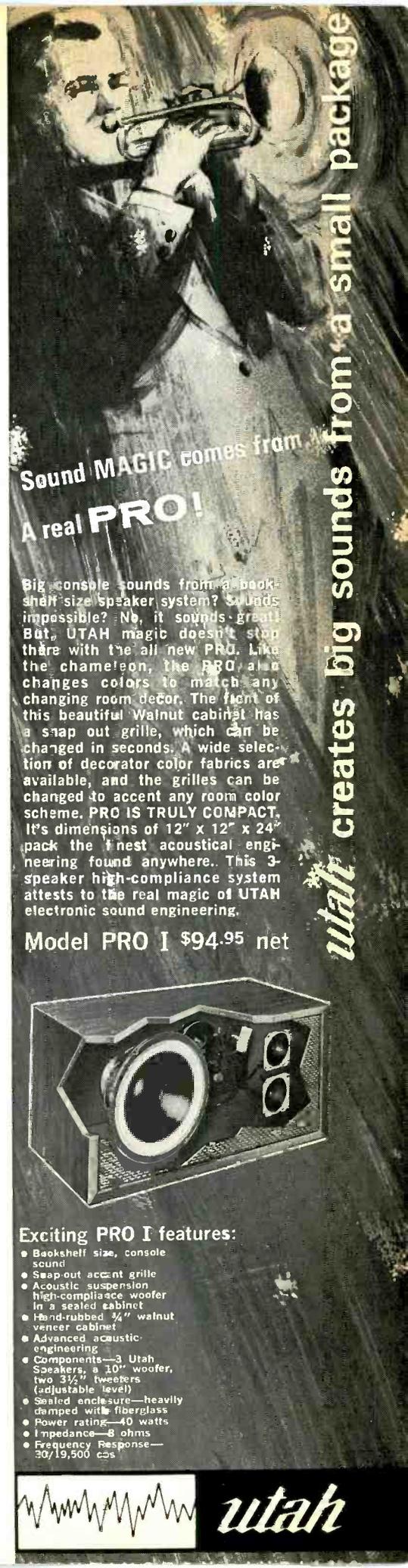
There's a lot of easy listening in this release. Combine a warm-voiced American singer of Italian extraction with a batch of native songs from the old country and you're well on your way to a successful Connie Francis album. Provide an Italian orchestra in the Ricordi Studios of Milan, Italy, and you're over the top with ease. Even as Perry Como did in his recent made-in-Italy album, Miss Francis responds instinctively to the Milanese scene in these arrangements of Italian favorites. Perhaps the easiest way to spot her response is in the several selections that we know fairly well over here—*La Violetera* and *Tango Delle Rose*. Throughout the album, wherever the mood calls for it—and it seems to in everything except a swirling tarantella—Connie Francis adds a slight sob in the voice, apparently the final touch in a true Italian album. C.S.

**Fantasy—Bali, Ceylon and Pakistan:
Music by Saburo Iida. The Philharmony
Orchestra, Tetsusaburo Hirai and Hi-
roshi Ishimaru cond.**

London SW 99379 (stereo).

The Japanese composer Saburo Iida is represented here by three skillfully orchestrated Oriental fantasies, based largely on traditional folk tunes, and descriptive of locales which obviously are exotic even to an Easterner. The suite *Bali Island* is the most ambitious of the

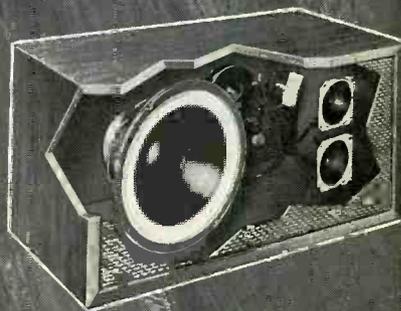
Check No. 151 on Reader Service Card→



Sound MAGIC comes from a real PRO!

Big console sounds from a bookshelf size speaker system? Sounds impossible? No, it sounds great! But, UTAH magic doesn't stop there with the all new PRO. Like the chameleon, the PRO also changes colors to match any changing room decor. The front of this beautiful Walnut cabinet has a snap out grille, which can be changed in seconds. A wide selection of decorator color fabrics are available, and the grilles can be changed to accent any room color scheme. PRO IS TRULY COMPACT. It's dimensions of 12" x 12" x 24" pack the finest acoustical engineering found anywhere. This 3-speaker high-compliance system attests to the real magic of UTAH electronic sound engineering.

Model PRO I \$94.95 net



Exciting PRO I features:

- Bookshelf size, console sound
- Snap out accent grille
- Acoustic suspension high-compliance woofer in a sealed cabinet
- Hand-rubbed 3/4" walnut veneer cabinet
- Advanced acoustic engineering
- Components—3 Utah Speakers, a 10" woofer, two 3 1/2" tweeters (adjustable level)
- Sealed enclosure—heavily damped with fiberglass
- Power rating—40 watts
- Impedance—8 ohms
- Frequency Response—30/19,500 cps

utah

Our tails are always red...

Irish tells you which end is up — automatically. A 30 inch trailer (always in red) and a 30 inch color-coded leader (never in red) eliminates tape stretch and wasting tape footage. Write on the leader and identify reel contents — you'll never have to worry about putting a reel back in the wrong box. We really care about how we make a tape. Irish is a premium quality tape — but costs no more. And there's no charge for the leader, trailer and reversing strips because we believe every good tape should have it.



Automatic metal reversing strips

30" red trailer tells you it's "the end"

30" color-coded leader. Write on it and identify reel contents

"Signature" Book Binding free. Handsomely identifies box contents.

IRISH MAGNETIC TAPE

458 Broadway, New York, N. Y. 10013

Check No. 152 on Reader Service Card.

Live Better Electronically With

LAFAYETTE RADIO ELECTRONICS

NEW! MODEL LR-1200T SUPER DELUXE 120-WATT
SOLID STATE FM/AM STEREO RECEIVER



259⁹⁵

No Money Down
99-0150WX*



NEW! RK-815 SOLID
STATE STEREO
TAPE RECORDER

No Money Down **129⁹⁵**
99-1532WX*

*Imported

FREE

1967 CATALOG NO. 670
Over 500 Pages

Everything in Electronics
For Home and Industry from the
"World's Hi-Fi & Electronics Center"

LAFAYETTE Radio ELECTRONICS
Dept. AC-7, P.O. Box 10
Syosset, L.I., N.Y. 11791

Send me the FREE 1967 LAFAYETTE Catalog 670

AE-7

Name

Address

City

State Zip

Check No. 153 on Reader Service Card.

scores, with conventional instruments colorfully used to evoke the sounds and spirit of vocal chanting, primitive dances, and the gently percussive *gamelan* music. The rhythmic patterns give the suite its most intriguing aspects, but there are also languorous sections of a rather lush, tropical beauty.

The suite *Ceylon Island* is more of the same, this time drawing its inspiration (and melodies) from the softer, more lyric songs of this tiny republic off the southern tip of India. Its second movement, *Ceylon Lullaby*, is an especially gracious miniature. The final suite, in two sections, taps both classical and folk music sources from Pakistan, but it is a bit too obvious in its rhythms, a little too pretentious in its orchestrations, to be entirely successful.

The disc, incidentally, was recorded in Japan, and its sonics are not up to American standards. There is a lack of definition in the orchestral sound, and an over-all muffled quality is no doubt a further contributing factor to the interesting-but-everything-sounds-alike impression of the music itself. R.S.

Music of the West: The Winchester Chorale.

Audio Fidelity AFSD 6164 (stereo).

I don't know what ever became of The Sons of the Pioneers, but their spirit lingers on in the bland, semi-pop stylings of a smallish choir known as The Winchester Chorale. So do their songs, for that matter: the thrice-familiar ballads here include such staples of the Hollywood West as *Cool Water*, *High Noon*, *Tumbling Tumbleweeds*, *The Last Round-up*, and *Wagon Wheels*. It's all quite pleasant, but if Never is heard a Discouraging Word, original musical ideas are in equally short supply. R.S.

Josh White: Folk Songs.

Archive of Folk Music FM 109 (mono).

There was a period in Josh White's career, about fifteen years ago, when he seemed temporarily to lose confidence in his ability to hold an audience by himself. For a while there, every solo concert turned into a group session, with sundry friends and relations called on-stage to share the instrumental and vocal spotlight with him. This set of reissues bears no original recording date, but I would guess that they're of similar vintage—say, 1955 or so. The symptoms are familiar: Josh's scintillating guitar is abetted by brush drums and frequently swamped by an electric organ, and three or four unidentified singers are along for the musical ride on most of the numbers. These complaints having been duly registered (and while I'm at it, I might as well throw in another: the album offers a total of less than 25 minutes of music; a reissue of a 10-inch LP, perhaps?), it must also be said that Josh was in great form. His voice is firm, his manner vibrant, and he sings with a full measure of that deep involvement which makes his blues and ballad performances so distinctive. The song list includes *Evil Hearted Me*, *Go Way from my Window*, *So Soon*, and a particularly fine version of *Bury Me High*. R.S.



The artist at work: Robert Rauschenberg, interviewed in a recent issue of Art in America

have you
discovered
Art in
America?

America's
most
beautiful,
knowledgeable
art magazine

SPECIAL INTRODUCTORY OFFER

Art in America

635 Madison Avenue, New York 10022

Please send me the next six issues (one year) of ART IN AMERICA for only \$8.75, which is \$6.25 less than the normal subscription price. I understand that I may cancel my subscription at any time and receive full refund for all issues not yet mailed.

AI

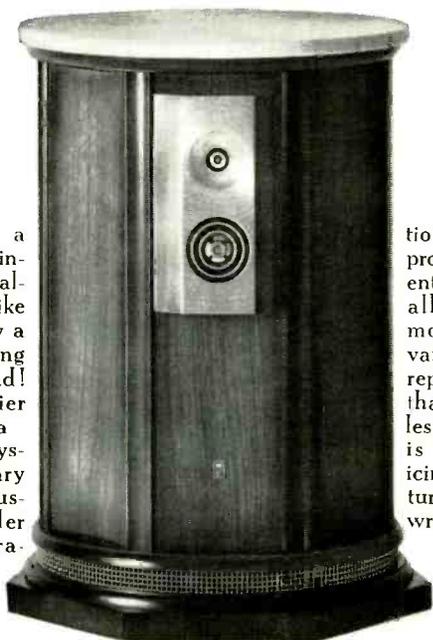
NAME _____

ADDRESS _____

Payment enclosed Bill me later

This is our idea of a well rounded speaker.

Forget the frills of a hand-rubbed walnut finish, statuesque originality and language like that! When you buy a speaker, you're buying performance. Sound! The Royal Grenadier 9000 is our idea of a true-to-life speaker system. Its revolutionary die-cast divergent acoustic lens assures fuller frequency and separa-



tion, plus broader sound propagation across the entire spectrum. All in all, it rounds out the most significant advances in stereophonic reproduction! The fact that we've added a flawless imported marble top is just so much more icing. For color literature and nearest dealer, write:

EMPIRE
645 STEWART AVE., GARDEN CITY, N.Y.

Check No. 155 on Reader Service Card.

Complement your hi-fi interest with an active hobby.

For the novice as well as the experienced model aviation enthusiast **AMERICAN MODELER** each month presents the most complete selection of articles, features and detailed plans of any magazine.

The foremost authorities in the field write on radio control, static scale models, full-scale aviation and trends and developments.

Send the coupon today for your entry into this fascinating hobby.

AMERICAN MODELER, DEPT. AM
1012 Fourteenth St., N.W.
Washington, D.C. 20005

Please send me **AMERICAN MODELER** for the period indicated below. My check (money order) is enclosed.

CHECK BELOW

1 year \$5.25 2 years \$9.00
 3 years \$12.00

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

(This offer good in United States and Canada only; foreign subscriptions, \$7.00.)



- Eskimo Songs from Alaska
Folkways FE 4069 (mono only).
- Kurdish Folk Music from Western Iran
Folkways FE 4103 (mono only).
- Folkways FE 4339 (mono only).

Music of Morocco

You've got to give Folkways credit. At a time when other companies are dreaming up bigger and better ways to update folk music with rock rhythms, flashy arrangements, and "hit" tunes, this haven for the traditionalist is still releasing authentic field recordings from lands around the world. The albums noted here are unique and fascinating documents of the musical life of three distinctive geographical areas, as valuable to the folk scholar as they will be distressing to the casual listener. The rough voices, the endlessly repetitive rhythms, the strange (to our ears) harmonies, and the raucous instrumental sounds just don't make it as background music!

The Iranian album offers the greatest variety, both of instrumental textures and vocal types, and thus is the least likely to set your teeth on edge. There are, in fact, some highly intriguing bardic songs that seem almost Hebraic in their sinuous cantillations, and some instrumental duets on tar (a kind of lute) and dimbek (a kind of drum) which have the compelling strength of Indian music. The album is also the most clearly recorded of the three, and by a good margin.

The Eskimo pieces were recorded at two village "sings," and are unaccompanied save for heavily rhythmic drum beats. There are some solos, but mostly everybody joins in, community style, lending a certain primitive urgency to the proceedings. Included are ancient, traditional material, along with such more modernized numbers as a *Helicopter Song* and even *Eskimo Rock n' Roll* (which, I must confess, I found indistinguishable from the older songs).

The Moroccan disc, comprising dance rhythms also exclusively, and marred by out-of-focus sound, is the least accessible of the three, and consequently the most monotonous to the uninitiate. R.S.

All About Love: Father Columba McManus.

Audio Fidelity AFSD 6169 (stereo).

Ever since the Singing Nun proved that there was hit potential in that old-time religion, record companies have been issuing sacred-songs-in-folk-style performed by musically minded men and women of the cloth. This disc goes a step further, in that Father McManus (an ordained priest in his native Canada) sings not only of the sublimated love for God and country, but of the passionate love of man for woman. Crooning with a gentle, liquid tenor, and backed by a lightly swinging accompaniment of guitars, bass, and drums, McManus makes a persuasive purveyor of such varied fare as *More, Yesterday*, the lovely *Fantastiks* romance, *Try to Remember*, and the Cuban *Guantanamera*. He doesn't have nearly the dramatic range to capture the

full flavor of such a tight-knit song as Jacques Brel's *Ne Me Quitte Pas* or so intensely poignant one as Pete Seeger's *Where Have All the Flowers Gone*, and he shares with some of his professional colleagues a propensity for sliding slightly off pitch at times, but for the most part, Father McManus has given us a most agreeable musical insight into what he calls "the sweet and bitter-sweet joys of human relationships." R.S.

The Spy with a Cold Nose. Music from the original soundtrack by Riz Ortolani. Columbia OS 3070 (stereo).

It's a lightweight, mixed-up score that Riz Ortolani has concocted for what apparently is a lightweight, mixed-up spoof of secret-agent movies. The short movements dart bewilderingly from mood to mood, and it takes a better man than I (or at the very least, one who has seen the film) to make order out of the musical chaos that juxtaposes upbeat discotheque numbers, perky guitar solos, sentimental serenades, an ersatz bit of English pomp and ceremony, a dollop of Russian gypsy music, and various other items even less susceptible to specific description. R.S.

Songs of Italy. Ettore Bastiannini. London International SW99412 Stereo

I suppose it will always be fashionable for opera stars to attempt popular/folk singing. After all, some have done quite well at it. Ettore Bastiannini here hurls his dramatic baritone at ten Italian songs. He leads off with three powerhouses: *O Sole Mio*, *Marechiaro*, and *Torna A Surriento*—and he never lets up from there. He seems determined to prove that he can sing as loudly as anybody. The fact that he also sings well is quite beside the point. He is certainly in good musical form: every note is on pitch. There is even a good degree of intelligence in his singing, but it is not enough. This album simply fails to catch fire, yet there is nothing that can be called bad.

The backings are by an anonymous orchestra that plays properly, provides good rhythm background and like the rest of the effort fails to be distinguished in any way. R.L.L.

December 7, 1941
The New York Times Mono

The date that is this album's title is clue enough to its content. But what it cannot convey is the extreme worth of this album. The assembly is by Bud Greenspan working with the resources of the Times.

In addition to the one record there is a 12-page supplement that reproduces pages of the Times immediately before and after that fateful day. The set is only available directly from the Times.

Narrator David Perry ties together the events that led to the bombing of Pearl Harbor. Liberal use of the voices that made the history of the time is made. You will hear Roosevelt's first draft pick—including the anguished cry of a mother: some of the repartee between Roosevelt and Willkie during the third term campaign; Lindbergh speaks out against in-

volvement; the Japanese peace envoys in Washington; and the radio break-in of the attack.

There is much more to be sure. Most memorable is the rarely heard complete address of FDR to the Congress on December 8. It takes six minutes and it is a high point of American rhetoric.

The production takes us through the days leading up to the attack and shows, with the advantage of history, what went on on both sides during those days. The narration is conservative and tight. The production moves along, never bogging down in sentimentality. In short it should be required listening—no one should ever

forget that "day that will live in infamy." R.L.L.

Songs from Old Russia. Various Artists London International TW 91424 Mono
Cossack Songs from the Don. Don Cossack Choir, Serge Jaroff, director. London International SW 99423 Stereo

Here are two from London International's Russian files. The first named is a hodge-podge of Russian folk-tunes featuring either the Balalaika Orchestra conducted by Alexander Bochensky, or the Black Sea Cossack Choir, or even the Don Cossack Choir—the same that has the second-listed disc all to itself.

These two are cut from the same mold.

THIS UNIQUE COLLECTOR'S RECORD COSTS \$3.00



TOMORROW IT MAY BE PRICELESS

The first of its kind, this record conveys a completely different musical concept. It is performed on a revolutionary new musical instrument called Explorer. A remarkable instrument, Explorer plays the part of various strings, reeds, brasses, and some percussive instruments.

The discriminating collector knows how the value of an original recording will improve with the years. Especially when performed by an entirely new principle.

The record will be priceless in more ways than one. It is also of great listening interest. Listen closely to "Granada". You'll swear that a group of flamenco guitars are playing with the time variance of individual performers. "Explorer Theme" on side two could preview the Sound of the Seventies. "Never on a Sunday", "Mr. Bach Meets Batman", "Caravan", and others are all played using a selection of instrumental tones that will delight all ears.

Friends will never guess that only two fine musicians are performing—and one is a drummer. The Explorer and an Allen Theater Organ are played simultaneously by Tom Hazleton; Gene Cizek contributes with percussion.

The Explorer is not a modified electric organ, uses no re-recording techniques, and isn't dependent upon programming for its sound.

You will agree this record presents a remarkable new musical concept. Available only in super-fi stereo as a limited edition. It costs just \$3.00. A small price to pay for posterity.

ROCKY MOUNT INSTRUMENTS, INC. DEPT. A, ROCKY MOUNT, N.C. 27801
A SUBSIDIARY OF ALLEN ORGAN COMPANY

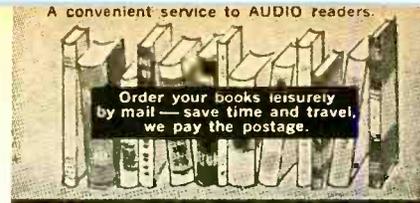
ROCKY MOUNT INSTRUMENTS, INC. DEPT. A, ROCKY MOUNT, N.C. 27801
I would like to hear this unique record. Enclosed is \$3.00 for each one ordered.

QUANTITY _____ (available only in stereo) AMT. _____

Name _____

Address _____

City _____ State _____ Zip _____



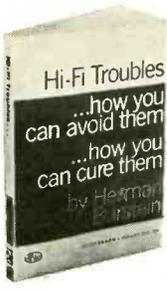
Maintaining Hi-Fi Equipment
Joseph Marshall
 A valuable reference for anyone whose living or hobby is servicing hi-fi equipment. Outlines the professional approach for servicing all types of hi-fi components. Covers trouble-shooting of electronic, mechanical and acoustic problems. 224 pages.
No. 58 Paperback \$2.90*



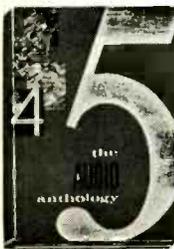
Designing and Building Hi-Fi Furniture
Jeff Markel
 Written by a professional hi-fi furniture designer who has taught furniture design at leading colleges, this book is an authentic reference of value to the hi-fi fan and professional custom builder. Covers everything from types of woods to furniture finishing for the mechanically adept; design principles, styles and arrangements for the decor minded. 224 pages.
No. 79 Paperback \$2.90*



HI-FI TROUBLES
 By Herman Burstein
HOW YOU CAN AVOID THEM HOW YOU CAN CURE THEM
 Just published! At last, a book which deals directly with the problems you face in maintaining your audio system in peak condition. Tells you how to locate troubles, what to do about them and how to do it—and, just as important: what NOT to do. Helps you to achieve the best in listening pleasure from your equipment.
No. 120 \$3.95



The 5th AUDIO Anthology
 Edited by C. G. McProud, publisher of AUDIO. An anthology of the most significant articles covering: stereo recording and reproduction; stereo multiplex; measurements; stereo technology, construction and theory — which appeared in AUDIO during 1958 and 1959. The 5th is truly a collectors' item and a valuable reference for the professional engineer, teacher, student, hobbyist and hi-fi fan. 144 pages.
No. 125 \$3.50



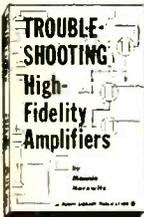
The 6th AUDIO Anthology
 Edited by C. G. McProud, publisher of AUDIO. Includes articles on the two most significant milestones in the field of high fidelity: FM STEREO and TRANSISTORS IN AUDIO EQUIPMENT. A meaningful reference for everyone in the fields of audio engineering, recording, broadcasting, manufacturing and servicing of components and equipment. A necessary book for the high fidelity enthusiast. 144 pages.
No. 130 \$3.95



"The AUDIO Cyclopeda"
Howard M. Tremaine
 • 1280 pages
 • 3400 topics
 • 1600 illustrations
 Here is one single volume with the most comprehensive coverage of every phase of audio. Concise, accurate explanations of all audio and hi-fi subjects. More than 7 years in preparation—the most authoritative encyclopedic work with a unique quick reference system for instant answers to any question. A vital complete reference book for every audio engineer, technician, and serious audiophile.
No. 123 \$19.95*



TROUBLESHOOTING High Fidelity Amplifiers
Mannie Horowitz
 Written specifically for the serviceman and audio hobbyist who wants to get into the profitable field of stereo hi-fi service. 12 fact-filled chapters with a plain and simple approach to troubleshooting all types of stereo and mono amplifiers—a direct text on curing both, vacuum tube and transistorized amplifier ills. Easy to read—includes data on test instruments and procedures. 128 pages.
No. 128 \$2.95



McProud High Fidelity Omnibook
 Prepared and edited by C. G. McProud, publisher of Audio and noted authority and pioneer in the field of high fidelity. Contains a wealth of ideas, how to's, what to's, and when to's, written so plainly that both engineer and layman can appreciate its valuable content. Covers planning, problems with decoration, cabinets and building hi-fi furniture. A perfect guide.
No. 115 \$2.50*



SOUND in the THEATRE
 First book of its kind . . . nothing like it has ever been published before! It is an authoritative text on electronic sound control for theatres, auditoriums, concert halls and other large enclosed areas where the source and the audience are present together. Contains complete procedures: For planning, assembling and testing sound control installations — Articulating sound control with other elements of production — Operation and maintenance of sound control equipment. Describes and illustrates 32 specific problems.
Harold Burriss-Meyer and Vincent Mallory
No. 126 \$6.95



SAVE • MONTHLY SPECIAL • SAVE

Save over 35% with this collection of AUDIO books
 5th AUDIO ANTHOLOGY (\$3.50) — 6th AUDIO ANTHOLOGY (\$3.95)
 McProud HIGH FIDELITY OMNIBOOK (\$2.50)
 TROUBLESHOOTING HIGH FIDELITY AMPLIFIERS (\$2.95)

Total Value All Four Books . . . \$12.90

YOUR COST ONLY . . . \$8.95 POSTPAID in U.S.A. & Canada
CIRCLE OS500

This Offer good only on direct order to the Publisher

AUDIO Bookshelf
 134 N. 13th Street, Phila., Pa. 19107

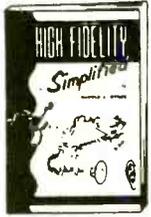
*All U.S.A. and Canadian orders shipped postpaid.

Please send me the books I have circled below. I am enclosing the full remittance of \$..... (No C.O.D. or billing.)

58	79	115	120	123	125
126	128	130	142	251	OS500

NAME _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

High Fidelity Simplified
Harold D. Weiler
3rd Edition
 The complete hi-fi story — answers all questions about tuners, changers, amplifiers, tape recorders, speakers, record players, etc. Lots of ideas for custom installations. Tells how to achieve concert hall reception in your home. 216 pages.
No. 142 \$3.30



Getting The Most Out Of Your Tape Recorder
Herman Burstein
 Written in "plain talk" for the man who has, or wishes to buy, a tape recorder. It answers the myriad questions raised by tape recording enthusiasts. Its chapters cover every phase of operation and maintenance—from adding a tape recorder to the hi-fi system, to a thorough dissertation on microphones. Lots of practical information on how to buy. 176 pages.
No. 251 \$4.25



They are not true folk performances so there is no appeal on this score. Then they are not so magnificently performed that this can be called out as a prime virtue (although the Don Cossacks are certainly professionally polished).

In short, these are two albums for listeners looking for old-home-type Russian fare. It can be occasionally exciting but it is mostly so-so. Too bad, because the recordings are excellent. R.L.L.

The Night of the Generals: Original Film Soundtrack, with music composed and conducted by Maurice Jarre.

Colgems COSO 5002 Stereo

If you missed Maurice Jarre's tension-filled backdrop for the film *Is Paris Burning?*, or would like to hear it again, try *The Night of the Generals*. Actually, it's an effective score, well-constructed and enhanced by the French composer's flair for colorful orchestrations. But the music adheres so closely to the harmonic and thematic formulas of such earlier Jarre pieces as *The Train*, *The Collector* and, as noted, *Is Paris Burning?* that one is hard put to differentiate among them. If you don't know the others, of course, this one will do nicely. R.S.

From Nashville With Love: Chet Atkins, guitar solos with Orchestra; arrangements by William K. McElhiney.

RCA Victor LSP 3647 Stereo

Chet Atkins, Tennessee's "Mr. Guitar," turns his fluid fingers to what is generally known, back East, as mood music. Very appealing mood music too, since the arrangements are tastefully relaxed, and Atkins' rambling guitar figurations blend warmly with the accompanying strings. The songs do not emerge with much individual personality, but then again, it might spoil the over-all mood if they did. On the list: *I Love Paris*, *Song from Moulin Rouge*, and such latter-day country-and-western favorites as *Something Tender*, *After the Tears*, and *Stranger on the Shore*. R.S.

Folk Songs: Gordon Bok.

Verve-Folkways FT 3016

In a quiet, unassuming, almost retiring way, Gordon Bok establishes himself as a major new folk talent. His debut disc is, perhaps, a bit overlaid with sad, moody songs, but there is a warmth of expression here, a sense of total involvement that is consistently rewarding. This applies both to such traditional British material as *Johnny Todd*, *Call the Ewes*, and *Rosin the Beau*, and a number of Bok originals. *Herring Croon* is an especially affecting ballad in the latter category, and Bok's sea-going heritage (he has spent most of his working life aboard ship or at harbor installations) is reflected in two other impressive maritime songs, *Acalanto* and *Fundy*. His expert guitar and laud accompaniments add a further note of distinction to these sensitive performances. R.S.

if you relax with records... Look for the ELPA Endorsement!



When you see the Elpa Seal of Endorsement on a component you can be assured that it is of highest quality and has successfully satisfied Elpa's stringent design and performance standards. THORENS superb turntables, ORTOFON cartridges, and CECIL E. WATTS record cleaning equipment all carry the Elpa seal and can be purchased with complete confidence. Write for the Elpa catalog, Dept. 9A5, Elpa Marketing Industries, Inc., New Hyde Park, New York 11040

THORENS / *Ortofon* / CECIL E. WATTS Ltd.



Check No. 158 on Reader Service Card.

the price is the same \$239.95
(as the former model TK-60)

only the value has increased
in the new model
KENWOOD TK-66



60 watts • AM/FM Solid State FET* Stereo Receiver

* Field Effect Transistor FM 4 gang front-end • 5 IF stages • Interstation muting circuit • All silicon transistor amplifier provides wide frequency range • Blow-out free exclusive automatic circuit breaker protects power transistor (U. S. Pat.) • Handsome simulated walnut finish cabinet included in price of unit plus many other features • Two year guarantee.

Visit your nearest KENWOOD franchised dealer and check the added value of model TK-66, or write to us direct for complete illustrated brochure.

...the sound approach to quality  **KENWOOD**

Los Angeles Office: 3700 S. Broadway Plc. Los Angeles, Calif. 90007
New York Office: 69-41 Calamus Avenue, Woodside, New York

Check No. 159 on Reader Service Card.

Jazz and All That

Bertram Stanleigh

Leonard Feather: Encyclopedia of Jazz (in the Sixties) Volume One, The Blues
Verve Stereo V6-8677

Horizon Press has just published, or is about to publish, an *Encyclopedia of Jazz in the Sixties*. Notes to this new Verve release do not quite manage to clarify whether Leonard Feather is author or editor of this new reference work. But the present recording is the first of a series of recorded companions to the text. It is a great record—absolutely superb. Each of its six bands offers a splendid

performance by top flight jazz artists, and the sound is sheer perfection. Any faults I have to find with this release have to do with the pretentiousness of its title and the scantiness of its contents. Six tunes by four instrumental groups of varying size is hardly an encyclopedic survey, and all the examples chosen turn out to be within the mainstream. There are no back glances toward the traditional or looks ahead into the angry experimental. One side is made up of performances by a big band organized specially for

this series. Headed by Oliver Nelson, whose arrangements it performs, it features an awesome array of big name talent, and its performance is brilliant. It contributes versions of *St. Louis Blues*, Feather's own *I Remember Bird*, and *John Brown's Blues*. Side 2 consists of *OGD* with Jimmy Smith, Wes Montgomery, and Grady Tate; *Blues for Eileen*, played by Count Basie and his Orchestra; and *C Jam Blues*, performed by Earl Hines, Johnny Hodges, Kenny Burrell, Richard Davis, and Joe Marshall. Any list of major omissions from this purported survey of the blues since 1959 would be far too lengthy for inclusion here, but it is very strange that room could not be found for at least one vocal blues. Certainly space limitations cannot be cited as a reason. Side 1 runs 15 minutes and 55 seconds; Side 2 is 16 minutes and 5 seconds. Maybe additional volumes on the blues are forthcoming, but it is difficult to understand why a bit more material could not have been incorporated in Volume 1. B.S.

Ray Charles: A Man and His Soul
ABC Stereo 590-X

This is a two-disc album reissue of some of Ray Charles' greatest hits on ABC. Fourteen photographs, a detailed discography of all of his Atlantic and ABC recordings, and a neatly written biography are among the several pages bound into the center of this handsomely designed collection. Twenty-four numbers are included, among them such successes as *I Can't Stop Loving You*, *Hit the Road, Jack*, *Ruby*, *Takes Two to Tango*, *Baby, It's Cold Outside*, and *One Mint Julep*. The full variety of styles of which Charles has demonstrated his mastery are represented in the group of selections, and the combination of choice material and attractive packaging makes this the ideal choice from among the many Charles discs available for anyone who does not already own these recordings in their original form. The superb musicianship of this fabled entertainer hardly needs emphasis. It has never had a better showcase than this new set. B.S.

Bill Evans: A Simple Matter of Conviction
Verve Stereo V6-8675

Playing with Shelly Manne, drums, and Eddie Gomez, bass, Bill Evans offers another memorable session. The title tune as well as three others are original Evans material. In addition, he turns his special reflective attention to *Stella by Starlight*, *Laura*, *Melancholy Baby*, *I'm Getting Sentimental Over You*, and *Star Eyes*. As is the case with everything this exceptional performer touches, he manages to add new depth to each familiar number. Such matters as brilliant technique are wholly subordinated to the strong communication he imparts. Both Manne and Gomez do a fine job of backing this magnificent pianist, but they have far less to say, and the stereo balance quite properly focuses attention on Evans, where it belongs. B.S.

There's more to Art than meets the ear.

theARTgallery magazine
Keeps you in tune with the VISUAL arts.
Subscribe or send for a free sample copy.



send this coupon now!

NAME _____
PLEASE TYPE OR PRINT

ADDRESS _____

CITY _____

STATE _____ ZIP _____

- Enclosed is \$5 for a one year subscription via first class mail (foreign \$8 via air mail)
- Please send a free sample copy

theARTgallery MAGAZINE
IVORYTON, CONNECTICUT 06442

Walter Wanderley Trio: Cheganca
Verve Stereo V6-8676

Just last month, Wanderley was collaborating with his compatriot, Astrud Gilberto, in *A Certain Smile, a Certain Sadness*. Here he's back again with his electric organ and percussion in a collection that features a number of Brazilian delights by Antonio Carlos Jobim, Vinicius de Moraes, Luiz Bonfá, Carlos Lyra, and some less familiar bossa nova creators. Bright, fresh tempi, a variety of percussion sounds, and bubbling good humor are all abundantly present in this crisply recorded, airy diversion. B.S.

Harold Vick Orchestra: The Caribbean Suite

RCA Victor Stereo LSP 3677

In 1953 a British group, called the Afro-Cubists, recorded a set of tone pictures of islands in the Caribbean. The suite seems to have made a strong impression on Harold Vick who devotes eight numbers from his first Victor release to selections from the Kenny Graham composition. The music is filled with the saucy rhythms of the islands, bright, Latin percussion, and atmospheric harmonies. It gets a crisp, energetic performance from Harold Vick, tenor, Blue Mitchell, trumpet, Bobby Hutcherson, vibes. Al Dailey, piano, Everett Barksdale, guitar, Walter Booker, bass, Mickey Roker, drums, and Montego Joe and Manuel Ramos, percussion. B.S.

Chris Connor Now!

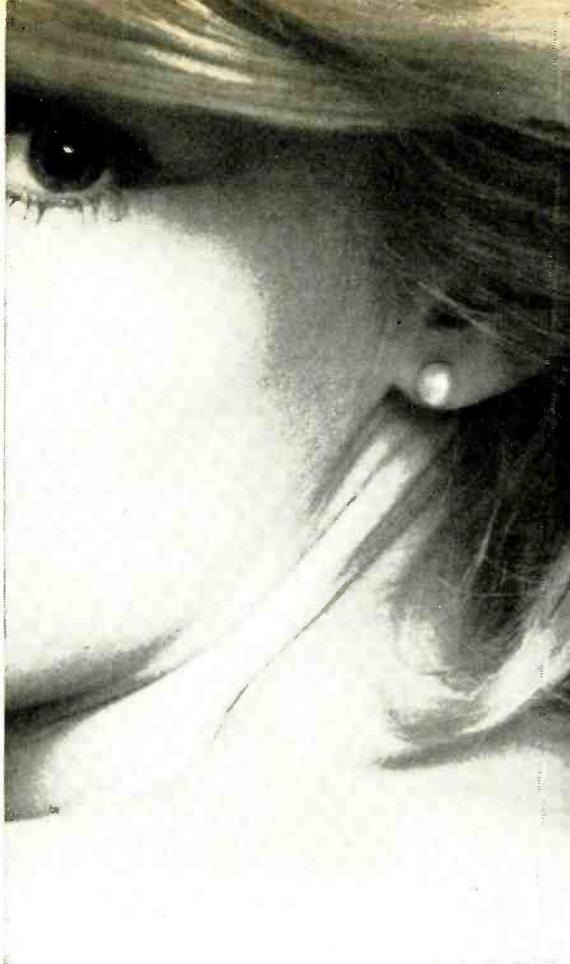
ABC Stereo ABC-S-585

With lots of echo and a new romantic approach to her material, Chris Connor is back again. Gone is that special angular manner of breaking up a phrase or emphasizing a syllable to accent the rhythm. Gone, too, is that super-intensity, that quality of vital necessity, that was unique to this singer. Without those special characteristics Chris sounds like a pleasant-voiced singer who knows her way around a ballad. To some rather elaborate arrangements by Don Sebasky, she sings *Goin' Out of My Head, Carnival, The Boys From Madrid, Love Life, Never on Sunday, Autumn, You're Gonna Hear From Me, The Shining Sea, I'm Telling You Now, Nowhere Man, Strangers in the Night*, and *Who's Afraid*. It's good to have Chris back on records, but can't we have some more challenging material? B.S.

Clancy Hayes: Live at Earthquake McGoon's

ABC Stereo ABC-S-591

Clancy's repertory includes some of the finest jazz, ragtime, blues, and old time favorites, and his rough, ready banjo style and voice are quite adequate for evoking nostalgic memories of other times and other performances of this music. The present set contains such gems as *Tishomingo Blues, I Ain't Gonna Give Nobody None of this Jelly Roll, Blues My Naughty Sweetie Gives to Me, My Little Bimbo Down on the Bamboo Isle*, and more than a dozen other tunes from the early part of this century. Turk Murphy's band backs Clancy in a lively, traditionally apt manner. B.S.



Go Ahead

Be
Selfish

ENJOY THE PURE SOUND
OF PERSONAL HI-FI WITH
SUPEREX WOOFER/TWEETER
STEREO/PHONES

Definitely, yours alone. All the advantages of a fine stereo "speaker" system — at your ears. With woofers, tweeters, crossover networks . . . exclusively Superex. No distractions, speaker placement or room acoustic problems. Just rich, clear, full-range response — the way it should be! Go ahead . . . pamper yourself with Superex. Your hi-fi dealer will be glad to help.

SUPEREX
stereo/phones

SUPEREX ELECTRONICS, 1 RADFORD PLACE YONKERS, N.Y.

Illustrated "The Pro"
approx \$50
Other Superex
Headsets
start at \$16.95



Check No. 160 on Reader Service Card.

The Watersons: Frost & Fire

Elektra Stereo EKS 7321

A collection of early English ceremonial folk songs sung by a family of four highly convincing performers who seem to have captured the essential style and enthusiasm of each selection. Among the better known contents are *Here We Come A-Wassailing, The Derby Ram*, and three numbers collected by Cecil Sharp: *Jolly Hawk, John Barleycorn, and Herod and the Cock*. Much of the material has been in constant performance since the Middle Ages. The recording was made in London by Topic, the leading folk recording company in Britain. While its recordings are generally less brilliant in sound than those generated by Elektra, the present disc is a quite adequate example of clean, studio recording. And the fascinating material, performed with such direct, artless charm, makes this collection a genuine treasure. B.S.

your own reference library
CLOTH BOUND BINDERS



\$4.95
post paid
HOLDS
12
ISSUES
OF
AUDIO

The valuable information in this publication will continue to serve you, month after month, year after year, when you file each issue in this easy-to-use, stiff-cover binder. Keep your copies safe from damage, safe from dust and discoloration, yet instantly available. Binding mechanism makes it simple to insert new issues, yet holds 12 copies firmly. Attractively finished in green cloth, with the publication title stamped in gold. Check must accompany order.

Order from AUDIO
134 North Thirteenth Street
Philadelphia, Pa. 19107

TO OUR READERS

A new post office directive requires publishers to pre-sort magazine mailings by 5-digit zip codes. In order to ensure the same prompt delivery of your copy of Audio, please check the address label from this issue. If it does not contain the 5-digit zip code, please write it in and mail it back to Audio, 134 N. 13th St., Phila., Pa. 19107.

Assure 100%
**COMPLETE
ERASURE**
of Recorded Tape
ON THE REEL



Use the

Magneraser®

— the Original and still the best!

Quickly erases a reel of magnetic tape or sound film of any size or type. Erasure is 100% complete even on severely overloaded tape. Lowers background noise level of unused tape 3 to 6 db. Also demagnetizes record-playback and erase heads. Only \$24.00. Two-Year Guarantee. Available at your dealer's or write us.

New ULTRA-SENSITIVE FLUTTER METER



With built-in Three-Range Filter, 3 kc Test Oscillator, High Gain Pre-amplifier and Limiter. Filter Ranges: 0.5 to 6 cps; 0.5 to 250 cps; 5 to 250 cps.

Designed for rapid visual indication of flutter and wow. Meets standard, set by the IEEE... Condensed Specs.: Inpu Voltage, 0.001 to 300 Volts; Ranges, 0.01 to 3%; Limiter Range, 20 db.; Oscillator (built-in), 3000 cycles; Net Price, \$495.00... Write for complete specifications and free 12-page booklet on Flutter.

AMPLIFIER CORP. of AMERICA

75 Frost St., Westbury, N. Y. 11590 • (516) 333-9100

Check No. 163 on Reader Service Card.

YL ACOUSTIC CO., LTD.



A
NEW
EVOLUTION IN
SOUND

YL HORN SPEAKER
COMPONENTS

Check No. 164 on Reader Service Card.

CLASSIFIED

Rates: 25c per word per insertion for noncommercial advertisements; 50c per word for commercial advertisements. Rates are net, and no discounts will be allowed. Copy must be accompanied by remittance. Closing date is the FIRST of the second month preceding the date of issue.

SERVICES

RECORDING SERVICES—Tape, Disc, and Duplication, including Norelco Carts. Fast Service, Reasonable Rates. Jones and Associates, Box 142, Dayton, Indiana 47941.

HIGH FIDELITY SPEAKERS REPAIRED
AMPRITE SPEAKER SERVICE
168 W. 23rd St., New York, N. Y. 10011
CH 3-4812

TAPE DUPLICATING. Low prices. Any quantity. G&G Recording Service, Box 412, Peekskill, N. Y. 10566.

HI-FI SPEAKERS REPAIRED
OLD SPEAKERS UPDATED
AUDIO SPKR TECHNICS
#3 Walker St., New York, N. Y. 10013
CA 6-7785

CUSTOM RECORDING SERVICE—Tape or disc recordings made from live or recorded material. High quality. Reasonable rates. Audio-Tech Laboratories, 2819 Newkirk Avenue, Brooklyn, N. Y. IN 9-7134.

PROTECT YOUR LPS—Heavy poly sleeves for jackets 5c, Round bottom for records 3c, New LP jackets, White 20c, Colors 25c. Min. order \$5.00. LP Supplies, Hillburn, P.O. New York.

FOR SALE

KIT EXPERTS—Dynaco Specialists—Kits at reasonable prices are our specialty. Also custom-wired kits guaranteed to exceed factory standards at substantial savings. Beautiful hand-crafted Walnut cases for complete Dynaco line, plus everything in audio. Kitcraft, Dept. A567, 738 Washington Avenue, Brooklyn, N.Y. 11238. MA 2-5230.

HARPSICHORD: Same as owned by Philadelphia Orchestra and RCA Victor. In kit form for home workshop assembly, \$150. Clavichord kit, \$100. Free brochure. Write: Zuckermann Harpsichords, Dept. R. 115 Christopher St., New York, N. Y. 10014.

TAPE RECORDERS, Hi-Fi components, Sleep Learning Equipment, tapes. Unusual Values, Free Catalog. Dressner, 1523T, Jericho Turnpike, New Hyde Park, N. Y. 11040.

FOR SALE

"CROWN" Professional Recorders: New and used. Reasonable prices. Wiegand Audio Labs, 221 Carton, Neptune, N. J. 07753.

DISC RECORDING EQUIPMENT: Cutter-heads, Recording Amplifiers, and Lathes. New and used. From Rek-O-Kut to Scully. Send requirements. Wiegand Audio Labs, 221 Carton, Neptune, N. J. 07753.

ALTEC LANSING franchised dealer. Price list and brochure sent upon request. Superior Sound, 621 So. Main St., N. Syracuse, N. Y. 13212.

FREE! Send for money saving stereo catalog AM and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 West 20th St., New York, N. Y. 10011.

SHACKMAN ELECTROSTATIC SPEAKERS. British. 180° dispersion. This midrange treble can be used with any woofer. Brochures, reports, and prices sent on it and full-range systems manufactured in Canada. Olson's Audio House. Box 1075. Wetaskiwin, Alberta, Canada.

CITATION "A" good condition. See AUDIO reports 10/62 and 4/63. \$175.00 w/cabinet. Robert E. Raymond, 730 West Washington Ave., South Bend, Ind. 46601.

MARANTZ 7C \$200. MARANTZ 8B \$200. Units still under warranty. John Woods, 109 Johnson Circle, Clarkesville, Tenn. 37040.

FOR SALE—Paraboloid microphone mounts. **TAPERS:** make your own wild-life recordings of birds, animals and nature sounds. Several sizes I have used last three years. Eighteen to forty inch, mostly short focus for portability so you can take the tools to the subject for real adventure and best signal/noise recording. Send stamped, addressed envelope for descriptions. Carl Frank, Creeknoll, Route 1, Rochester, Minnesota, 55901.

JBL S7R speaker system. Custom built, rock solid enclosures (7 cubic feet). Teak trim. Matched pair, \$800 firm. R. A. McCormack, 414½ Carnation, Corona del Mar, Cal. 92625.

FAIRCHILD COMPANDER, Model 510 Ser. No. 2947. Factory rechecked, \$35, including shipment. Alex Martin, 5642 Macey St., Cincinnati, Ohio 45227.

ATTENTION EXPERIMENTERS! New HAMMOND Stereo-Mono reverberator mechanisms—\$7. Net. Cal's, Box 234, Dearborn, Michigan 48121.

FOR SALE

JBL THEATRE SPEAKERS: Two C-55 Cabinets W/033 speaker systems. \$1500.00. N. Hakken, 811 Beaconsfield, Grosse Ple. Park, Mich., 48230, VA 4-1269.

TAPE RECORDERS direct from importer. Three-motor, six-head, automatic reverse. Famous make. Also battery for A.G.C. All solid state. Write for special prices, duty paid. DOK (USA) INC., AU Box 2494, Culver City, California 90230.

Sale: Klipschorn, K-7, Mahogany finish, with latest drivers including latest woofer, mid-range horn, mid-range driver, tweeter, balancing network. \$525.00.

Tom Groom
324 North Spring St.
Murfreesboro, Tenn. 37130

EQUIPMENT WANTED

WANTED. Audio Baton (Blonder Tongue) & Fairchild Componder or Equalizer System. State Price, Make & Condition: Guy Arthur, RFD #1, Box 408C, St. Joseph, Michigan 49085.

WANTED: FAIRCHILD COMPANDER. ROBERT HAWKINS, 434 West 120th, N.Y.C., 10027.

WANTED: Fisher MPX-50 plug-in adaptor. Dana, Box 596, Marblehead, Mass. 01945.

WANTED: Two Fairchild Capacitor Microphones. Donald Bisbee, 685 South Roys Ave., Columbus, Ohio 43204.

WANTED: Pair KLH-9 or AR used speakers. Dave Mosemann, Manheim, Pa.

2 KLH SPEAKERS. Please state age, condition and price. Arthur A. Pesaturo, Jr., 122 Isabella Ave., Providence, Rhode Island 02908.

WANTED: J. B. Lansing Speaker Enclosure System #C-34-001. Paul Mayer, 6460 Honeysuckle Dr., Cincinnati, Ohio 45230.

WANTED—ONE ALTEC TUNER Model 206A or 204A. If you have any Altec tuners, let me know. Arden Robl, 308 Ohio St., Oshkosh, Wis. 54901.

WANTED CITATION II
Orlando V. Ramirez
P.O. Box 627
Mayaguez, P.R. 00708

WANTED — MISC.

WANTED for historical collection: early (1915-1935) loudspeakers, microphones, phonographs, broadcast monitor receivers, transcription equipment, theater sound equipment, wax disc cutting equipment, etc. Curtiss R. Schafer, RFD 1, Newtown, Connecticut 06470.

COLLECTOR desires JAZZ airshots, other rare material, especially mainstream, and blowups. Jeff Lowenthal, 9040 Federal Court, Des Plaines, Ill. 60016.

EMPLOYMENT

HELP WANTED

ACOUSTIC ENGINEER, position with growth potential. Responsibilities include design of acoustic and transducer components, speakers, and systems. BSEE or BS in Physics plus four years related experience. Send resume and salary history to Personnel, LTV Ling Altec, Inc., 1515 So. Manchester, Anaheim, California. An Equal Opportunity Employer.

POSITION WANTED

AIR FORCE VETERAN: Desires job as High Fidelity Salesman; extensive Practical Knowledge in High Fidelity. Experienced Audiophile. Martin Caulfield, 4026 68th Street, Woodside, N. Y. 11377.

MSEE GEORGIA TECH, 1966, BSEE Mississippi State University 1965. Tau Beta Pi, Eta Kappa Nu. Desire technically challenging work in audio field. Jim Harden, 28 Paradise Ct., Palm Bay, Fla. 32901.

TO OUR READERS

A new post office directive requires publishers to pre-sort magazine mailings by 5-digit zip codes. In order to ensure the same prompt delivery of your copy of AUDIO, please check the address label from this issue. If it does not contain the 5-digit zip code, please write it in and mail it back to AUDIO, 134 N. 13th St., Phila., Pa. 19107.

NOW...PERFECT FM

ELIMINATE

FM

INTERFERENCE!

With the Sensational

New! FINCO

FM BAND PASS FILTER



ENGINEERED TO
MOUNT ANYWHERE

Get only pure FM signals. Use a Finco FM Band Pass Filter to stop interference and block out unwanted signals from T.V., Citizens Band and Amateur transmitters, motors, autos and fluorescent lamps. Size: 4 1/4" x 2" x 1 1/2". Available at your Finco Hi-Fi dealer. Satisfaction guaranteed!

Model 3007 Only \$6.95 List

THE FINNEY COMPANY

34 West Interstate St., Dept. AM-5 Bedford, Ohio

Check No. 165 on Reader Service Card.

free

ACOUSTECH

Solid State
Stereo Kits

The complete story in color, with pictures and specifications, of the most exciting line of solid state stereo kits. "... in the top ranks of modern stereo." Hirsch-Houck Labs—Electronics World. "... will outperform most factory-assembled rigs you can buy today."

Popular Science

ACOUSTECH

Acoustech, Inc. Div. of Koss Electronics
139 Main St., Dept. A-5, Cambridge, Mass. 02142

Please send me your colorful kit brochure with complete details on the top-rated line of solid state stereo kits.

Name _____
Address _____
City & State _____ Zip Code _____

Check No. 166 on Reader Service Card.

FINCO-AXIAL FM-STEREO-KIT



FOR THE BEST FM RECEPTION

PROVIDES THE MISSING LINK IN FM STEREO

New Finco-Axial replaces twinlead . . . gives shielded protection to the incoming signal and eliminates all outside and inside line pick up interference.

QUICK, EASY INSTALLATION . . .

Finco-Axial Can be Installed Anyplace
FINCO-AXIAL-FM STEREO KIT, Model 7512AB High performance Indoor and Outdoor Matching Transformers convert old-fashioned and inefficient 300 ohm hook-ups to the new Finco-Axial 75 ohm FM Stereo reception system.

List price for complete kit, 7512AB \$8.95
7512-A Mast Mounted matching transformer. List \$5.40

7512-B FM Turner mounted matching transformer. List \$4.15

FINCO-AXIAL SHIELDED CABLE, CX SERIES
Highest quality 75 ohm swept coaxial cable (RG 59/U) complete with Type F fittings and weather boot ready for installation.

Available in 25, 50, 75, 100 ft. lengths.
List prices \$5.55, \$8.65, \$11.50, \$14.20

Write for Brochure No. 20-349

THE FINNEY COMPANY

34 West Interstate St., Dept AM 5 Bedford, Ohio

Check No. 167 on Reader Service Card.

CANADA High Fidelity Equipment

Complete Lines • Complete Service

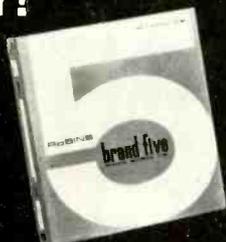
Hi-Fi Records — Components
and Accessories

ELECTRO-VOICE SOUND SYSTEMS

126 DUNDAS ST. WEST, TORONTO, CANADA

Check No. 168 on Reader Service Card.

YOUR BEST TAPE BUY!



ROBINS
INDUSTRIES CORP.
FLUSHING, N. Y., 11356

Check No. 169 on Reader Service Card.

Advertising Index

Acoustech, Inc.	103	Radio Corporation of America	Cover 3
Acoustic Research, Inc.	41	Rectilinear Sound Systems	14
Allen Organ Company	97	Reeves Equipment	49
Altec Lansing	69	Robins Industries Corp.	104
American Modeler	96	Rocky Mount Instruments, Inc.	97
Amplifier Corporation of America	102	Rola Celestion, Ltd.	67
Art Gallery	100	Sansui Electric Co. Ltd.	87
Art in America	95	Schober Organ Corporation	92
Audio Bookshelf	98	Scott, H. H., Inc.	Cover 2, 29
Audio Dynamics Corp.	19-20	Sherwood Electronic Labs, Inc.	24
B S R (USA) Ltd.	16-17	Shure Brothers, Inc	13, 77
Benjamin Electronic Sound Corp.	85	Sony Corporation of America	45, 75
Bogen Communications Div., Lear Siegler, Inc.	81	Sony/Superscope	65
Bozak	30-31	Stanton Magnetics	39
British Industries Corporation	3, 5, 7, 9	Superex Electronics Corp.	101
C-M Laboratories	73	Tandberg of America, Inc.	33
Classified	102	United Audio Products	42-43
Concertone (Classic Industries)	10	University Sound	35, 37
Concord Electronics Corp.	71	Utah Electronics	93
Crown International	83	Wharfedale	7
Dynaco, Inc.	88	YL Acoustics	102
E-V Sound Systems	104		
Electro-Voice, Inc	1, 53-56, Cover 4		
Elpa Marketing Industries	99		
Empire Scientific Corp.	96		
Ercona Corporation	86		
Fairchild Recording Equipment Corp.	4		
Finney Company, The	103, 104		
Fisher Radio Corporation	59		
Garrard Sales Company	5		
Gotham Audio Corporation	15		
Harman-Kardon, Inc.	11		
Heath Company	49, 51		
Hi-Fidelity Center	104		
Kenwood Electronics	99		
Lafayette Radio	94		
H. J. Leak & Co., Ltd.	86		
Magnecord, Div. Telex Acoustic Prods.	89		
Marantz Company	63		
McIntosh Laboratory, Inc.	47		
Morhan Sales Company	94		
Multicore Solders	9		
Norelco	61, 79		
Pickering & Company, Inc.	23		
Pioneer Electronics U.S.A. Corp.	91		

We Own The Sharpest Pencils In Town!

YOU SAVE MORE ON HI-FI COMPONENTS & TAPE RECORDERS

- We invite your test of our "We Will Not Be Undersold Policy."
- 15-day money-back guarantee.
- 2-yr. unconditional guarantee parts & labor no charge, at local warranty station, factory or our service dept.
- Trade-ins-highest allow. Send your list.
- Most items shipped promptly from our 250,000 inventory, fully insured.
- Our specialty—APO & Export.
- 21st yr. dependable service world wide.

RATED #1 SERVICE—SATISFACTION ACCORDING TO NATIONAL SURVEY

Easy-Pay-Plan—Up to 24 mos. to pay. Write for our price First!

HI-FIDELITY CENTER
"The House of Low Low Prices"

239-U East 149th St.,
New York, N.Y. 10451

Check No. 170 on Reader Service Card.