AUDIO

JUNE, 1959
50¢

...the original magazine about high fidelity!

CDC

MUSIC MATES!

RCA-7199 and RCA-7027-A...Perfect Pair For High-Fidelity Amplifier Designs

Offer them a "top" note. Send your "deepest" bass. Blast your "fullest" fortissimo at them. Never fear the outcome if your high-fidelity amplifier is designed around this "perfect pair"...RCA-7199, medium-mu triode sharp-cutoff pentode and RCA-7027-A, beam power tube.

Study the sensitivity of the high-g_m pentode unit of the RCA-7199...wonderful for use in a low-noise low-hum amplifier; consider the medium-mu triode unit...ideally suited for use in a phase splitter. On the masculine side of the table is the other "mate", RCA-7027-A, developed specifically to reproduce the "big sounds". A pair of 7027-A's in a push-pull class AB_1 circuit utilizing feedback and driven by a 7199 with an input signal of 2 volts can deliver a power output up to 76 watts with total harmonic distortion of less than 0.5% with a hum and noise level of 85 db below 76 watts.

Ask your RCA Field Representative for the details on the High-Fidelity "Music Mates"...RCA-7199 and RCA-7027-A. For technical bulletins, write RCA Commercial Engineering, Section F-91-DE, Harrison, N. J.

RCA-7199 and RCA-7027-A...*music mates and quality mates*...blend into a system that provides music reproduction at its finest!

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RADIO CORPORATION OF AMERICA
Electron Tube Division ***Harrison, N. J.***

JUNE, 1959 VOL. 43, No. 6

Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

COVER PHOTO—Part of the home installation of R. G. Solhberg, Pasadena, California. Further description and more photos of this unique system appear on page 36.

AUDIO (title registered U. S. Pat. Off.) is published monthly by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary. Executive and Editorial Offices, 204 Front St., Mineola, N. Y. Subscription rates—U. S. Possessions, Canada and Mexico, $4.00 for one year, $7.00 for two years, all other countries, $5.00 per year. Single copies 50¢. Printed in U.S.A. at Lancaster, Pa. All rights reserved. Entire contents copyrighted 1959 by Radio Magazines, Inc. Entered as Second Class Matter February 9, 1950 at the Post Office, Lancaster, Pa. under the act of March 3, 1879.

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AUDIOCLINIC??

JOSEPH GIOVANELLI*

A Complex Listening Room

Q. *The problem is to design and install a listening situation where a maximum number of individuals can audit any of twelve channels of classical music material through crystal earphones (perhaps 20–50) built into tables in a large room. The number of auditors will vary at any moment from minimum to maximum for any of the twelve channels and switching clicks and level variations must be held to an absolute minimum. The crystal phones have a response of 100–8000 cps. All of the auditors will be located within 50–150 feet of the sound source.*

1. How are high impedance phones (50,000 ohms) best connected to such a switching arrangement?

2. Is there any practical reason why two one-quarter track heads on one tape deck (plus two one-quarter track erase heads) cannot supply the material for 4 of these channels? Can these channels be erased, recorded and played back separately with ease? D. H. R., Rochester, N. Y.

A. 1. The phones can be driven very nicely from cathode followers because the wattage required for each headset would be measured in milliwatts rather than watts. A few milliwatts would be enough. Remember that crystal phones are voltage-operated devices.

If I were making this installation, I would proceed as follows: Since there are 12 amplifiers and possibly 50 headsets, I would not use a separate amplifier for each headset. The number of tubes and other components would be staggering, and maintenance would become a major problem. Even my proposal will encompass quite a bit of circuitry. For simplicity, assume that you are going to use 20 headsets. The output of each program channel is fed into four cathode followers, each of whose impedance is made as low as possible. Each cathode follower will supply a maximum of five headsets. The coupling capacitor from each cathode follower should be quite large, 0.25 μf or perhaps as high as 1.0 μf. The far sides of each of these capacitors are terminated with 470-k resistors. (There will be 48 cathode followers, and hence 48 separate terminations.) Divide your phones into 4 groups, 5 per group. Each headset should be provided with its own 50-K

* *3420 Newkirk Ave., Brooklyn 3, N. Y.*

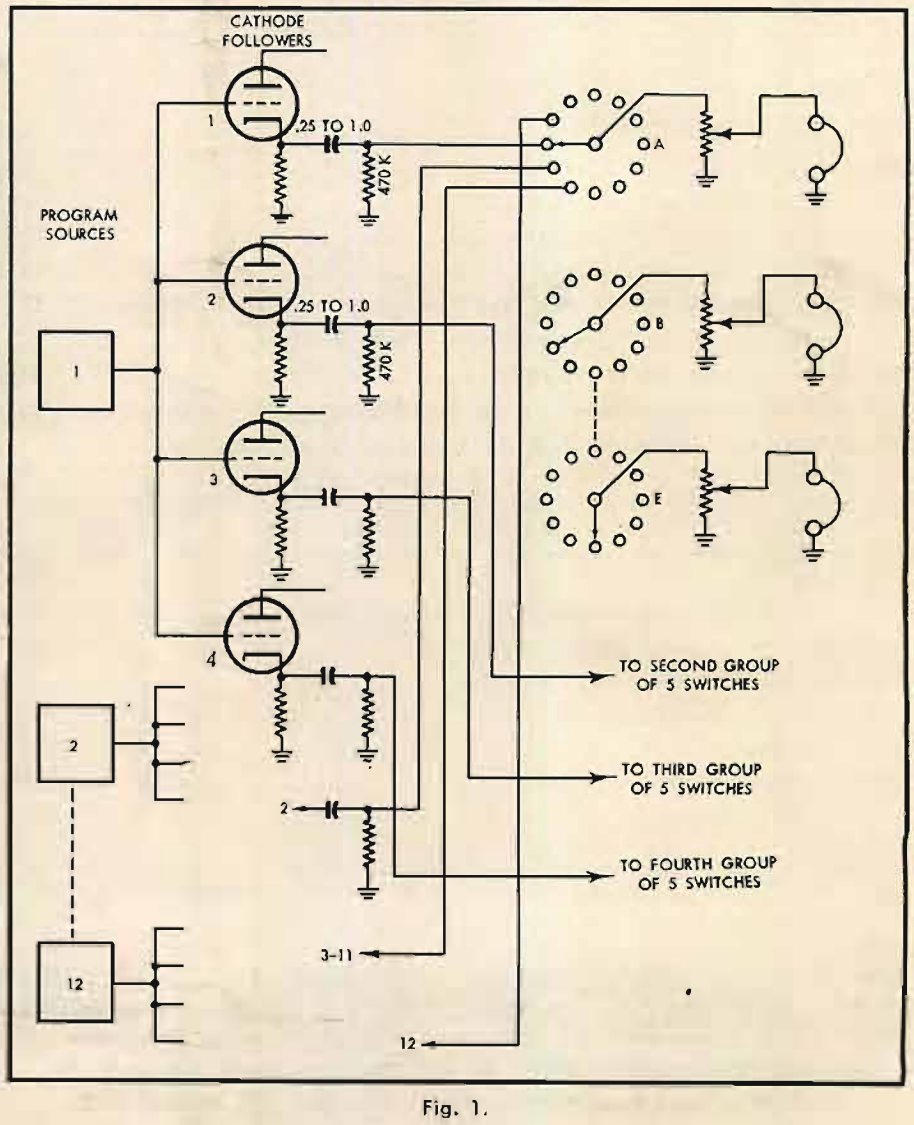

Fig. 1.

THE Garrard PAGE

Serving the owners of Garrard—world's finest record playing equipment—and other discriminating listeners.

DON'T COMPROMISE WITH QUALITY...

The advantages are all in favor of the

Garrard CHANGER

The World's Finest

It's Quiet

The Garrard is actually a superb turntable. No matter how precisely you check wow, flutter, and rumble content—you will find Garrard Changers comparable to the best professional turntables.

It's "Clean"

Garrard's exclusive aluminum tone arm makes it non-resonant, and distortion-free. That is why it is superior to most separate transcription arms.

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Garrard insures professional tone arm performance. It is precision-engineered to track all cartridges at lightest proper weight, thus insuring minimum friction and record wear.

It's Gentle

With the exclusive, foolproof pusher platform, the Garrard actually handles records more carefully than your own hand—definitely more carefully than any other record changer or turntable.

It's Convenient

Garrard affords all the features of a manual turntable, with the tremendous added advantage of automatic play when wanted! Pre-wired for stereo—can be installed in minutes.

It's Economical

Despite its many advantages, the cost of a Garrard Changer is still less than a turntable with separate arm. Backed by Garrard's 36-year record of perfect, trouble-free performance.

BIC ENDORSED QUALITY

There's a Garrard for every high fidelity system. Fully wired for Stereo and Monaural records.

RC98 Super Changer $67.50	RC88 Deluxe Changer $54.50	RC121/II Intermix Changer $42.50	TPA/12 Stereo Tone Arm $19.50	301 Transcription Turntable $89.00	4HF Transcription Manual Player $59.50	Model T/II Manual Player $32.50

GARRARD SALES CORPORATION, Div. of British Industries Corp., Port Washington, N. Y.

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Please send your new comparator guide which compares all Garrard players and their advanced features.

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Address_____

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potentiometer for individual volume adjustment. Each phone is also fitted with a switching circuit such that you can switch to any of the 12 program sources.

Here is where the grouping comes in and where things can get complicated. Remember that there are four cathode followers per program channel. Each is intended to feed a particular group of five headsets. We will arbitrarily number each cathode follower of a given source 1, 2, 3, and 4. Cathode follower 1 of each channel will feed group 1 as follows:

1. Connect the arms of the five switches (A, B, C, D, and E) in group 1 to their respective potentiometers and phones.
2. Connect position 1 of switch A of group 1 to cathode follower 1 of program channel 1.
3. Connect position 2 of switch A of group 1 to cathode follower 1 of program channel 2.
4. Connect position 3 of switch A of group 1 to cathode follower 1 of program channel 3.
5. Proceed until all 12 positions of the switch are connected.

This will allow one pair of headphones in one group to receive any of the program channels. Switch B of group 1 is similarly wired to cathode follower 1 of each of the 12 program sources. Positions C, D, and E are similarly connected. Group 2 is wired in the same manner, except that all switch positions are wired to cathode follower No. 2 of each program channel. Proceed likewise for groups 3 and 4.

The system should incorporate a VU-meter circuit which can be switched to any of the inputs of the 12 program preamplifiers in order to determine whether enough level is being sent out to supply adequate listening level to the groups of headphones.

Note that I am loading the cathode followers as lightly as possible. This is done in order that the level will remain substantially constant with a load of from 1 headset to 5 headsets. There should be no switching clicks, even when a listener switches to a group to which no one else is listening. This is accomplished through the use of the 470-k grid resistors: they keep the capacitors charged even when they are not loaded by phones. *Figure* 1 shows the method of wiring one group of headphones. The diagram should be followed for each of the remaining three groups, *Figure* 2 shows the detail for a typical cathode follower.

You should be able to use two 4-track tapeheads in the manner you suggest, since each actually has only two "heads," not four. They are spaced so as to cover tracks 1 and 3, counting from the top. The second head is mounted slightly lower and covers tracks 2 and 4. However, there is one thing which must be done. If you wish all four tracks to play at once, they must be recorded in the same direction, not alternately as in the usual 4-track machine.

Erasing an individual tape presents seri-

(*Continued on page 73*)

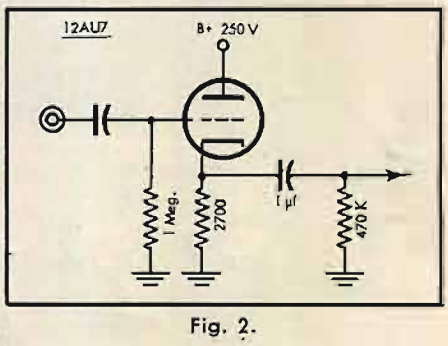

Fig. 2.

SUPERLATIVE

THE PEERLESS K-241-D (20-20 Plus) INPUT TRANSFORMER

The K-241-D is a 20-20 Plus transformer of comparatively small size in relation to its performance characteristics. Its primary balance places it in a class with repeating coils (See Chart C). It is magnetically shielded to 90 db. The following charts show its superb performance.

They demonstrate the quality of Peerless which can help solve your input transformer problems.

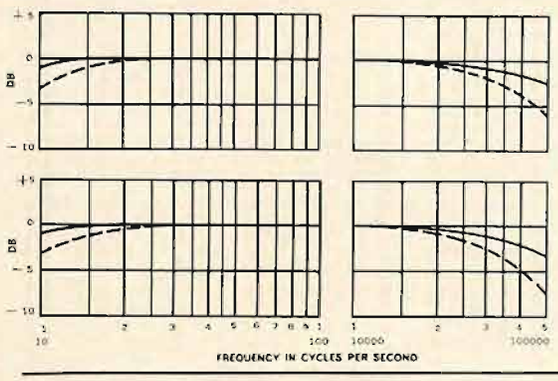

DIAGRAM A - Frequency Response K-241-D
Frequency response curves for four operating conditions, divided into two parts. The first shows response at maximum rated power level with the transformer terminated resistively and unterminated. The same conditions of operation are shown in the second part except for the −60 dbm level which is representative of microphone output. Extreme performance stability is illustrated by these frequency responses taken at widely different power levels and under two extremes of operations; that is, with open circuited secondary and with fully loaded secondary. Performances between these extremes are within the illustrated limiting curves.

——— TERMINATED - - - - - - UNTERMINATED

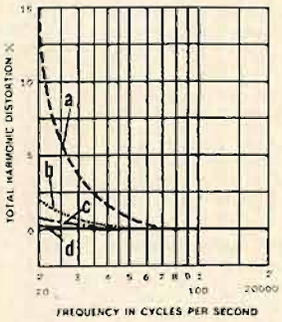

DIAGRAM B - Harmonic Distortion K-241-D
Distortion characteristics are shown under three conditions.

a. Input at +8 dbm, secondary open circuited
b. Input at +8 dbm, secondary resistively terminated
c. Input at 0 dbm, secondary resistively terminated
d. Oscillator residual distortion

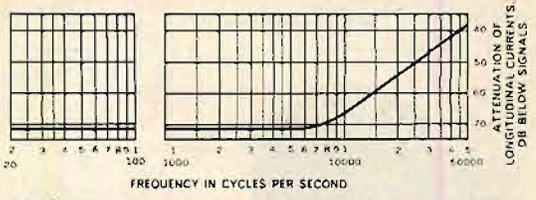

DIAGRAM C - Longitudinal Current Cancelling Characteristics of the K-241-D
The attenuation of longitudinal currents, measured on the 600 ohm input connection is shown in db below the relative steady-state transmission level.

Frequency response is guaranteed on all 20-20 plus transformers

Descriptive Data	**Max. Level	Impedance, Ohms Primary	Secondary	Primary DC Max.	MA Unbal.	Dimensions, Inches Height	Depth	Width	Weight Lbs.	Net Price
Frequency response, ±1 db: 10-25,000 cps. Primary balanced to attenuate longitudinal currents in excess of 50 db. Secondary may be used single ended or in push-pull. Has 2 secondary windings with balanced capacitance to ground.	+8 dbm	500-280-125-31 or 600-340-150-37.5	70,000*** or 84,000***	0	—	2¾	1½	2	1	$30.00

Electrostatic shield is provided between primary and secondary. Has 90 db electromagnetic shielding. Insertion loss 1¼ db. Transformer will operate into open circuit or resistive load. Frequency response down less than 1 db at 15 KC, when operated into resistive load shunted with 120 MMFD, capacitance. High power rating makes transformer suitable for use as output transformer.

*This transformer may also be used as a bridging transformer. Complete application data in each packing box.

**Maximum operating level, 1 mw reference.
***Impedance is total of two separate windings.

Available only through authorized Peerless distributors.

12 | 58

Since 1935, Peerless has designed and manufactured transformers of highest reliability to exact specifications for electronic application. Peerless — pioneers in size-reduction — established industry standards for ruggedness of packaging and reliability of sealing.

Peerless is the leader in the design and production of broadband transformers.

Transformers engineered and built by Peerless include: units from ⅛ of a cubic inch to more than 8 cubic feet; from fractional voltages to 30,000; from less than one cycle to approximately a half megacycle, and in one, two, and three-phase or phase-changing configurations. Construction categories cover the entire range from open-frame construction to potted, hermetically-sealed and vacuum-impregnated units. Peerless transformers can be varnish-treated, fosterited, epoxy or silastic-impregnated and encapsulated. Hermetically-sealed units can be compound, resin, mineral or silicone oil-filed.

Whatever your transformer needs, Peerless engineers can design to any given military or commercial specifications, and manufacture in any quantity. We invite your inquiries.

PEERLESS ELECTRICAL PRODUCTS
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Division of ALTEC

LETTERS

Hi-Fi System Hum

SIR:

The important topic of hum is again considered, this time accidentally. To those who have checked, eliminated, rechecked, rewired, and so on, until every method of hum reduction has been employed with a lack of sufficient results, I suggest one more try. A few years ago, I succeeded in reducing the hum level within my radiophono hi-fi system (which is responsive audibly and technically down to 26 cps) to a nearly inaudible level. Recently, however, I have been disturbed by a gradual increase in the hum level. This situation has been growing worse over the past few months.

Last week, as a result of installing some heavy appliances in my home, I had my electrical service rewired from pole to branch-circuit panel. At the same time, the water-pipe ground was lifted temporarily for a few days while a new location for the ground connection was established near the new meter box. Simultaneously the hum level increased significantly. Since the water-pipe ground for the new electrical service has been established, the audible hum has disappeared completely.

As a result, I should like to offer the following advice: Check your water pipe ground connection from your electric power panel, meter box, and so on. Make sure that all connections are cleaned, tightened and protected from corrosion and mechanical abuse. Low impedance grounds are essential—apparently even in your electrical service.

A. C. POFF, JR.,
6926 El Cedral St.,
Long Beach 15, California.

A.C. Balance in Power Amplifier

SIR:

I should like to take exception to one statement made by Mr. Horowitz in his fine article on push-pull amplifiers in the April issue.

A. C. balance has proved beneficial in cases where perfection demands distortion at the lowest possible level, even with closely matched output tubes, and with selected dual-triode inverters or drivers.

I can think of some half-dozen high-power kit amplifiers to which balancing arrangements have been added to the phase-splitter circuit. In each case, a lower intermodulation and harmonic distortion was realized. Further, any change of tubes from the phase splitter on to the output stage almost always necessitates re-balancing.

To be completely objective, however, in most cases the difference, while measurable, cannot be detected by ear.

L. B. DALZELL,
1162 Fleetridge Drive,
San Diego 6, California.

Audio Patents

SIR:

For a long time I have intended to write and tell you that I have missed the feature Audio Patents, by R. H. Dorf, and would like to see it reinstated.

Please add my voice and vote to the reader who recently wrote to you in the same vein.

C. E. BEILMAN,
Argonne National Laboratory
P. O. Box 299,
Lemont, Illinois.

We miss them, too. ED.

NEW LITERATURE

• **Electro-Voice, Inc.,** Buchanan, Mich., has just published one of the most handsome and worth-while high-fidelity catalogs ever to be produced. A completely new and colorful guide to the extensive E-V line of speakers, enclosures, and speaker systems, Catalog 134 also contains a well-written introduction to stereo sound and illustrates proper placement of speakers in stereo music systems. Irrespective of your interest in speakers and speaker systems—whether layman or professional—this catalog will be a worthy addition to your audio library. Available upon written request. Specify Catalog 134. **F-16**

• **Valor Instruments, Inc.,** 13214 Crenshaw, Gardena, Calif., has performed a fine industry service with the publication of "Audio Transistor Kinks," Vol. 1, No. 1, a four-page folder covering "Voltage Breakdown and Leakage Current in Transistors." Written on a professional engineering level, these articles have stimulated a great deal of favorable comment so far, and will undoubtedly be of considerable interest to AUDIO's readers who work with transistors in any manner. **F-17**

• **Jensen Manufacturing Company,** 6601 S. Laramie Ave., Chicago 38, Ill., fully illustrates and describes its new line of monophonic and stereo speaker systems in Catalog 165-C which will be mailed free upon written request. Complete specifications of the new Jensen tube-vented Bass-Superflex enclosures for high-compliance Flexair woofers are included. The Stereo Director units which are said to permit "aiming" of directional frequencies, thus eliminating the need for angling cabinetry, are fully explained. Also illustrated and described are the Jensen kits for those who wish to build their own cabinets or built-in speaker systems. An excellent catalog. Write for a copy. **F-18**

• **CBS-Hytron Advertising Service,** Parker St., Newburyport, Mass., will mail free a copy of a most interesting article titled "Why a Ceramic Cartridge?" Written by Bud Tomer, this 4-page folder does an excellent job of analyzing the basic differences in crystal, ceramic, and magnetic pickups. Although proponents of other types of cartridges may take issue with certain of its conclusions, no one will deny that the author presents his case with force and authority. Write for this excellent piece of audio literature—of interest to engineers and hobbyists alike. **F-19**

• **University Loudspeakers, Inc.,** 80 S. Kensico Ave., White Plains, N. Y., has just issued a handsomely-prepared 16-page booklet appropriately titled "An Informative Guide to High Fidelity Stereo and Monophonic Speaker Systems and Components." Available free upon written request, this book is full of useful information, tips and practical suggestions of interest to everyone contemplating building or improving a hi-fi speaker system. In addition, there is a complete, concise, illustrated description of every speaker and accessory component manufactured by University. Direct your request for a copy to Desk BL-1. **F-20**

• **The Turner Company,** 909 17th St., N.E., Cedar Rapids, Iowa, will mail upon request a new catalog on the company's entire line of microphones, stands, and other miscellaneous accessories. Illustrations, specifications, and description of each product make this publication an excellent handbook for the selection of microphones and accessory equipment for any application. Write for it. **F-21**

• **Amplifier Corp. of America, TransMagnemite Division,** 398 Broadway, New York 13, N. Y., will mail without cost a new 6-page brochure describing in detail exclusive mechanical and electrical features of the latest TransMagnemite transistorized, battery-operated, spring-motor portable tape recorders which were engineered especially for professional field applications. Single- and multi-speed models are available and listed with their respective recording characteristics tabulated for easy reference. The recorders' operations are concisely explained and complete technical specifications, recommended accessories, as well as direct factory prices are included. **F-22**

SUPERLATIVE

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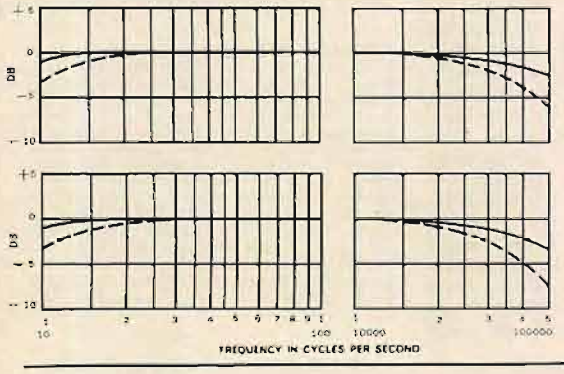

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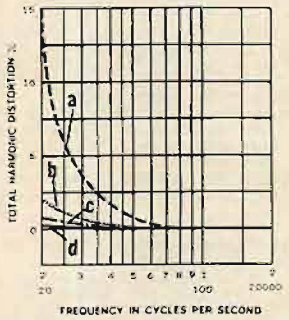

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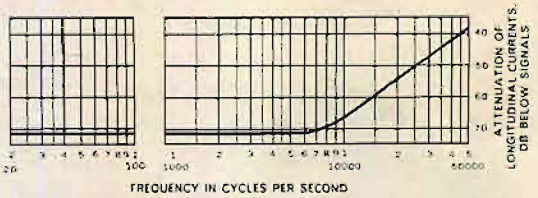

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Descriptive Data	**Max. Level	Impedance, Ohms Primary	Secondary	Primary DC Max.	MA Unbal.	Dimensions, Inches Height	Depth	Width	Weight Lbs.	Net Price
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*This transformer may also be used as a bridging transformer. Complete application data in each packing box.

**Maximum operating level, 1 mw reference.
***Impedance is total of two separate windings.

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12-58

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Easy-to-build

HEATHKIT®

- style
- performance
- quality

costs you less!

STEREO EQUIPMENT CABINET KIT

MODEL SE-1 (center unit) **$149.95**
Shpg. Wt. 162 lbs.

MODEL SC-1 (speaker enclosure) **$39.95** each
Shpg. Wt. 42 lbs.

Superbly designed cabinetry to house your complete stereo system. Delivered with pre-cut panels to fit Heathkit AM-FM tuner (PT-1), stereo preamplifier (SP-1 & 2) and record changer (RP-3). Blank panels also supplied to cut out for any other equipment you may now own. Adequate space also provided for tape deck, speakers, record storage and amplifiers. Speaker wings will hold Heathkit SS-2 or other speaker units of similar size. Available in unfinished birch or mahogany plywood.

MONAURAL-STEREO PREAMPLIFIER KIT (Two Channel Mixer)

MODEL SP-2 (stereo) **$56.95** Shpg. Wt. 15 lbs.
MODEL SP-1 (monaural) **$37.95** Shpg. Wt. 13 lbs.
MODEL C-SP-1 (converts SP-1 to SP-2) **$21.95** Shpg. Wt. 5 lbs.

Special "building block" design allows you to purchase instrument in monaural version and add stereo or second channel later if desired. The SP-1 monaural preamplifier features six separate inputs with 4 input level controls. A function selector switch on the SP-2 provides two channel mixing. A 20' remote balance control is provided.

World's largest manufacturer of electronic instruments in kit form

HEATH COMPANY
Benton Harbor, 25, Michigan

a subsidiary of Daystrom, Inc.

HIGH FIDELITY RECORD CHANGER KIT

MODEL RP-3 **$64.95**

Turntable quality with fully automatic features! A unique "turntable pause" allows record to fall gently into place while turntable is stopped. The tone arm engages the motionless record, and a friction clutch assures smooth start. Automatic speed selector plays mixed 33⅓ and 45 RPM records regardless of sequence. Four speeds available: 16, 33⅓, 45 and 78 RPM. Changer complete with GE-VR-II cartridge with diamond LP and sapphire 78 stylus, changer base, stylus pressure gauge and 45 RPM spindle. Shpg. Wt. 19 lbs.

PROFESSIONAL STEREO-MONAURAL AM-FM TUNER KIT

MODEL PT-1 **$89.95**

The 10-tube FM circuit features AFC (automatic frequency control) as well as AGC. An accurate tuning meter operates on both AM and FM while a 3-position switch selects meter functions without disturbing stereo or monaural listening. Individual flywheel tuning on both AM and FM. FM sensitivity is three microvolts for 30 db of quieting. The 3-tube FM front end is prewired and prealigned, and the entire AM circuit is on one printed circuit board for ease of construction. Shpg. Wt. 20 lbs.

"EXTRA PERFORMANCE" 55 WATT HI-FI AMPLIFIER KIT

A real work horse packed with top quality features, this hi-fi amplifier represents a remarkable value at less than a dollar per watt. Full audio output at maximum damping is a true 55 watts from 20 CPS to 20 kc with less than 2% total harmonic distortion throughout the entire range. Featuring famous "bas-bal" circuit, push-pull EL34 tubes and new modern styling. Shpg. Wt. 28 lbs.

MODEL W7-M **$54.95**

"BOOKSHELF" 12 WATT AMPLIFIER KIT

MODEL EA-2 **$28.95**

There are many reasons why this attractive amplifier is such a tremendous dollar value. You get rich, full range, high fidelity sound reproduction with low distortion and noise . . . plus "modern styling". The many features include full range frequency response 20 to 20,000 CPS ±1 db with less than 1% distortion over this range at full 12 watt output—its own built-in preamplifier with provision for three separate inputs, mag phono, crystal phono, and tuner—RIAA equalization—separate bass and treble tone controls—special hum control and it's easy-to-build. Complete instructions and pictorial diagrams show where every part goes. Cabinet shell has smooth leather texture in black with inlaid gold design. Shpg. Wt. 15 lbs.

HIGH FIDELITY AM TUNER KIT

MODEL BC-1A **$26.95**

Designed especially for high fidelity applications this AM tuner will give you reception close to FM. A special detector is incorporated and the IF circuits are "broadbanded" for low signal distortion. Sensitivity and selectivity are excellent and quiet performance is assured by a high signal-to-noise ratio. All tunable components are prealigned before shipment. Your "best buy" in an AM tuner. Shpg. Wt. 9 lbs.

HIGH FIDELITY FM TUNER KIT

MODEL FM-3A **$26.95**

For noise and static-free sound reception, this FM tuner is your least expensive source of high fidelity material. Efficient circuit design features stabilized oscillator circuit and broadband IF circuits for full fidelity with high sensitivity. All tunable components are prealigned before shipment. Edge-illuminated slide rule dial. Covers complete FM band from 88 to 108 mc. Shpg. Wt. 8 lbs.

"MASTER CONTROL" PREAMPLIFIER KIT

MODEL WA-P2 **$19.75**

All the controls you need to master a complete high fidelity system are incorporated in this versatile instrument. Features 5 switch-selected inputs each with level control. Provides tape recorder and cathode-follower outputs. Full frequency response is obtained within ±1½ db from 15 to 35,000 CPS and will do full justice to the finest available program sources. Equalization is provided for LP, RIAA, AES, and early 78 records. Shpg. Wt. 7 lbs.

"UNIVERSAL" 12 WATT AMPLIFIER KIT

MODEL UA-1 **$21.95**

Ideal for stereo or monaural applications, this 12-watt power package features less than 2% total harmonic distortion throughout the entire audio range (20 to 20,000 CPS) at full 12-watt output. Use with preamplifier models WA-P2 or SP-1 & 2. Taps for 4, 8 and 16 ohm speakers. Shpg. Wt. 13 lbs.

HIGH FIDELITY TAPE RECORDER KIT

MODEL TR-1A **$99.95**
Includes tape deck assembly, preamplifier and roll of tape.

MODEL TE-1 **$39.95**
Shpg. Wt. 10 lbs. (Tape Preamplifier Only)

The model TR-1A provides monaural record/playback with fast forward and rewind functions. 7½ and 3¾ IPS tape speeds are selected by changing belt drive. Flutter and wow are held to less than 0.35%. Frequency response at 7½ IPS ±2.0 db 50-10,000 CPS, at 3¾ IPS ±2.0 db 50-6,500 CPS. The model TE-1 record/playback tape preamplifier, supplied with the mechanical assembly, provides NARTB playback equalization. A two-position selector switch provides for mike or line input. Separate record and playback gain controls. Cathode follower output. Complete instructions provided for easy assembly. Signal-to-noise ratio is better than 45 db below normal recording level with less than 1% total harmonic distortion. (Tape mechanism not sold separately). Shpg. Wt. 24 lbs.

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DIAMOND STYLUS HI-FI PICKUP CARTRIDGE

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Replace your present pickup with the MF-1 and enjoy the fullest fidelity your library of LP's has to offer. Designed to Heath specifications to offer you one of the finest cartridges available today. Nominally flat response from 20 to 20,000 CPS. Shpg. Wt. 1 lb.

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The SS-1B employs a 15" woofer and super tweeter to extend overall response of basic SS-2 speaker from 35 to 16,000 CPS ±5 db. Crossover circuit is built in. Impedance is 16 ohms, power rating 35 watts. Constructed of ¾" veneer-surfaced plywood suitable for light or dark finish. Shpg. Wt. 80 lbs.

MODEL SS-1B
$99.95

SEND FOR FREE CATALOG

Describing over 100 easy-to-build kits in hi-fi, test, marine and ham radio fields. Also contains complete specifications and schematics.

"BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

MODEL SS-2 **$39.95**
Legs: No. 91-26 Shpg. Wt. 3 lb. $4.95

The modest cost of this basic speaker system makes it a spectacular buy for any hi-fi enthusiast. Uses an 8" mid-range woofer and a compression-type tweeter to cover the frequency range of 50 to 12,000 CPS. Crossover circuit is built in with balance control. Impedance is 16 ohms. Power rating 25 watts. Tweeter horn rotates so that the speaker may be used in either an upright or horizontal position. Cabinet is made of veneer-surfaced furniture-grade plywood suitable for light or dark finish. All wood parts are precut and predrilled for easy assembly. Shpg. Wt. 26 lbs.

LEGATO HI-FI SPEAKER SYSTEM KIT

MODEL HH-1 **$299.95**

The startling realism of sound reproduction by the Legato is achieved through the use of two 15" Altec Lansing low frequency drivers and a specially designed exponential horn with high frequency driver. The special crossover network is built in. Covers 25 to 20,000 CPS within ±5 db. Power rating 50 watts. Cabinet is constructed of ¾" veneer-surfaced plywood in either African mahogany or white birch suitable for the finish of your choice. All parts are precut and predrilled for easy assembly. Shpg. Wt. 195 lbs.

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QUANTITY	ITEM	MODEL NO.	PRICE

AUDIO *etc.*

Edward Tatnall Canby

A Pilot for Regency

1. THE REGENCY HFT-1A

I've been playing with a pair of lovely little all-transistor preamplifiers lately. And as a result, I've been fussing with a problem in pilot lights.

Except for the glaring lack of this last commodity, the Regency HFT-1A battery-powered Pre-Amplifier (Regency's spelling) is a pleasure to use and a double-pleasure, more or less, in a pair for stereo. A pleasure for me, that is, until I ran the batteries dead, which was all too soon. More of this later.

Transistor audio, especially the all-transistor sort, has been exerting a lot of fascination upon audiofans this last year. There is the newness of the circuitry, of course. But more important are the new factors of miniature size, extraordinarily low current drain and the convenience of low-impedance inputs that allow the transistor preamp to be used in place of a transformer for low-impedance broadcast-type mikes (with long cables) and for magnetic phono cartridges. Also of interest is the battery-type operation and the new applications for portable, non-power-line hi-fi, often possible from an auto battery. Last year, the Vico all-transistor complete hi-fi amplifiers brought more inquiries to this department than anything I had mentioned in many a month, though the company later got into a snarl of some sort and gave up.[1]

I first got interested in transistor hi-fi thanks to the pioneer Fisher all-transistor preamp of a few years back, a small battery-operated unit that unexpectedly went to work as an emergency mike preamplifier for my broadcast tape set-up and managed to last a whole season on the original battery, pending the completion of my permanent equipment. The new Regency preamp is its latest descendent and it is a "complete" unit, with phono equalization, bass and treble controls, function switch, all operated in a very small space from built-in batteries. I was delighted at the compactness, good looks and the easily managed multiple functions that have been incorporated into this small unit and my only beef, a great big one, is that the Regency doesn't tell you when it is turned on. Not so you'd notice it, anyhow. For this, however, I have found a dramatic solution, not envisioned by Regency.

You see, the very first day I got these two preamps I inadvertently left them on for several hours. A few days later I did it again, though I had told myself I just wouldn't. That time it was overnight. The end came quickly, alas, when I set off for the country the same weekend leaving the little darlings happily burning their hearts (batteries) out. When I got back, on blue Monday, they were dead, very dead.

But before I give you my answer to this life-and-death problem in Regency's HFT-1A, let me describe the preamps' living virtues, given fresh batteries.

The HFT-1A is a neat oblong measuring only about seven by two by three inches, add a quarter-inch or so each way. It is black with a handsome gold front panel and four round, black control knobs, legibly marked SELECTOR, BASS, TREBLE, LEVEL, garlands of numbers encircling the last three, zero at the top. (One curious thing is that the "flat" position is not exactly at the zero point but slightly off to one side—which is just plain nutty and surely unnecessary. But the displacement is slight enough so you can ignore it in practice and, at this stage, I've already forgotten the precise "flat" points.) The SELECTOR knob has four positions, rather faintly marked MAG PHONO, MIC, TUNER, XTAL PHONO.

What? No RIAA, AES, 78, COL, LP, LON, etc.? Nope! Not a trace of 'em, and I thoroughly approve. This is a good example of the latest trend in the old business of record equalization and it was surely inevitable, once the dismal tangle of some years back was ironed out in favor of near-conformity, around RIAA.

I've always felt that eventually we would have on most equipment just the one equalization position—more accurate, none at all, with RIAA taken for granted and built-in. That's what we have in Regency's preamp, and I remind you that most variations in the old record curves can still be taken care of via the average bass and treble controls—and that, too, within quite small tolerances, as was pointed out long years ago by engineer Howard Sterling in connection with his Electronic Workshop and Waveforms amplifier lines.

The rear of the Regency is neatly arranged, with four input sockets at the usual right end of the panel (as you look at the back) and a single main output socket at the other end, well isolated. Good: too many preamps mix the inputs and outputs together, inviting all sorts of wrong connections.

In operation, the little preamp is easy and convenient to use (not counting that fatal lack of an ON signal). The unit is just heavy enough so that you can work it with one hand, without slippage. Note that many small units of this sort are so light in weight that, paradoxically, you must use both hands in order to operate the controls. A thought, here, for those who would achieve even more extreme hi-fi miniaturization.

A pair of Regencies *will fit nicely* into an odd corner of any hi-fi system, on top or to one side of other equipment, with a minimum of cables; there are cork composition feet on the bottom corners to anchor the unit and minimize scratches. They're only stuck on, with rubber cement, but they work. Why not?

A removable back plate with two screws allows for battery changing and the unit will operate either on one or two 9-volt batteries—same life but higher sound quality with 18 volts. This would seem to be an inherent choice in transistor battery-powered equipment and it represents a good value, too, since you may economize with only one battery (they cost plenty of cash) or, in an emergency, make use of one when a second isn't available. The relatively large-capacity batteries that were furnished by Regency were a good idea, but when I tried to replace them I found that one New York supplier didn't carry the type. Not important, since battery availabilities vary from place to place; I put in a common but smaller type, Burgess 2U6, which worked out fine. There's room for various types and sizes, in case of necessity.

As to sound, the Regency preamp does, to be sure, produce that characteristic slight hiss, at higher gain levels, which seems to be inevitable in all-transistor design at this stage. Here, you trade hum for hiss and, when you come down to it, I prefer a bit of hiss any day. Not obtrusive mind you—just a bit of it, down in the tube-noise area.

As a comparison, I tried one Regency preamp hooked into one half of a stereo set-up, the other channel going through a Dynakit preamp, both set at RIAA with the tone controls flat. (The Regency, by the way, has all the gain you can possibly want and, indeed, it had more gain by a good deal than the corresponding input channel on my dual-12-watt stereo amplifier of standard tube design.) Now here I noticed at once, I must admit, that the tonal balance on this direct comparison of two stereo channels was not exactly the same through the two preamps—RIAA or no. (But I would be hard put to it to choose which seemed "righter"). They *were* slightly different, and that was that.

Tolerances

Which, I think, merely offers a slightly realistic proof of the principle, usually left unmentioned, of allowable tolerances in good audio design. Nobody matches the RIAA curve *exactly*, without some leeway. Maybe nobody ever has. Every audio man, every manufacturer, knows perfectly well that those little works "plus-or-minus" mean what they say, and in every audio component, too.

Perhaps the tolerances in matching the ideal RIAA curve (which, I gather, is supposed to be designed for fairly easy matching via common component values) are not quite as close in general practice as, say, the much-advertised tolerances for over-all amplifier response, distortion and so on. I wouldn't know. But I strongly suspect that in much of our present audio equipment, including the best, equalization tolerances are wide enough so that if two unlike models of different make happen to hit the opposite extremes within their respective tolerance limits, the resulting sounds *on direct comparison* could be noticeably different, taken from the standard RIAA control settings. Nothing for us to be ashamed about, I'd guess; nor could I put blame either on Dyna or Regency in this

[1] The Vico line is being reorganized, the entire inventory having been sold out by its originator, Video Instruments. A new corporation was being formed to take over the line and the interim management was by the Altshuler Management Co., 1555 North Bronson Av., Los Angeles 28, Calif. Further information will be forthcoming from them, when & if.

particular comparison of mine. The difference was within *my* tolerance.

If you use a pair of identical Regency preamps (or a pair of Dynakits) for stereo, these minute differences will never show up at all. They didn't in my pair of pairs.

2. BATTERY PILOT

But now we come to the big joker in the Regency Pre-Amplifier—and in virtually every other battery-operated transistor device in the audio field. (That's why I'm making a big point of it here.) How can you tell when the thing is on? How can you prevent accidental extinction of the expensive batteries inside?

You see, this is one of those petty, external problems that just don't get attended to properly by engineer designers, who have their hands terribly full with weightier matters of transistor circuitry, space constriction and what-not. But for ye doughty consumer, this is the top-rating problem—if his batteries go dead by mistake. No two ways about *that:* ask the man who'd had it happen to him. Me, for instance.

I don't need to go into the practical difficulties involved in figuring out a really visible mechanical ON signal for such devices. The problem was a familiar one in the old portable radios, long before transistors. Various mechanical possibilities were tried out with greater or lesser ingenuity; some makers clearly had this on their minds more than others. Some of the old radios said "on" to you in very small letters, or none at all. Others politely waved neat little red flags. Not bad.

But the tiny transistor radios have just about given up on this score, and most of us have had to accept battery loss as one of the inevitable risks of portable miniature equipment. Nothing can be done, we say, and shrug it off—until the next transistor battery goes dead.

Now in hi-fi equipment the situation isn't quite as simple, nor can we shrug quite so easily. Our standards for hi-fi operation are definitely higher and more exacting, for one thing, and that includes reliability of operation—over a long time. There isn't a one of us who won't be violently annoyed if a transistor preamplifier goes dead on us just when we want it, thereby knocking our entire hi-fi system out of service.

In the home, where the rest of our equipment ordinarily runs on 117 volts and is good for indefinitely long use, such a failure of crucial equipment can be particularly infuriating. Even in the sort of portable, outdoor, camp-style use that is the special strong point of transistor hi-fi, battery failure by accident is enough to make anybody curse and swear. It's just too much to take, especially when the fault is your own. Phooey! is the mildest term likely to be emanated, and Regency would do well to cock its mental ear and shiver at the mere thought of stronger language.

For these reasons, you would think, *any* battery-operated hi-fi component (not to mention small radios and the like) would be designed at the least for maximum visibility of whatever ON indicator is practical under the circumstances. Even if you can't do more than mark the ON-OFF switch, you can make the indication as visible as possible, especially if your ON switch is incorporated in the volume control, as in the Regency preamplifier.

Dead or Alive

But the Regency people evidently had their minds elsewhere. Their little preamp, so neatly and sensibly turned out in other respects, is a real booby trap for the accident-prone operator with *his* mind on other matters (music, for instance). Indeed, the combination of factors that ask for accidental running-down of the batteries is quite uncanny. As I say, I was caught three times and struck out, cold.

A. The ON switch is on the level control, a round knob with a very small white dot that in normal use appears at a great variety of positions, rather than one standard and instantly visible ON location, to catch the eye.

B. This black knob, with the too-small white dot, is right alongside *three other identical black knobs with small dots,* all of which are constantly variable in their positions. Nice to look at—but your eyes haven't a chance of noticing the special position of that tiny, CRUCIAL white dot on the right knob that indicates ON, via the volume control.

C. Finally, it just happens that the switched volume control used on this Regency preamp is one of those that rotate almost all the way around at the extremes of its turn. The OFF position is at roughly half past six; the ON position when the volume is fully rotated is half past five. Much too close for comfort and your eye is very unlikely to notice the small difference at all. Mine didn't.

So, you see, in order to ensure, as the British say, that the preamp gets turned off every time, you really must have a check list and a co-pilot to read the items off for you, each time you cease playing your hi-fi! With the best will in the world, I couldn't make my pair of Regencies last more than a week—and the four new batteries cost me money that wasn't pleasant spending.

The simplest sort of solution for this problem is, obviously, to put maximum common sense and ingenuity into designing visible ON-OFF positions that are as blatantly clear as possible, so that your eye is caught even when you are at your most absent-minded peak of non-attention. Not easy, but something can be done, even without special gadgets. Simply use clear marking.

Beyond that, you could try again to work out some ingenious mechanical signal of the "red flag" sort which appears when the unit is turned on, disappears when it is off. Every good reason for doing so.

Don't forget that when a battery operated unit is used with other equipment—as here—each section must be turned off independently. That was my primary trouble. After years of habit-forming master-switch operation, I just didn't remember to turn off my 117 volt equipment *and* then turn off each of the preamps, separately. Thus for hi-fi equipment of this battery sort you need much more, a really drastic ON signal, an indicator that positively yells at you, so to speak.

In fact, what you need, obviously, is a pilot light. Of course! Natch! What else! And there, friends, is the big question that struck me. *Why not* a pilot light?

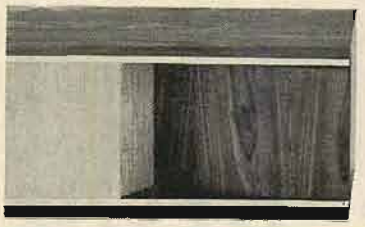
Let's Add a Pilot Light

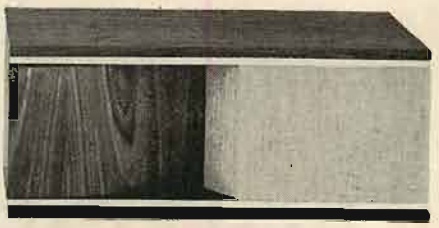
Now there must be something wrong here. You CAN'T add a pilot light. If you could, somebody—everybody—would have done so, long since. Pilot lights just aren't practical in battery operation. They are fine when the current source is 117 volts from the power line. Nobody, but nobody, would be foolish enough to think that a pilot light on a battery would make sense. Nobody but me, anyhow.

You see, I'm an obstinate cuss when I get annoyed. I won't take no for an answer until I get pushed real hard.

When these two neat little Regency pre-

(*Continued on page 46*)





PRESENTING THE JBL RANGER-MINIGON

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JBL

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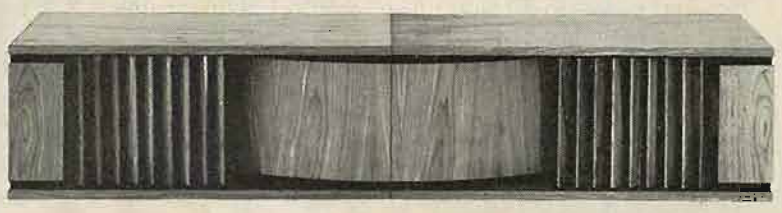
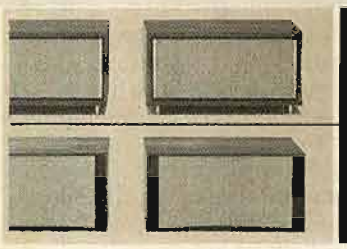
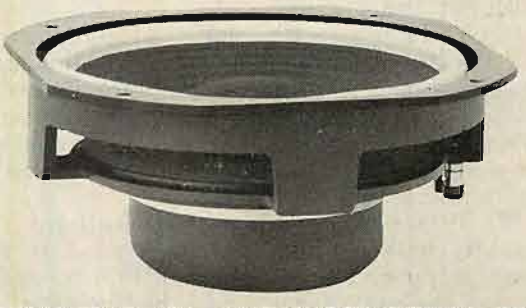




New JBL Dale Enclosure, Model C49, for JBL Linear-Efficiency drivers measures 23¾" x 11⅝" x 12" high, is delightful in its simplicity, refreshing in its restrained use of interest-arousing design details.

New JBL Madison Enclosure, Model C48, 23¾" x 13½" x 11¾" high, reflects the influence of Danish design. Finished on four sides and front, the Madison may be used in either vertical or horizontal position.



PRESENTING THE JBL LINEAR-EFFICIENCY SPEAKER

You see an all-new precision transducer that could only be a product of James B. Lansing Sound, Inc. The company which brings you the best speakers for horn enclosures and the best units for reflex enclosures now offers the finest infinite baffle type transducers. Under intensive development for a year and a half, design judgment and engineering decisions were recurrently confirmed by analog computer. You will hear big, deep, accurate bass from these instruments. Application of new principles of cone suspension permits unusually long linear excursion. Relatively high efficiency with its attendant precision transient response, clean reproduction, vast dynamic range is achieved by use of large voice coils, precision-instrument tolerances, advanced magnetic circuitry—all typical of JBL transducers.

Illustrated above is the JBL Model LE10, the super 10" Linear-Efficiency Low Frequency Driver. To the left are the new LX3 Dividing Network and the new JBL Model LE30 High Frequency Driver. To the far left is the new LE8, the super 8" extended range Linear-Efficiency Loudspeaker which gives a flatness of response from 30 to 15,000 cycles that is without precedent in a unit of this size.

Write for a complete description of these new units and the name of the Authorized JBL Signature Audio Specialist in your community.

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EDITOR'S REVIEW

STEREO QUALITY

THERE IS QUITE A DIFFERENCE of opinion as to the quality of stereo records, and of stereo reproduction in general. While many listeners are relatively well satisfied, some of the hypercritical ones complain loudly that stereo records do not compare in quality with the monophonic LP's. Still others—and some of the same ones—insist that no stereo effect is discernible in their listening rooms.

We must admit that not all stereo records are superlative, but we hasten to add that not *all* LP's were out of this world either. All the way from the original scheduling of a recording date to the issuance of pressings there are many things that can go wrong —careless or inadequately rehearsed playing, improper microphone placement, faulty tape recording, faulty transferring to master disc, trouble in processing, trouble in pressing, poor handling and packing, and on and on and on. Any recording is subject to most of the same faults—stereo or monophonic—and the one most likely to appear only in stereo work is the matter of microphone placement. There are many ways in which microphones may be distributed about an orchestra, and the techniques are certainly not yet reduced to a cut and dried process. It is still pretty much cut and *try*.

But there is also the matter of equipment and—and don't forget it for a moment—the matter of phasing. Some months ago we were invited to the studios of a record company to hear the tapes of a new recording. Before going into the listening room, we were told that one of the speakers wasn't right, and would we overlook it.

We listened for eight bars, concluded that the speakers were out of phase, and asked to have the music stopped. Thirty seconds with a screwdriver to reverse one pair of wires and the "speaker" was all right again, and the tapes sounded fine.

If it is possible for those who work with music regularly—and in this case the same ones who made the original recording—to hear a playback in which one speaker is out of phase and not know what is wrong, think how much more likely the average listener is to encounter the same difficulty. Stereo reproduction *can* sound horrible—or at least it can lose all the quality it should have—if the speakers are not phased properly. And placement in the room is also important. Quite a bit of experimenting may be found necessary before one reaches the best quality and the optimum in stereo that he has a right to expect. After that, the excellent records will sound superb, and the mediocre and poor ones will sound mediocre or poor —at least it will be possible to judge *records* from that time on.

We will agree that a stereo system is more critical to set up and get working to the listener's complete satisfaction than any single-channel outfit. But in all fairness, remember how long and hard you worked to get your first monophonic system performing the way you wanted it to. And by the same token, remember that early LP's weren't all perfect either.

From our own observations, much of the cause for complaint arises from listening to pseudo-high-fidelity merchandise with which the market is flooded. People who have heard about stereo and have gone to their local appliance outlets and listened to some of the merchandise offered under the label "high fidelity" have found little to get excited about.

Two six-inch speakers 24 inches apart can never approach satisfactory stereo quality, nor will an assortment of oversized TV-quality speaker units in half-inch plywood cabinets come anywhere near to good musical reproduction. Even if you are not in the market for a top-quality component stereo installation, at least take the trouble to condition your ears to what a good system can sound like, even if you must stick to a budget figure below what you would like. But judging the whole field of stereo records on equipment that in itself is far from perfect is like deciding that automobiles are no good because you have just taken a ride in a 1924 Maxwell and been less than enthralled.

Not everyone needs a Rolls Royce, but make sure by trying a ride in one before you make up your mind.

FOUR-TRACK TAPE

Nearly a year ago we read considerable publicity about a four-track tape cartridge operating at 3¾ ips which was expected by its originators to revolutionize the tape-playback industry, but the machines failed to reach the market. However, the four-track idea has caught on, and performance at 7½ ips has proved excellent on most of those machines so far introduced, comparing quite favorably with two-track models with respect to both quality and signal-to-noise ratio. Undoubtedly much of the improvement in performance is the result of improved heads, which might possibly have made the two-track 7½-ips tape comparable with professional single-track 15-ips tape.

Herbert L. Brown, vice-president and manager of Ampex Audio, Inc., and recently elected president of the Magnetic Recording Industry Association, announced on May 20 that producers of recorded tapes had joined together to launch a wave of four-track stereo entertainment, and that at least 150 releases of the new tape would be forthcoming within the next few weeks.

With a number of machines available on which to play the new four-track recorded tapes, it seems likely that magnetic tape will quickly regain the position it held before the introduction of the stereo disc. While 7½-ips stereo tape is better than discs, in general, it did not compare in price on a two-track basis. With four tracks it does.

FLUXVALVE AND T-GUARD ARE TRADEMARKS USED TO DENOTE THE QUALITY OF PICKERING & COMPANY INVENTIONS. 2371 A

Truly the finest stereo pickup ever made... the STANTON Stereo FLUXVALVE is hermetically sealed in lifetime polystyrene with all of the precision that has made Pickering a quality leader in the field of high fidelity for more than a dozen years.

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"No man can improve an original invention..."

—William Blake

THERE are many scientists today who would argue this point with Blake.

At Bell Telephone Laboratories, for example, we have seen original inventions improved and re-improved countless times, the better to serve mankind.

But William Blake went on to say "... nor can an original invention exist without execution organized, delineated and articulated." Here Blake expressed ideas that apply with striking emphasis today. At Bell Laboratories organized effort is constantly aimed at fostering an environment in which inventions can exist and prosper, where they can be expressed either as ideas or in physical form, and where clear understanding of their principles can be achieved.

By helping scientists and engineers to reach for the things they seek, by organizing and coordinating their efforts, Bell Laboratories has made important contributions to the art of communications: proof of the wave nature of the electron, first research in radio astronomy, discovery of the transistor principle, invention of the feedback amplifier. Such ventures into the unknown have twice brought the Nobel Prize to Bell Laboratories scientists, and at the same time have helped create the most efficient and versatile telephone system ever known.

William Blake (1757-1827), a versatile genius, was famous for brilliant, sometimes prophetic, insights which he expressed with provocative beauty in drawing, painting, poetry and prose.

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The TW/PA2—A Comprehensive Tape Preamplifier

ARTHUR W. WAYNE*

For high-quality reproduction from tape, the amplifier must be designed for the job. Simplicity does not always produce the desired results, and most stereo preamps are complex, though not necessarily complicated.

THERE ARE MANY excellent professional tape preamplifiers on the market, particularly in U.S.A., but, unfortunately, the circuitry of most of them is rather beyond the capabilities of the average hi-fi enthusiast. On the other hand, the number of simple-to-make circuits must be legion; but so also must be the number of disappointed amateur builders. This is not to say that the designers of the simple circuits do not know what they are doing—it is merely that the comparatively complicated professional amplifier is, usually, the end product of an intensive development project, while the simple do-it-yourself affair is more likely to be the result of a one- or two-of construction. The chief difference is dictated by the professional's basic necessity to make a profit in a highly technical atmosphere, as compared to the somewhat less strenuous demands of the man who likes to make things. However, it is sometimes possible to combine the advantages of both worlds, and the preamplifier to be described, the Shirley Laboratories Ltd. type TW/PA2[1], while being a really professional piece of equipment, is not too difficult to make, needing, mostly patience and a delicate touch with the soldering iron. It is a design which has been on the market for some while, and was originally evolved as the basic unit in a very exacting set-up indeed.

From the schematic, *Fig.* 1, it will be seen that the recording amplifier is entirely separate from the replay preamplifier, this arrangement removing, at one stroke, what is probably the most difficult part of tape amplifier construction, the involved switching required when the tubes are used for more than one function. As shown, the circuit is arranged for use with the Ferrograph "A" and "B" decks, but details for coupling to almost any other type of deck will be given later. The recording amplifier is in three stages, comprising a Mullard EF86 microphone and low-level pickup preamplifier, and the two halves of a Mullard ECC81 double triode as the main amplifier. Auxiliaries included during the recording function are a sustained peak-indicating voltmeter of conventional design, and, of course, a bias and erase oscillator. On replay, an EF86 is the head preamplifier, with another EF86, triode-connected, as the second stage. The separation of the record from the replay section permits, with three-head decks, continuous monitoring during recording. Letters and figures in the schematic refer to the tag-strips on the underside of the Ferrograph deck, connection and switching details of which are shown in *Fig.* 2.

Circuitry

The circuit will now be considered in more detail. J1 is an ordinary single-circuit telephone jack, and can quite

* *Shirley Laboratories Ltd., 3 Prospect Place, Worthing, Sussex, England.*

[1] FS 100 in U.S.A.

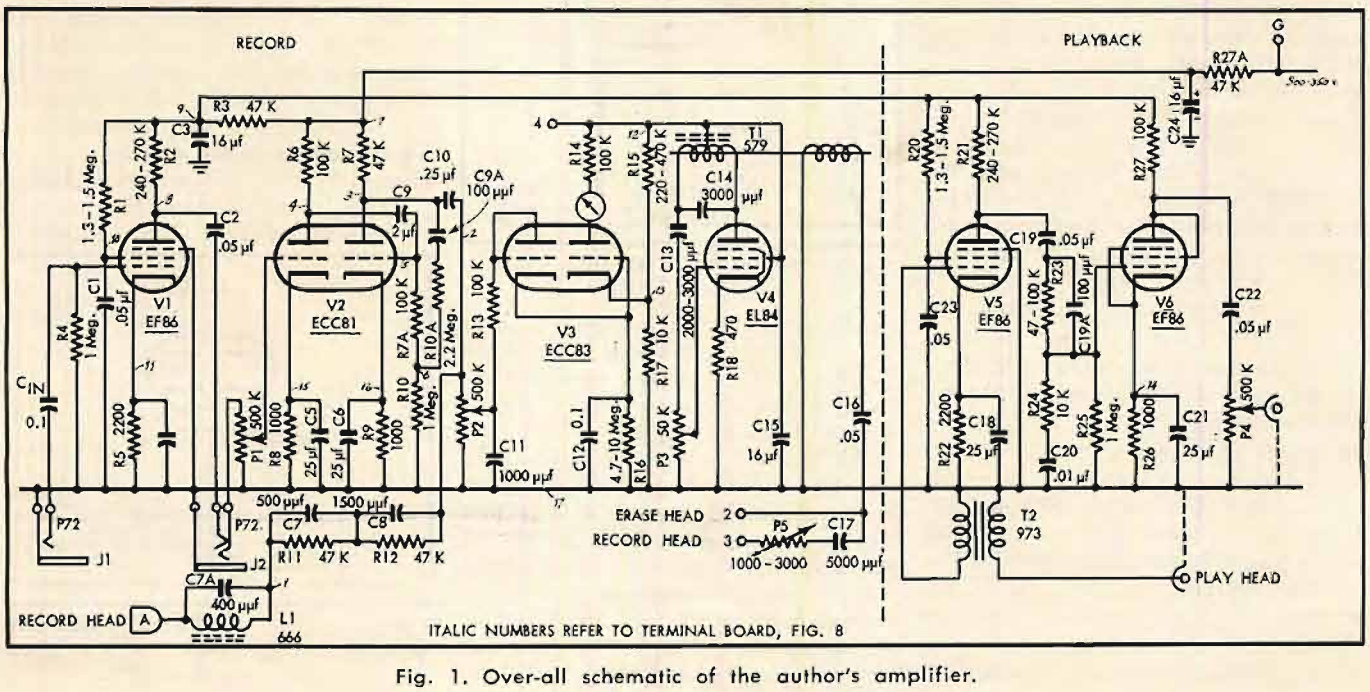

Fig. 1. Over-all schematic of the author's amplifier.

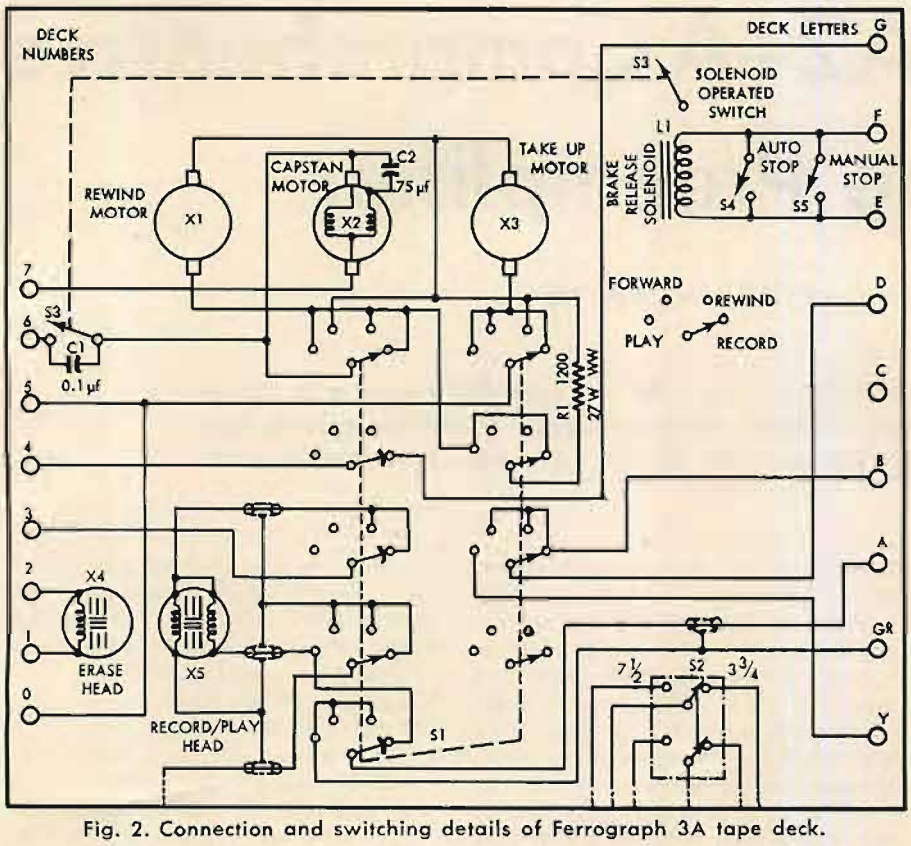

Fig. 2. Connection and switching details of Ferrograph 3A tape deck.

satisfactorily be replaced by an RCA-type phono jack. The value of R_1, V_1 grid leak, is chosen as a reasonable compromise for loading most types of microphone; and there is no reason why it should not be replaced by a resistor of lower value, if preferred, although users of crystal microphones should be warned that, with certain individual tubes, higher values may result in excessive grid current. When the signal source is a pickup, equalization and the termination load must be provided prior to the input. R_1 and R_2 are low-noise high-stability resistors, and C_1 grid 2 decoupling capacitor, can be increased to 0.1 µf with a slight improvement in bass response. This increase has not been found necessary in the commercial versions of the amplifier. Coupling capacitor C_2 is chosen to give, with P_1, almost unity coupling down to 50 cps, and departures from this condition, which may be necessitated by excessive bass content in the input signal to J1, can be calculated quite easily from the formula $R^2/\sqrt{R^2+X^2}$ where X = reactance of the coupling capacitor in ohms at the significant frequency f_o, $R = P_1$, and $R/\sqrt{R^2+X^2}$ = fraction of f_o passed to the top of R via C_2.

J_2, the high-level input, for crystal pickups and radio tuners, is a standard two-circuit telephone jack, and insertion of the plug disconnects the whole of the low-level section from the rest of the amplifier. A phono jack may be used in this position, too, but if it is, care must be taken to ensure that only low-impedance sources are put across its terminals, or noise from the preceding stage may appear in addition to the signal. P_1, the RECORD gain control, is connected via its slider to the grid of V_{2A}, half of an ECC81. It will be noticed that R_8, the cathode resistor for this tube, is quite low in value as compared to R_6, the

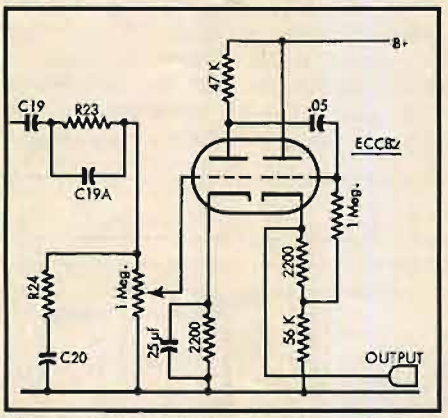

Fig. 3. Cathode-follower output stage in replay amplifier.

anode load. This in intentional, again with grid current in mind, to avoid the possibility of noise when operating the gain control. C_9 passes the amplified signal from V_{2A} to the grid of V_{2B}, which is, as can be seen, employed rather as a low-output power amplifier than as a voltage-amplifier; and C_{10} couples V_{2B} to the recording head by way of R_{11} and R_{12}, which have the effect of making the tube appear as a constant-current generator to the head, an essential condition in view of the inductive component of the windings. C_7 and C_8 provide the usual recording treble lift, and although the circuit seems too simple to be effective, it does in fact work remarkably well. It is self-limiting in respect to the different tape speeds in regular use, C_7 having no noticeable effect at 3¾ ips, boost at this speed being ensured mainly by C_8, while at 7½ ips, C_8 and C_7 between them, together with the tape and head losses, give an ideal rise up to about 12,000 cps, after which the response drops steeply. At 15 ips, the useful response is held up to around 15,000 cps. All these figures, of course, are to some degree dependent on the geometry and adjustment of the heads, as well as the characteristics of the tape itself. Recording bass boost, to accord with NARTB requirements, is covered by the feedback network C_{9A}, R_{7A}, R_{10}, R_{10A}, and if additional treble boost is desired for pulse and similar work, R_{10} may be bypassed by a capacitor of 25 µµf to 200 µµf, the actual value needed being determined by experiment in association with the necessary test gear. (It should perhaps be remarked that, if this modification be made, it is unpleasantly easy, without great care in lead dress, to convert the amplifier into an effective pulse generator on its own). As C_7 and C_8 offer a comparatively low-impedance path at the bias frequency of 50 kc, a trap consisting of a 20-mh coil tuned by a 400-µµf capacitor terminates the recording amplifier.

Record level monitoring is by the sustained peak-indicating VTVM. V_3, R_{13}, R_{14}, R_{15}, R_{16}, R_{17}, C_{11}, C_{12}, and delay on the needle return is determined by the RC network C_{12}, R_{16} time-constant, which may be multiplied, by varying C_{12}, without upsetting the operating conditions other than increasing the hang of the needle on peaks. P_2 taps off the monitoring signal to a figure convenient for the meter to handle, while C_{11} bypasses stray bias which might prevent the meter from zeroing accurately. It is possible that R_{15} will be a subject for adjustment, as the necessary backing-off voltage on the cathode of V_{3B} is affected by individual valves as well as by the delay network; but 470k serves in the majority of cases. (U.S. constructors

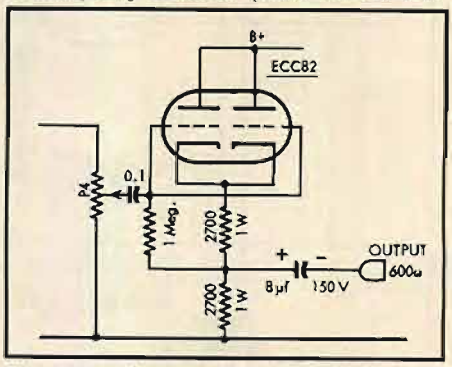

Fig. 4. Another output circuit which gives good output into 600-ohm load circuit with low distortion.

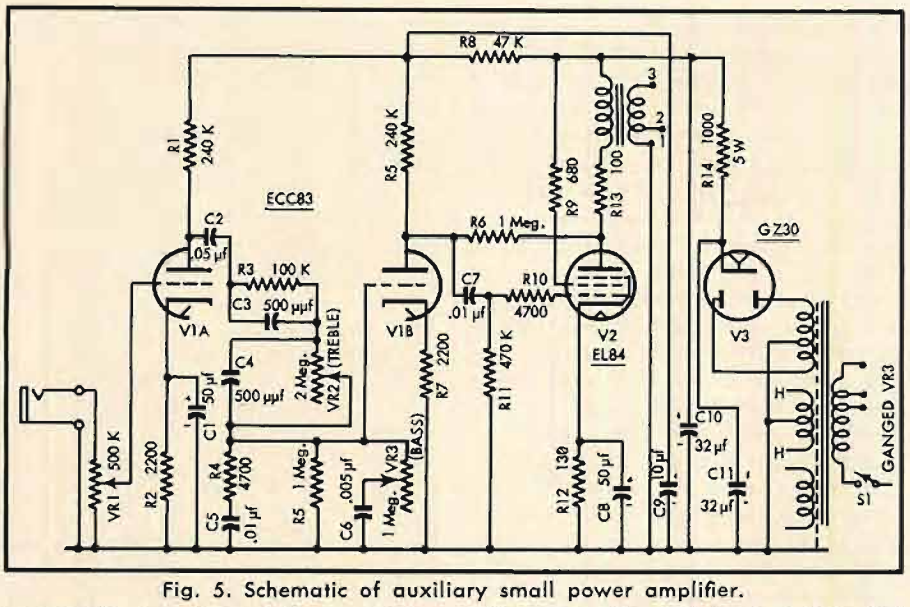

Fig. 5. Schematic of auxiliary small power amplifier.

may prefer a cathode follower driving a standard VU meter.)

T_1, C_{14}, V_4 comprise the bias- and erase-oscillator section. (T_1 is the Ferrograph 579 coil, and V_4 the EL84 steep-slope power pentode.) P_3 permits of adjustment of grid drive for maximum output consistent with good waveform, which should be a pure sinusoid, free from second harmonics; and current feedback via R_{18} helps ensure this. C_{15}, by acting as a reservoir of B+, prevents the too rapid cessation of oscillation when the B+ supply is switched off via the deck function switch, this being essential to ensure that the heads will not be left in a state of permanent magnetization, with consequent noise on the tape. Because of the comparatively low impedance of the heads, T_1 is wound with a step-down secondary winding, and the erase head takes its current from this by way of C_{16}, the record head being fed through C_{17} and P_5, the potentiometer providing an adjustment for optimum bias, the value of which is stated by the makers of the deck for each individual head. (Note that recording bias is not taken across the whole head winding, but is brought in via a tap about a third of the way from ground terminal.)

On replay, the head is coupled to V_5 via the deck switch and T_2, the Ferrograph step-up transformer type 977, which has a ratio of 1:6; and the coupling between V_5 and V_6 includes the replay equalizing network, where most of the bass boost is provided, as well as a small increment of treble lift to help compensate for high-frequency losses during REPLAY. C_{20} presents an increasing reactance as the frequency decreases, in accordance with the formula $X = 10^6/2\pi fC$, (where f is in cps and C is in µf), its shunting effect on the signal becoming less and less, R_{24} providing the step, while the RC network R_{23}, C_{19A} boosts treble according to the same formula, the decreasing reactance of C_{19A} bypassing R_{24} at the upper end of the scale. V_6 is another EF86, triode-connected, and P_4 is the output potentiometer. For long lines, this may be replaced by a control of down to 100k, with slight reduction of maximum output signal, or it is possible to substitute a double triode for the EF86, the second half being arranged as a cathode follower. The circuit is given in *Fig.* 3, and may be used for feeding into lines up to 20 ft. long, provided the terminations are not less than about 80k ohms. With 600-ohm terminations, severe distortion will occur with this type of cathode follower, even at low levels, and it will be more satisfactory to retain the EF86 and follow it with an ECC82 connected as a cathode-follower in the circuit of *Fig.* 4, which will permit of a maximum output signal of about 2 volts into such a terminating impedance, with no measurable loss over the whole of the audio range and beyond. (From the circuit as given in *Fig.* 1, up to 3 volts are available from a tape fully modulated on the recording section of the amplifier.

It will be noted that B+ for the replay section is drawn from the junction of R_3 and C_3: and this is absolutely essential if the power supplies as a whole come from the main power amplifier into which the output from V_6 is fed. The response on the replay side is such as to permit of appreciable signal being passed at 2 cps or even lower, and in most cases, if B+ is taken from the junction of C_{28} and R_{27A}, and providing of course that the low-frequency response characteristics of the power amplifier are good enough, interaction will cause motorboating at any frequency between 0.5 and 10 cps, depending on the circuit constants.

Figure 5 is the schematic of an auxiliary small power amplifier, for monitoring with three-head decks. Not to put too fine a point on the matter, it can fairly be described as the triumph of brute force and ignorance over civilized design. It really is a disgraceful example of low cunning. A very flexible tone-control system is simulated by the simple expedient of cutting bass and boosting treble as a permanent feature, and then reversing the process as required, by means of P_2 and P_3. Negative feedback to minimize hum and distortion is provided by R_6 and R_9, and, as the output transformer is outside the feedback loops, there is very little risk of instability; so this component does not have to be in the luxury class: the cheapest will do. The experimenter will no doubt try various values for R_6, and the lower it is, the greater the feedback. The only restriction in this direction is when the shunting effect of R_6 on R_5 is so great as to reduce the load on V_{1B} to too low a figure. Substitution of the ECC83 by an ECC81 will put off the evil, although the gain of the amplifier as a whole will be reduced, even without feedback. Lead dress is unimportant, as it appears to be quite impossible to make mistakes in that direction, but if the WB/U is used also as a power source for the TW/PA2, B+ is better drawn from the cathode of the

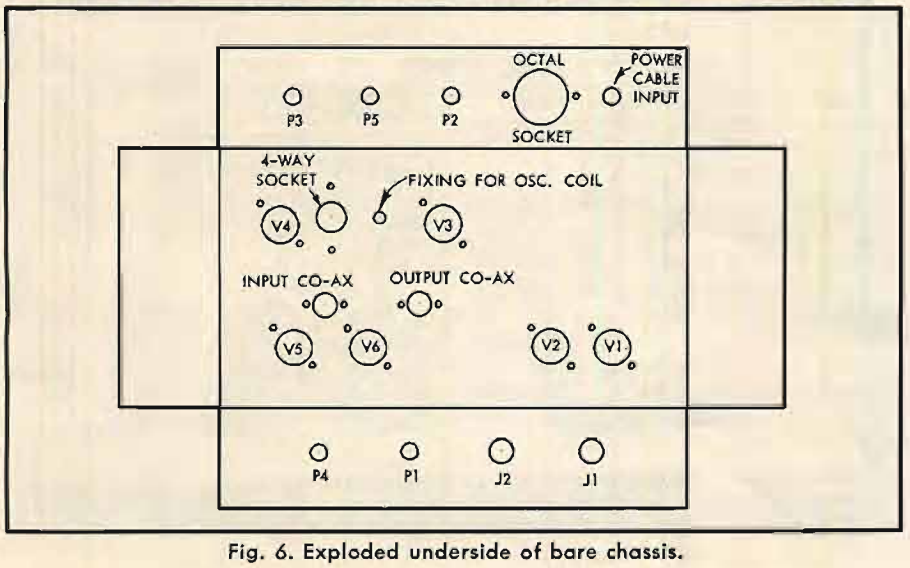

Fig. 6. Exploded underside of bare chassis.

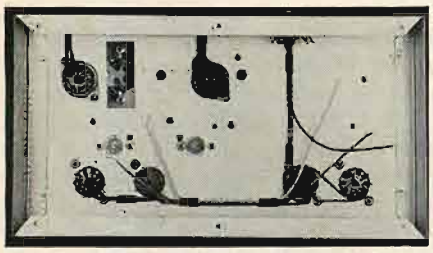

Fig. 7. Chassis with sockets and heater wiring in place.

GZ30, and not from the junction of R_{11} and C_{10}. The amplifier is unworthy of further comment. Suggestions as to obtaining the parts for it will be given later, and the total cost need be no more than twenty dollars, and may well be much less, as most of the bits and pieces will already be in most constructors' junk boxes.

Returning to the TW/PA2, the general dress should follow, in broad outline, that of the commercial article which, one may be sure, is arranged with ease of construction and duplication of results in mind. The suggested chassis is of mold steel, and is fitted with a bottom cover, so totally enclosing the works, and excluding external hum and noise pick-up. An exploded view of the inside is shown in *Fig.* 6, and the tube-socket and control holes can be drilled or punched either before or after folding, with equal facility. Apart from the main openings, the amateur will probably find it easier to drill as he goes along, rather than measure and mark out first.

The factory wiring procedure is based on the assumption that the deck cable forms are attached, and the power cable is wired in, before any other work is done. (It *is* only an assumption, but it helps clarify the position in the operator's mind.) With this end in view, a three-way cable-form is connected to the lettered terminal-strip under the deck, one lead being joined to Gr, a ground point on the frame, another to A, which carries the recording signal, via the switching, to its appropriate head, and the third to G, the B+ bus for the oscillator. The remote ends of the form are soldered into three of the pins of an octal plug, for which a socket is provided on the rear of the amplifier chassis, behind the recording section. The corresponding socket holes are noted, and that going to the Gr pin is joined via a short length of # 20 or heavier wire to any near point on the chassis, for which one of the socket fixing rivets is an obvious choice. The reason for this connection is to keep the deck frame and motor grounds away from the main amplifier ground point. Five tags on the octal socket are thus available as anchor points, and the four-wire power cable is now wired into place. It carries heater supply, and B+ from the power-pack, but if these supplies are taken from the main replay power amplifier, the ground return from this is not used, or hum will certainly result. The replay output co-ax shell is the *only* ground connection between the two amplifiers. R_{27A} is wired across the B+ "in" terminal and the remaining spare on the socket, which is now the main B+ bus. Next, all the controls and the two jacks are fitted into their respective positions,

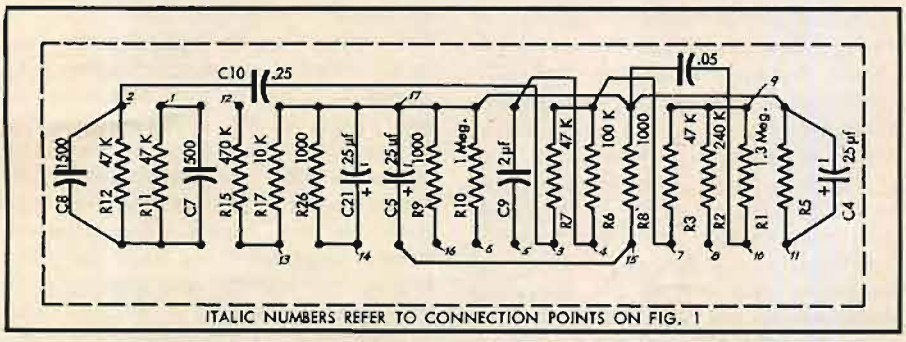

Fig. 8. Arrangement of parts on resistor strip (group board).

and then the tube heaters are wired up; but note that the form between V_2 and V_6 carries, in addition to the heater wires, one extra wire each for (1) the B+ line from the junction of R_3 and C_3 to the replay section, (2) the cathode lead from V_6 to R_{26}, C_{21}, which are located on the main group-board, and (3) the connection between the spigot[2] of V_6 tube socket to the spigot of V_2 socket. The next operation is the fitting of the two co-ax inputs, one for the replay input and the other for output, and the shell are joined, via solder-tags under the fixing rivets, by a short piece of # 16 wire. *Figure* 7 shows the heater wiring, together with two of the extra wires, as well as the B+ wire from the octal socket, ready for soldering to the main group board.

The oscillator section is now wired, as is the V_3 circuitry, a length of insulated wire being first soldered to pin 3 of V_3 socket for later connection to the junction of R_{15}, R_{17}, which are on the main group-board. Connections for the B+ line for V_3 and V_4 are by way of a 4-pin socket on the chassis and corresponding plug and cable-form to the deck, and this socket also carries the bias, erase and ground returns i.e. 2, 3, 4, and 1 in *Fig.* 2. The main group-board, which has already been assembled and wired, is then bolted into place, and the replay section B+ feed wire—which, as will be remembered, is included in the form from V_6 to V_2—is connected to the junction point of R_2 and R_3, another wire from the B+ terminal on the four-pin socket being joined to the top of R_{15}. C_{23} and C_3 are now soldered into place, and the remaining lead in the form, from V_6 cathode, is wired to its appropriate position on the group-board, the latter being shown in *Fig.* 8. The shield around the replay section is prepared by mounting a small terminal strip on it, and soldering on to this all the remaining components belonging to V_5 and V_6, with the exception of R_{22}, C_{18}, R_{24}, R_{25}, and C_{20}, which are laid as near to their

(*Continued on page 74*)

[2] Mr. Wayne tells us that the "spigot" is the center shield of the noval socket.

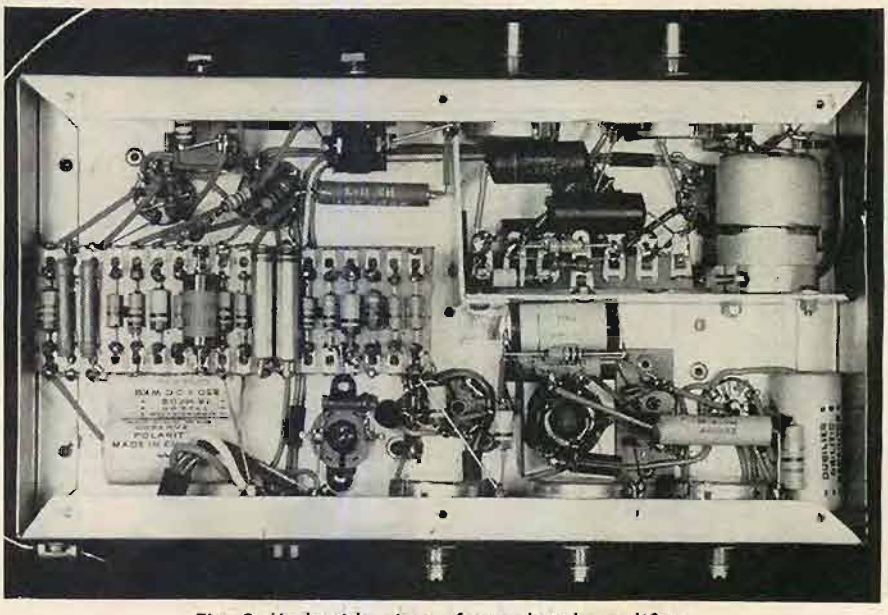

Fig. 9. Underside view of completed amplifier.

The Trimensional Stereo Speaker System

VICTOR BROCINER*

The desirability of a compact, single-cabinet speaker system for stereo has led to the development of a new design incorporating the equivalent of two 3-way speaker systems in one cabinet of moderate size.

STEREO INSTALLATIONS involving two separate speakers, no matter how compact, are not always feasible in modern living rooms. Locating the speakers for best stereo performance sometimes leaves no way of positioning furniture in an attractive manner. The requirement that the listener be on or near the center line between the two speakers makes locating two separate systems and seating arrangements even more of a problem.

For many homes, the ideal solution for stereo would utilize some means whereby the two normally separated speaker systems are combined in a cabinet of modest proportions, while providing adequate separation and spread of sound for real stereo. This was the basic objective in developing the University "Trimensional" speaker system. A maximum cabinet width of 30 in. was specified.

Since it is required that the speaker systems for the two channels be physically close together and that the apparent sound sources be separated by a considerable distance, the obvious solution is to direct the sound from the speakers in such a manner that the listener hears mainly the sound reflected from the walls of the room. This idea is illustrated in *Fig.* 1. The usual wall surfaces reflect sound fairly well in the frequency range above 150 cps or so, and it is within this range that the stereo effect takes place. The difficulty in the simple arrangement of *Fig.* 1 is that, since the speakers themselves

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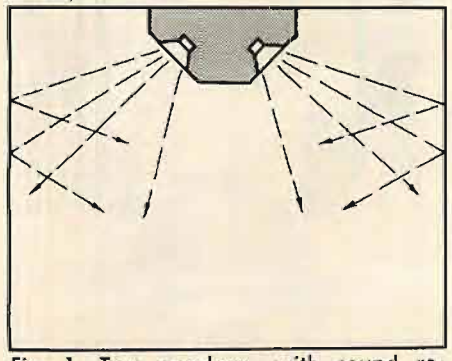

Fig. 1. Two speakers, with sound reflected from side walls.

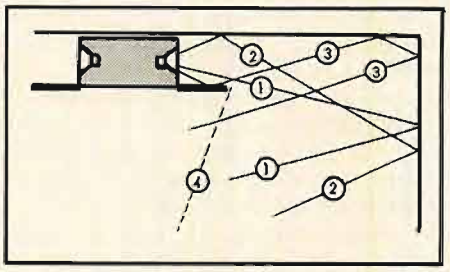

Fig. 2. Sound paths from one side of speaker; similar paths exist on other side.

are not extremely directional, a good deal of sound reaches the listener directly from the speakers, and the sources appear to be close to the cabinet. The remedy, of course, is to make the speakers directional, but, for frequencies down to 150 cps, the space required to accomplish this is not compatible with the requirement that the width of cabinet be kept below three feet.

The solution adopted was to place two doors on the front of the cabinet where they are out of the way when the unit is not in use, and arranged so that they can swing outward to the positions shown in *Fig.* 2, when using the speaker for stereo. The doors are large enough to reduce the direct sound from the speakers to a sufficient extent to keep it from masking the sound reflected from the walls. A certain amount of sound, of course, "leaks" around, or is diffracted from the edges of, the doors, but the effective separation between these apparent sources is of the order of 4 to 5 feet. The over-all effect is similar to that of a phantom channel in the center to provide a continuous sound field.

Figure 2 also shows the way in which sound is reflected from the rear of the deflector doors, from the rear wall, and from the side walls to form two broad sound fields which are continuous through the center. The paths followed by the sound are as follows:

(1) Sound from the speaker reflected by the side wall.
(2) Sound reflected from the rear wall and then again by the side wall.
(3) Sound reflected by the front deflector, then by the rear wall, and finally by the side wall.
(4) Sound directly from the speakers, spreading around the deflectors.

The resulting virtual sources of the sound, or rather the *areas* from which the sound seems to come, spread not only beyond the confines of the cabinet but beyond the walls of the room. The resulting spread is actually greater than that obtained with a conventional two-speaker arrangement. In effect, a curtain of sound is produced that extends across the end wall and beyond both side walls.

An interesting consequence of the reflections from the walls is illustrated in *Fig.* 3. Unlike the situation obtained with two speakers, in which there are two sound sources, there are multiple virtual sources, located behind the wall, spread out in depth. The sound field created by these virtual sources, plus the diffused sound arriving from the rear wall, is seen to be three-dimensional. It is this quality that inspired the name "Trimensional." The sense of depth produced is definitely audible, and has been judged by a large proportion of the listeners in exhaustive listening tests, to add appreciably to the realism of reproduction.

Sometimes an engineering development yields unexpected dividends. The nature of the broad sources created by the Trimensional speaker is such that a good stereo effect is produced throughout the room. See *Fig.* 4. In the listening tests previously referred to, *all* of the audience heard stereo, regardless of their positions. Demonstrations under difficult conditions have confirmed this fact—even at the 1959 San Francisco International High Fidelity Show at the

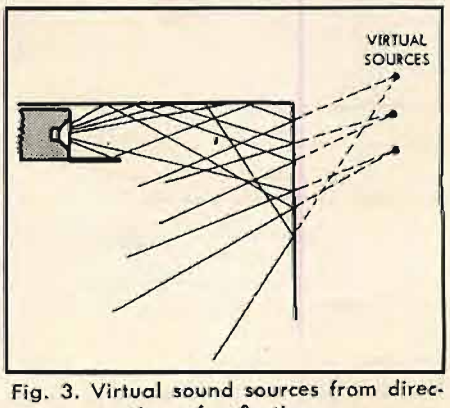

Fig. 3. Virtual sound sources from direction of reflections.

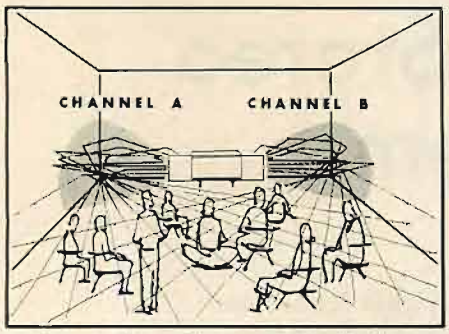

Fig. 4. Over-all sound distribution.

Cow Palace, where no side-walls were provided in the "booths," and it was possible to install plywood panels no more than 4 ft. wide to simulate the end walls of a room.

Construction Details

The construction of the speaker system is shown in *Fig.* 5. Front and interior views are included in *Figs.* 6 and 7. It will be seen that there is an 8-inch speaker for the mid-range, plus a compression-type horn-loaded tweeter, facing in each direction. The upper crossover frequency is 3000 cps; the mid-range units cover the range down to 150 cps. The tweeter and mid-range speaker on each side are mounted in a closed compartment, independent of the low-frequency speaker, to prevent the latter from driving the mid-range direct-radiator speakers. These compartments are of adequate size to ensure that the resonant frequency of the mid-range speaker remains below the crossover frequency.

The 150-cps crossover frequency was chosen on the basis of extensive tests, which indicated that the stereo effect occurs over a frequency range that extends down to this region. Thus, all the frequencies involved in creating the directional effect are covered by the speakers mounted in the sides of the cabinet.

There being no directional effect below 150 cps, the low-frequency source can be located according to considerations of best performance, greatest convenience, appearance, and ease of assembly. For the same reason, it is not necessary to use two separate woofers. In the Trimensional speaker, the bass of both channels is reproduced by one speaker.

If all stereo recordings were made with moderate microphone spacing, such that both microphones received essentially identical signals below 150 cps, it would only be necessary to reproduce the bass range from one channel, boosted 3 db to make up for the absence of the other channel. However, with the microphone techniques currently in use, it can easily happen that one channel contains practically all the bass, such as when a group is being recorded with one microphone close to the bass instruments. There is, of course, no way of predicting which channel will have most of the bass. The logical answer is to combine both channels up to 150 cps. This is accomplished at no sacrifice in performance, affording an appreciable saving in space and cost.

The combination of the two channels below 150 cps can be effected by means of a special filter and transformer network. A typical schematic of such a filter is shown in *Fig.* 8. It is seen to be rather complicated, and it is expensive, too, since the isolation transformer must perform well down to the lowest frequencies to be reproduced and must be capable of handling the full power of one channel.

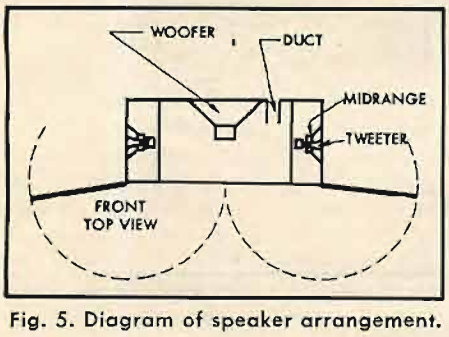

Fig. 5. Diagram of speaker arrangement.

A simpler and more satisfactory solution of this problem is afforded by the use of a woofer with a dual voice coil. *Figure* 9 shows the schematic of the speaker circuit and indicates the essential simplicity of the system. The woofer has two voice-coil windings, bifilar wound, with four leads brought out to terminals. Each winding is connected to its amplifier channel through a choke which acts as a low-pass filter. The two voice-coil windings simply add the bass from the two channels.

There is practically no transformer action between the two voice coils at low frequencies; the two amplifiers are electrically isolated, and no undesirable interaction can occur between them. The elimination of a common ground connection is also an advantage. At the higher frequencies, the chokes isolate the voice coils from the amplifiers, and any coupling that may occur between the windings has no effect on the latter.

The single woofer used in the Trimensional speaker system is a high-compliance design, capable of large excursions without departing from linearity. The moving system has high mass, as required for good response, down to, and below, 30 cycles. The free-air resonance of this 12-inch unit is 18 cps.

Bass Enclosure

In order to obtain optimum response to 30 cps with minimum excursion of the voice-coil, the 2 cubic-foot bass enclosure is "vented" by means of a tubular duct.[1] Through careful adjustment of system Q's, excellent damping is obtained, as indicated by the tone-burst photograph in *Fig.* 10.

Note the almost nonexistent "hangover" which is actually less than the amount to be expected from the listening room itself. The woofer-enclosure combination is designed for operation from any high fidelity power amplifier having high damping factor.

The duct provides a load on the

Fig. 6. External view of the speaker with doors open. When closed, the doors cover the entire front.

[1] Victor Brociner, "Compact ultra-linear speakers for stereo." AUDIO, Aug. 1958.

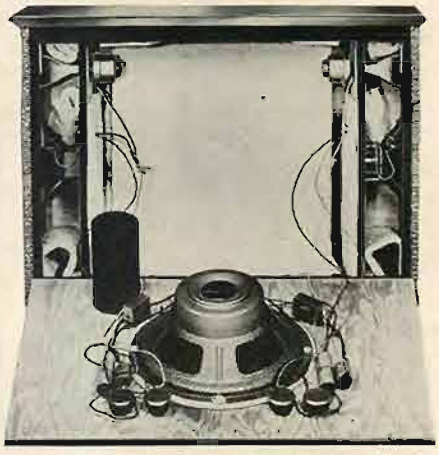

Fig. 7. Internal construction of the speaker.

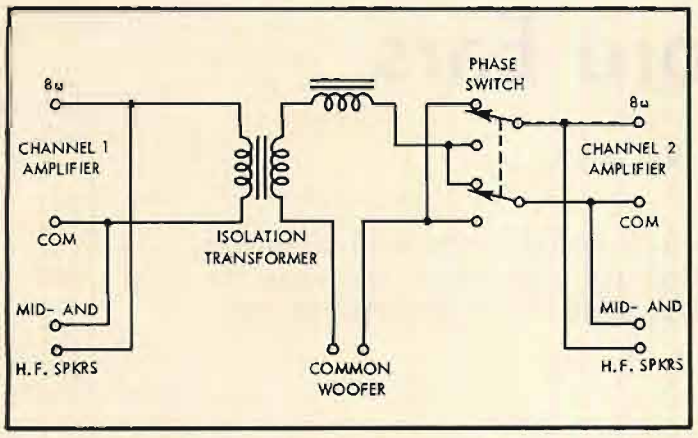

Fig. 8. Stereo network to feed signals from two amplifiers to a single woofer.

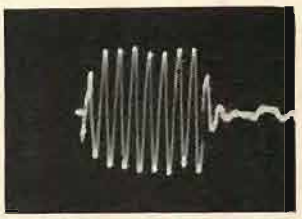

Fig. 10. 50-cps tone burst. Irregularity of modulation envelope is inherent in the test equipment.

speaker, in the vicinity of cabinet resonance, that is practically pure radiation resistance. At the bottom of the range, most of the power is radiated from the duct; as a result, voice-coil excursion is markedly reduced, with corresponding reduction in distortion. This action is evidenced by the presence of a noticeable breeze in the vicinity of the vent when low frequencies are reproduced at high level. If the vent is closed while 30 cps is fed to the speaker at high power, the increase in motion of the cone is readily seen.

Incidentally, there seems to be some popular misconception about the reasons for using a duct instead of a simple opening or port in "phase inverter" enclosures. Special properties are somehow associated with a duct that make for improved performance. The usual explanation is that the duct calls for an opening of considerably greater area than a port, that this provides with a larger value of radiation resistance and that this, in turn, results in more bass and better damping.

From an intuitive standpoint, this looks very plausible. Does it bear analysis? The radiation resistance, in mechanical units, of a large opening is greater than that of a small one, just as it is for a large speaker compared to a small one. In the case of a speaker cone, which is driven by a *force* determined by its electromechanical coupling and the applied power, more power is radiated the larger the cone. But a port is driven by the *pressure* developed in the box. If we use a large opening, the fluid velocity out of the port will be lower. The lower velocity counteracts the effect of the increase in radiation resistance; in fact, it compensates it exactly. The *power* out of the port is not affected by its size.

The significant difference between a duct and a port is that the frictional loss in a port increases more rapidly than the inertance as the port size is decreased. As the port becomes very small (a fraction of a square inch), the resistance becomes so large that the system becomes over-damped and the port-cabinet combination no longer functions as a phase inverter. Tuning a small box to a low frequency requires a small port; a duct allows a larger opening to be used, which avoids excessive resistance in this "circuit element." The lower air velocity also prevents the production of noise due to turbulence.

Efficiency and Frequency Response

The efficiency of the system is moderately low; this is typical of small cabinets having extended bass range. Experience has shown, however, that a dual 12-watt stereo amplifier provides very satisfactory operation for average home use.

It will be remembered that most of the energy above 150 cps reaches the listener after one or more reflections. At each reflection there is a certain amount of loss. The nature of most surfaces is such that this loss is greater the higher the frequency. So, if the frequency response of the speaker were flat, the listener would hear a response that is deficient in highs—progressively so as we go up the frequency scale.

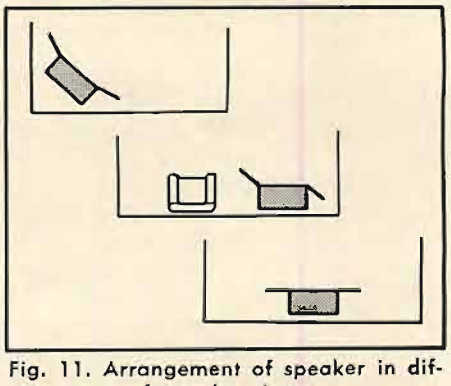

Fig. 11. Arrangement of speaker in different locations.

In order to compensate for this, the Trimensional speaker is designed to have a response curve that rises with frequency. This response can be varied at will to compensate for the different reflective characteristics of various wall materials, construction, and decorative treatment. L-pads controlling the midrange units and tweeters on each side permit adjustment of the response characteristic. If the listening room is not symmetrical acoustically, it is possible to achieve balance both tonally, and in loudness, by means of these controls. The range is sufficient to enable the user to compensate for sizable losses such as may be caused by nearby upholstered furniture or drapery. An obstruction adjacent to the speaker can be taken care of by turning the door on that side slightly forward to prevent blocking of the lower frequencies. At the same time, the controls described

(*Continued on page 74*)

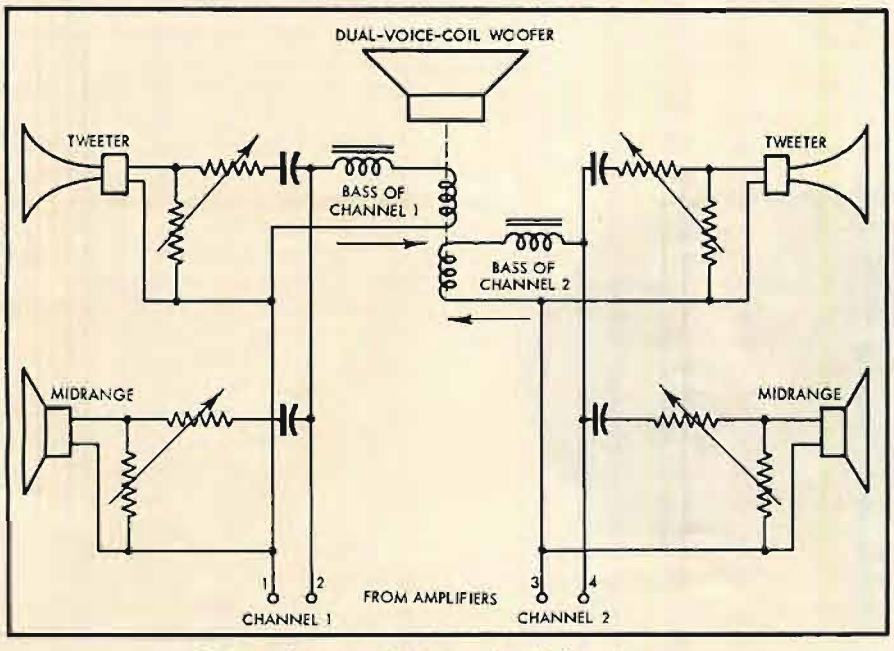

Fig. 9. Schematic of Trimensional circuitry.

Two More Ears

M. DAVID WEISBERG*

One effective method of making a high-quality stereo headset from a surplus item with a minimum of effort and expenditure. Many are the uses for such a device, both in the laboratory and in the listening room.

THE AVERAGE CITIZEN'S conception of a pair of headphones is that of a device that holds the studio engineers' head together. Or perhaps the earmuffs that the "ham" down the street wears so as not to hear the wails of irate TV viewers. This attitude may be due to the fact that headphones are not generally associated with living room listening. My own experience with them had been confined to the "ham" shack or the test bench. Some time ago, the need arose for some way of listening to the audio system without annoying others. It was tried, with a pair of 'phones at hand, but the results seemed to justify all the derogatory remarks heard on the subject.

The answer to complaints of poor reproduction through 'phones may be had by understanding them. There are three basic types: magnetic, crystal, and dynamic. The first constitutes about 90 per cent of the commercial and surplus market and is the type found in telephone handsets. The least expensive of the three, it consists of an iron diaphragm close to one or two electromagnets with permanent magnet cores. These are rugged units of 2000 to 8000 ohms impedance, the best of which are lacking in response at both ends of the audio range. Peaked in the 300- to 3500-cps range, they are designed primarily for speech and will seriously distort when subject to dynamic, wide-range audio material.

The crystal 'phone is similar to the crystal microphone in that they both employ piezo-electric salts. When subject to an alternating current, the crystal moves and in turn moves a fiber diaphragm linked to it. This produces sound. These are high-impedance devices of medium price, and while lacking in low-frequency response, they are capable of satisfying the casual listener. They are delicate, however, and may be rendered useless by running d.c. on them, or by exposure to shock, heat, or moisture.

The remaining class, the dynamic, is the least common and the most expensive. It is basically a miniature PM speaker, consisting of a moving coil connected to a cone, usually of fiber. Possessing the widest response of all, the dynamic 'phone is a low-impedance device. It is usually available in some standard line value, such as 600 ohms.

It appears then, that the dynamic type is the choice. A look at a current catalog, however, may prompt the reader to leave the order blank blank. The tag, over forty dollars, will deter all but the most heavily endowed. If the surplus ads are consulted, you will find "moving coil" units available for seven or eight dollars. These are dynamic units used by the military for audiometer tests and are duplicates of some units available on the commercial market. This is the type to purchase.

* *2707 Creston Ave., Bronx 68, N. Y.*

Fig. 1. Modified phones showing wiring method, 4-pin plug, and matching connector.

Conversion Procedure

The degree of conversion is up to the user and his requirements. If the application is monophonic and impedance mismatch can be tolerated, the 'phones may be used "as is." For greater flexibility, it is advisable to change the cord. Not only will the cord be too short but it is unsightly and, finally, is not wire but tinsel covered threads to which it is impossible to solder. On the rear of each unit there are two screws. Loosen each a turn or two and the wires will come out. Remove all the cord from the headband. Using four conductor intercom cable, strip back the jacket for 18 in. Wrap Scotch brand electrical tape around this point to build up the cable diameter. Examination of the headband will reveal four cable clamps, two on each side. One is larger than the others and this is one that holds the cable. Slide plastic spaghetti over two of the wires, route them over the headband and under the clamp. The remaining two wires are treated in the same manner, being run under the clamp adjacent to the cable. Examination of *Fig.* 1 will make this clear. The headband shown in the photo was taken from a pair of magnetic surplus 'phones, the wires being run through the leather loop. You now have the two pairs of wires terminating near their respective earpieces. Bare the ends and solder each into a piece of brass tubing 1/8" by 3/8" long or into the screwdriver slot of a machine screw of the same dimensions. Slide these into the 'phone terminal holes and tighten the screws. The other end of the cable may be terminated in one or two plugs, depending on intended use. For monophonic use, connect the two units in series or parallel, using a standard phone plug.

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For binaural use, connect each unit to its own phone plug. Proper phasing may be had by noting the color code of the wires, and to which terminal on the headphone each one goes. When connecting the wires at the plug, join like terminals under one screw and the remaining two under the other. Don't make the mistake of wiring the two leads of one phone together or to both plugs (in the stereo connection). Before attaching the plug, make sure all the hardware is on the cable and facing in the right direction. The connector shown in *Fig.* 1 is a four-pin type which allows attachment of extensions wired for varied purposes.

The phones are ready to use at this point, but unless your program source terminates in 250 or 600 ohms, there will be a power-transfer loss and the frequency response will suffer. However, you may not be able to notice either, since the phones demand far less power than is normally available.

The truly dedicated audiofan may demand a closer match and this may be had in two ways. The nominal terminal impedance of each phone is 300 ohms. Series connected, this represents 600 ohms at the plug, or 150 ohms in the parallel connection. A small transformer to match 150 or 600 to 4, 8, or 16 ohms will provide a proper match. This not only entails spending money, but it seems just a bit odd to have to use three transformers between the output tubes and the voice coil. There are three, for within each unit there is a miniature 300-to-8-ohm transformer. By removal of these, you have your pick of 4 or 16 ohms monophonically, or 8 ohms for each channel of a stereo system.

Removing Transformers

To remove the internal transformers, remove the phones from the headband and note that these do not unscrew as do the magnetic type. That would make your job and this article shorter. Place the unit face down on a hard surface and pry up the crimped edge of the retaining ring, using a knife or screwdriver. The latter is preferable, since it won't go too far into the table when it slips! After the crimp is undone, slip off the retainer ring and the black bakelite cap. This will expose a silver metal disc with six brass rivets anchoring it to the case. With a small bit, drill out the rivets, going only deep enough to remove them. These will be used in reassembly. The fiber washer on the rear of the case will be loose now and it may be removed. Slide a knife blade between the case and the metal disc and work it around. The assembly is now free of the case except for the wires soldered to the cord terminals. Unsolder these at the terminals. Remove the metal disc and you can see the treated fiber cone. Some units may have a thin latex covering over the rear

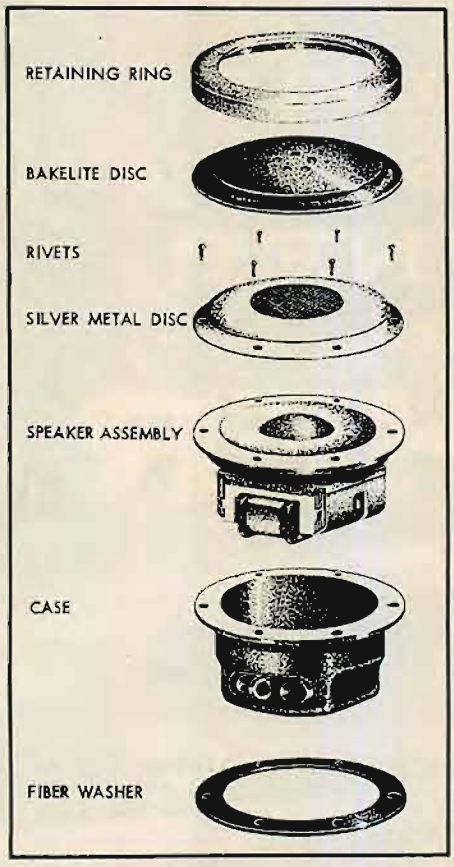

Fig. 2. Assembly detail of a single headphone unit.

of the speaker assembly. This is presumably for waterproofing and may be removed and discarded. On one side of the speaker, the transformer is held in place by a drop of solder and two integral spring clips. Cut the two voice-coil wires as close to the transformer as possible. Unsolder, push in on the two clips and remove the transformer. Scrape the clipped ends of the wire and resolder to the cord terminals on the case. Use spaghetti to avoid shorts to each other or to the case. Check the connections with an ohmmeter. The voice coil reading should be 10 to 12 ohms. Check each wire for a short to case. Refer to *Fig.* 2 during reassembly, in the event you forgot what-goes-where. Use Neoprene or Pliobond cement between washer and case, case and speaker, and the speaker and disc. This is a rubbery adhesive that will help hold everything together and prevent any metal-to-metal chattering. Reassemble, line up all the rivet holes, and replace the rivets. Face down, on a hard surface, deform the ends of the rivets with a center punch or small screwdriver. Place the black bakelite cap over the metal disc, noting the two projections that mate with holes in the disc. This prevents rotation of the cap. Place the fiber washer over the rear of the case, the retaining ring over the front and recrimp the assembly together. The ring will appear a bit chewed up but this won't show when ear cushions are added. Now proceed in the same manner with the second headphone unit, making sure that the wires from the voice coil go to the same respective terminals as in the first unit.

Applications

The use of the phones will be determined by the needs of the reader, but it should be pointed out here that phones have not been designed to compete with loudspeakers. It has been the purpose of this article to provide, at a cost commensurate with utility, a means to enjoy audio material where the size or volume of a loudspeaker precludes its use. The fine timbre of a properly baffled woofer will just not be present in a pair of headphones. The physical configuration limits the listening to one person. With these limitations in mind, it might seem that there is little use for a headset. This is not quite so, for there are many instances where phones may even be necessary. When recording, for example, it is wise to use phones for monitoring to avoid feedback to the mike. It is manna to the modern cliff-dweller, who, Fletcher Munson or not, has to keep the power down when listening at midnite. By the same token, it eliminates outside noises while you're trying to hear soft passages. Low-power amplifiers will overload the headset long before they reach saturation. So little power is required that it is advisable to use a "T" pad in the headphone line to reduce the volume. When stereo in considered, think of the ease of channel balancing without having to wear a path thru the rug between your easy chair and the preamps. Furthermore, the listener's position in the room is no longer critical.

After many hours of listening by headset to varied selections, both monophonic and stereophonic, several comments are in order. It was found desirable to boost the bass and droop the treble slightly. The bass lacks the drama of a large enclosure, but it has no "boom" and is adequate. If the headphones are pressed tightly to the ears, the bass will be more pronounced. Because of this, ear cushions should be selected for tightness of fit. At first the headset may feel uncomfortable, but after a short time they are unnoticed. Because of the great sensitivity, extremely soft passages will be heard quite clearly. In fact, in the absence of a signal, tube noise and so on may be heard. This is masked by the signal, the signal-to-noise ratio being the same as when speakers are used. Due to the droop at the low end of the audio range, hum and rumble are no more objectionable than with speakers. When listening to stereo, the sound seems to come from within the listener's head. The spatial effect is quite pronounced and this listener has often lapsed into an unawareness of the fact he was hearing stereo through headphones. Æ

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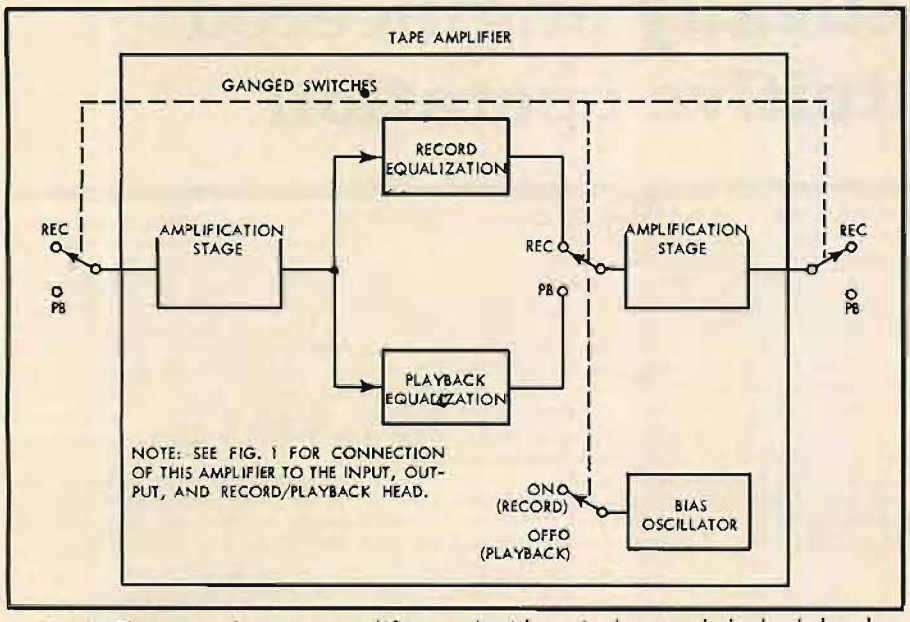


Fig. 3. Elements of a tape amplifier used with a single record-playback head.

recording is compensated by an equal error in playback.

But if it is one's intention to play recorded tapes—commercial tapes or those recorded on friends' machines—then correct azimuth alignment of 90 deg. becomes imperative, and there is no advantage in this respect over a three-head machine, except for the fact that there is less work in aligning one head than two.

When a single head is used for both record and playback, the playback requirements take over. That is, the requirements are more exacting for playback than for recording. A head suitable for playback can generally be used for recording, but not vice versa.

A prime requirement of the playback head is a narrow gap. The narrower the gap, the better is the high-frequency response, all other things remaining the same (same tape speed, head quality, equalization, and so on). The slower the tape speed, the proportionately finer must be the gap in order to maintain the same frequency response. Thus if a gap of .0002 in. is adequate at 7.5 ips to maintain response out to 15,000 cps, then a gap of .0001 in. is required at 3.75 ips.

A narrow gap is not a prime requisite of a record head. To the contrary, a relatively wide gap—in the range of .0005 in.—tends to be optimum. The narrower the gap in recording, the more difficult it is for the magnetic flux produced by the head to permeate the tape. The tape acts as a bridge from one edge of the gap to the other, so that the magnetic flux courses through the tape. But if the gap and therefore the bridge (the tape across the gap) are too narrow, not enough flux travels through the tape, so that the record head has to work all the harder to impress the desired amount of signal on the tape; the resulting increase in signal requirements raises the possibility of distortion. On the other hand, it is claimed that the increased efficiency of modern heads makes it possible to record satisfactorily with the narrowest of present-day gaps (.00009 in.).

Playback heads produce a very small signal voltage, on the order of a few millivolts at the most, and generally much less. Hence there is a very difficult problem of keeping noise and hum in

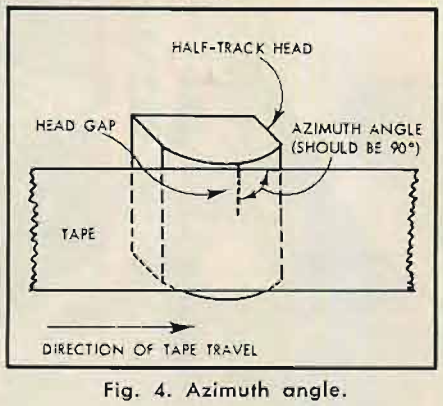


Fig. 4. Azimuth angle.

the tape amplifier sufficiently low to permit a satisfactory signal-to-noise ratio; the problem is substantially more difficult than in the similar case of the magnetic phono cartridge. To maximize the signal-to-noise ratio, a high-impedance playback head is desirable, that is, one having a large number of turns for high voltage output. (If a transistorized tape amplifier were used instead of one with vacuum tubes, then current rather than voltage would be the prime requirement; as yet, however, virtually all tape amplifiers employ vacuum tubes, which have a high input impedance, so that voltage rather than current is the significant electrical quantity.)

On the other hand, for recording purposes a head with relatively low impedance is desirable. A certain amount of audio voltage is required to drive audio current through the record head, thereby generating magnetic flux and impressing a signal on the tape. The higher the impedance of the head, the greater is the required driving voltage. But it is more difficult to develop a low-distortion signal at high voltage than at low voltage. If the recording has low impedance, the required driving voltage is reduced, and the difficulty is avoided.

By the use of separate heads for recording and playback, the contradictory requirements of each type of head with respect to gap width and impedance can be met. But if the same head is to be used for both purposes, then compromises are evidently in order. Thus record-playback heads typically have an inductance of about 0.5 henry, whereas a head designed expressly for playback may have an inductance of as much as 2.5 henries, and therefore greater output. On the other hand, a head designed specifically for recording may have an inductance of 50 millihenries or less.

At the same time, it should be recognized that the compromises entailed in record-playback heads are not so severe as to prevent quite good results from being obtained with them. But the perfectionist, desiring the best possible results in the present state of the art, can obtain even better results with separate heads designed for each function.

Three-Head Machines

Machines with separate record and playback heads generally are in the semi-professional and professional class, where maximum assurance is required that (1) the unit is in proper condition before the recording session commences, and (2) that the recording is proceeding satisfactorily during the session.

The three-head machine, with separate amplifiers for recording and playback, permits one to monitor the tape as it is being recorded, as illustrated in *Fig.* 5. That is, one can listen either to the incoming signal (which is about to be recorded) or one can switch to the playback signal (which has just been recorded). The time difference between

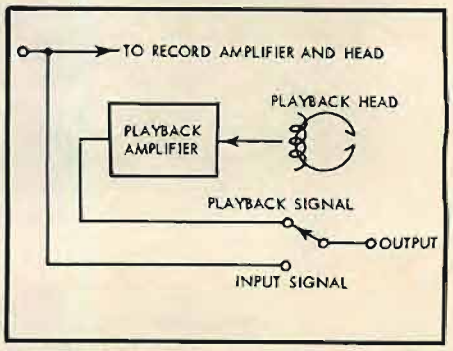
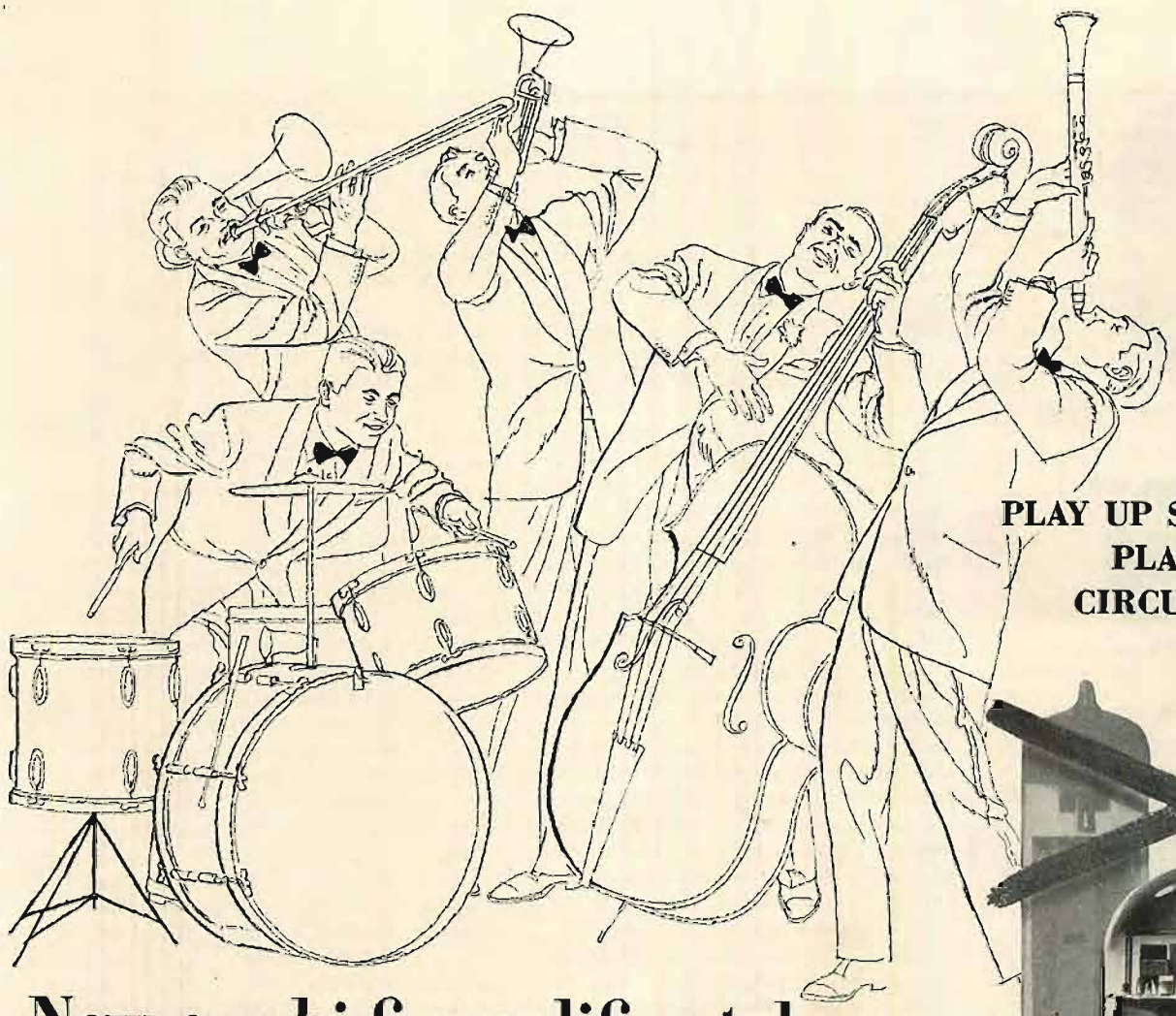
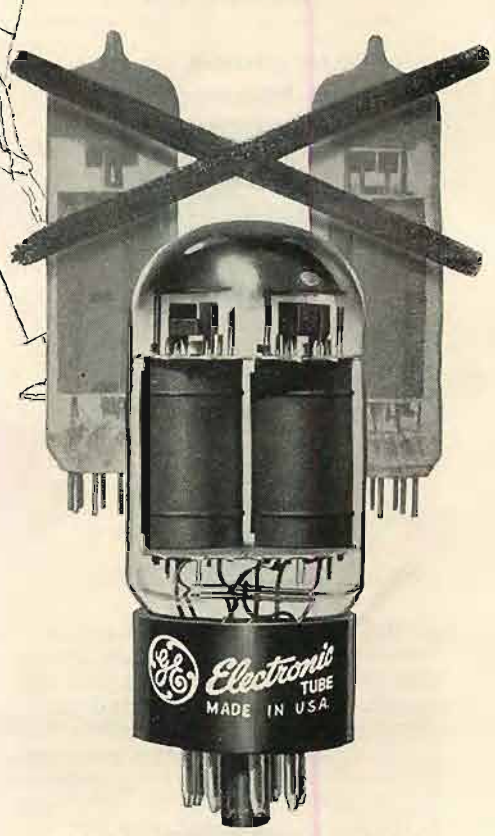


Fig. 5. Monitoring provision in a tape machine with separate record and playback heads.



PLAY UP SPACE SAVING!
PLAY DOWN
CIRCUIT COSTS!



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the two signals is so small—roughly about 1/6 second at 7.5 ips—that alternate switching between them affords a very accurate indication whether the recorded signal is similar to the original signal. If there is a noticeable increase in distortion in the recorded signal, one can reduce the recording level. Conversely, one can increase the level if the monitoring arrangement indicates no perceptible increase in distortion. Similarly, if frequency response of the taped signal sounds reasonably close to that of the original signal, the recording may proceed; if not, then the frequency response of the tape recorder bears looking into (which is the subject of a later article). Ordinarily, one would not wait until a recording session to check frequency response by the monitoring method. Instead, one would make a test run, using a phonograph record or FM program as a signal source.

There are three basic tests required to ascertain whether the tape recorder is operating at its maximum potential for recording and reproduction of sound. These concern the frequency response of the machine, distortion, and signal-to-noise ratio. A high-quality tape recorder, into which category most three-head machines are apt to fall, contains adjustments for frequency response and permits one to adjust bias current, which in turn affects both frequency response and distortion. The higher the bias current (within the normal range of adjustment), the lower is the distortion, but also the worse is the treble response.

While one can check frequency response, distortion, and signal-to-noise ratio on a two-head machine by first recording a tape with the proper signals, rewinding the tape, and playing it back, this is a cumbersome, time-taking, and somewhat inaccurate process. Each time an adjustment is made, it is necessary to repeat the procedure to learn the result of the adjustment. With a three-head machine, where recording and playback are virtually simultaneous, one can check performance as swiftly as in the case of control amplifiers and power amplifiers. (The techniques of testing will be discussed in a later article.)

In the case of frequency response, there are two tests which should be made: (1) to ascertain whether playback equalization corresponds to the standard curve, which is NARTB at 7.5 ips; (2) to ascertain whether flat response is achieved when playing a tape recorded on the same machine. While the first test can be made as easily on a two-head machine as on a three-head one by using a standard test tape and checking for flat playback response, the second test is greatly facilitated by three heads.

A few of the better (and higher-priced) two-head machines can match the performance of the three-head ones, at least to the extent where the differences are inaudible, or negligible. The advantage of the three-head machine, then, lies not in actual performance but in greater *assurance* of proper performance. Such assurance is obtained through greater ease of testing and through greater ease of adjustment when testing reveals that something is wrong.

The importance of periodic testing, and adjustment if necessary, should not be underestimated if high fidelity standards are in force. If the operator of a tape recorder is interested merely in operation—whether mediocre, fair, or good —that is one thing. But if he considers mediocre or fair operation as equivalent to failure, then regular testing and adjustment become an essential part of the operating procedure. The professional and semi-professional recordists check their equipment before trouble develops, not only after it happens. Similarly, the audiofan desiring high fidelity performance from his tape recorder will try to head off trouble before it spoils a recording session, often irretrievably.

On the other hand, the importance of ease of testing and adjustment depends upon the amount of use that the tape recorder sees. A professional or semi-professional machine may be used many

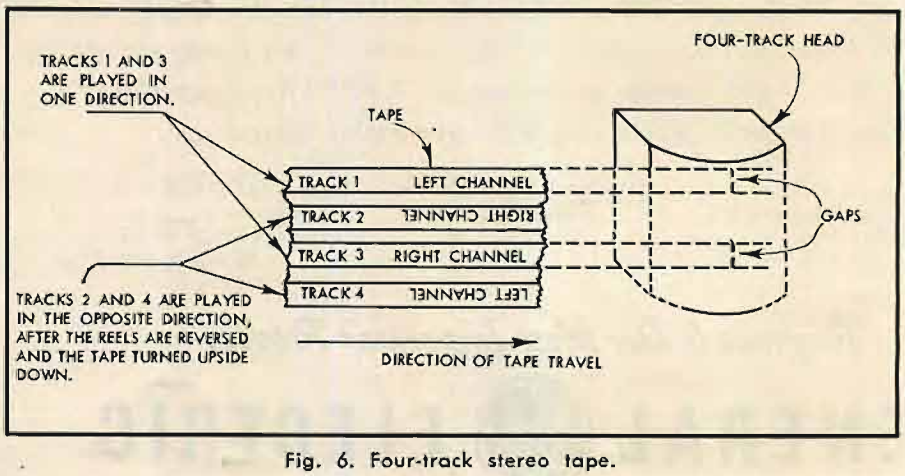

Fig. 6. Four-track stereo tape.

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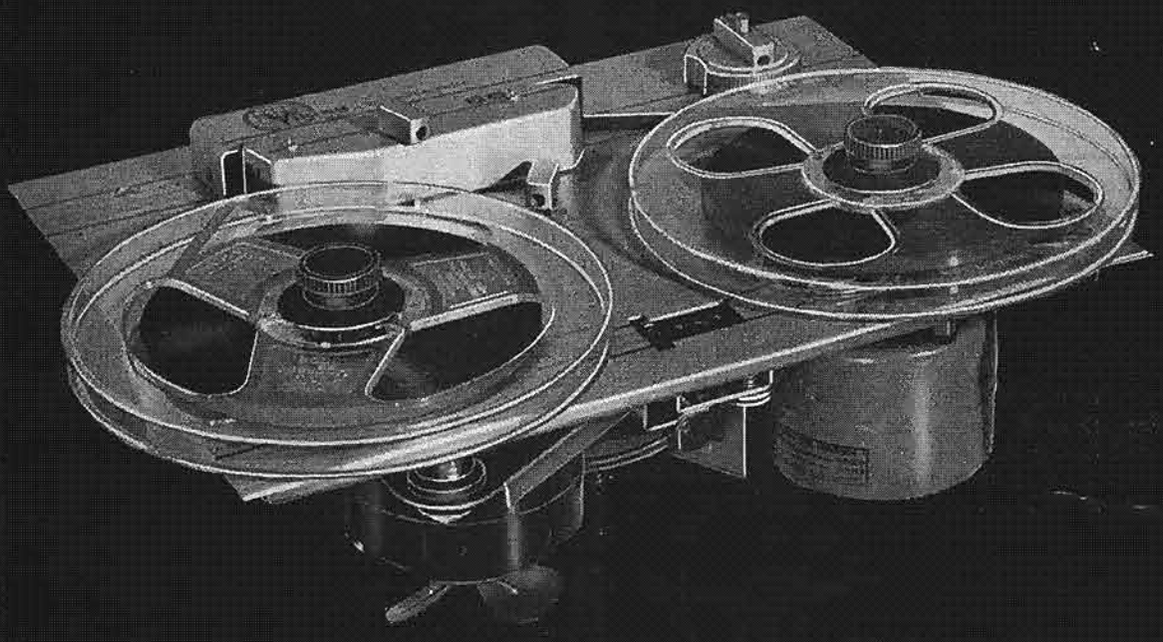

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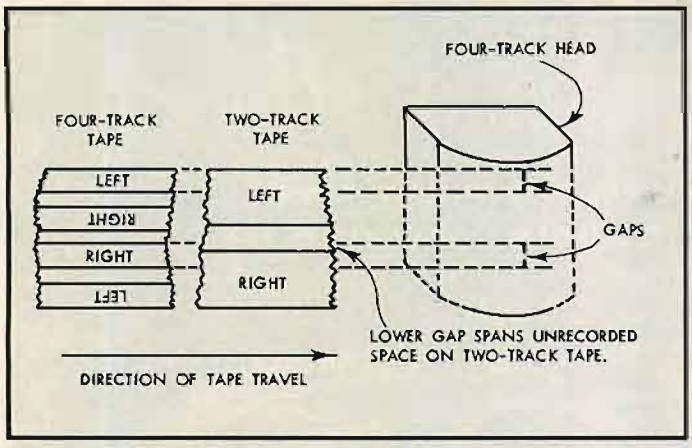

Fig. 7. Result of using a four-track head to play a two-track stereo tape.

hours a week, so that quick, easy checking and adjustment are imperative. But in the home, a machine may receive only a few hours of use each week or each month, so that facility of checking and adjustment becomes relatively less important. For one thing, the smaller amount of use means that trouble is less apt to occur. For another, when trouble does develop, there is apt to be less urgency about curing it.

A disadvantage of a three-head machine, compared with a two-head one, concerns azimuth alignment. Not only is it more time-consuming to align two heads instead of one, but more equipment is necessary. Where a single head is used for record and playback, an azimuth alignment tape is all that is needed. But where separate heads are employed, one needs in addition an audio oscillator or other source of single frequencies (such as a test record) in order to align the record head.

A *possible* disadvantage is that due to the oscillator. The frequency of the oscillator is usually between 30,000 and 100,000 cps, and the signal it generates has the characteristics of a radio wave. There is a problem of preventing this wave from being picked up and amplified by the playback amplifier, which is a very high gain affair. If picked up, the bias frequency signal can be amplified to the extent where, though not audible in itself, it may cause malfunction of the playback amplifier by driving it to excessive distortion, or perhaps by blocking the audio playback signal. While commercial equipment employs proper shielding, layout, and other measures so that the problem ordinarily does not arise, the amateur builder who ventures upon construction of a tape amplifier containing separate record and playback sections for a three-head machine may run into considerable difficulty on this score. The author speaks here from experience with one such tape amplifier that he sought to build; after his first try, he had to tear down the unit and redesign it with respect to layout and shielding.

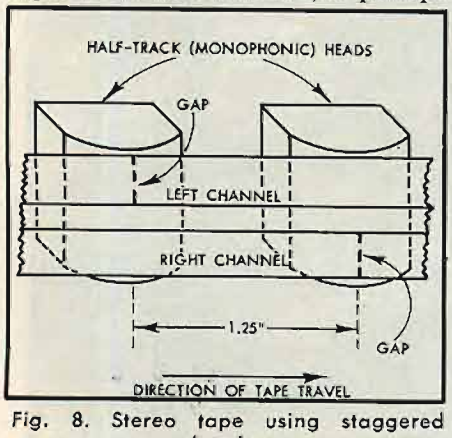

Fig. 8. Stereo tape using staggered heads.

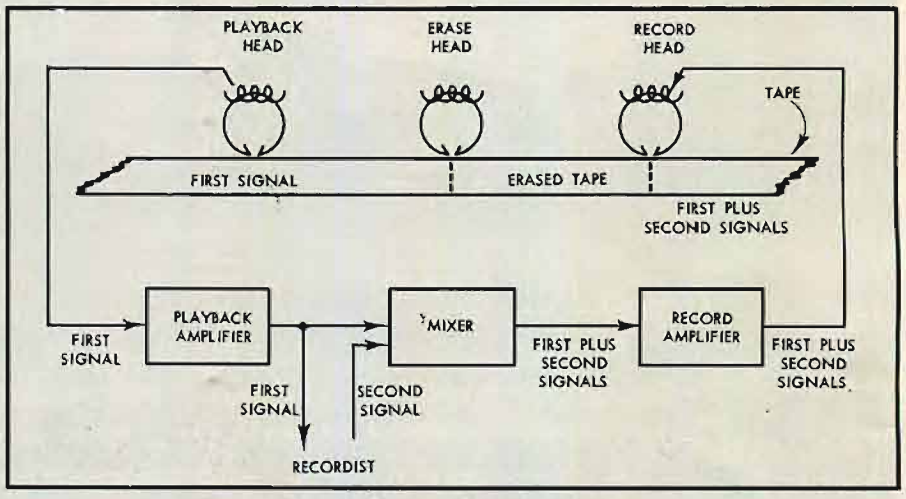

Fig. 6. Four-track stereo tape.

Tape Recorders with Extra Heads

The introduction of four-track stereo tape has brought new problems. As shown in *Fig.* 6, two tracks are recorded in each direction, so that a stereo tape may be reversed just like a monophonic half-track tape. Obviously, each of the four tracks is considerably narrower than those on a two-track stereo tape, and the signal output of each section of the four-track playback head is proportionately reduced, resulting in a lower signal-to-noise ratio. If one plays a two-track tape with a four-track head, there is an unnecessary sacrifice in signal-to-noise ratio, because part of the recorded signal is not picked up. Therefore the individual may wish to add an extra two-track head so that he can obtain better results when playing two-track stereo tapes (or half-track monophonic ones).

If a four-track head is used to play a two-track stereo tape, one section of the head will partially span an unrecorded space on the tape, as shown in *Fig.* 7. Therefore this section of the head will produce less signal output than the other section, resulting not only in deterioration of signal-to-noise ratio, but also in lack of balance between the two signals. This problem can be met by a mechanical device that moves the four-track head up or down—up for playing four-track stereo tapes and down for playing two-track stereo tapes. However, there is some danger of impairing azimuth alignment as the head is moved up and down. Thus the audiofan may prefer to install an extra two-track head, so that it and the four-track head can each remain in fixed position.

Four-track stereo tape is associated in the main with the 3.75 ips speed. As previously pointed out, this speed requires the playback to have an extremely fine gap if frequency response is to be maintained out to 15,000 cps or thereabouts. But, as also pointed out, the gap *might* be too fine to be suitable for recording. Consequently, it may be desirable to have an extra head for recording purposes.

Initially, the majority of stereo tape machines—at least those for the home—employed staggered heads for playback, spaced about 1.25 in. apart, and positioned so that one operated on the

(*Continued on page 45*)

Comparison between stereo record-playback heads. Left, two-track (Shure TR-40); right, four-track (Shure TR-48).

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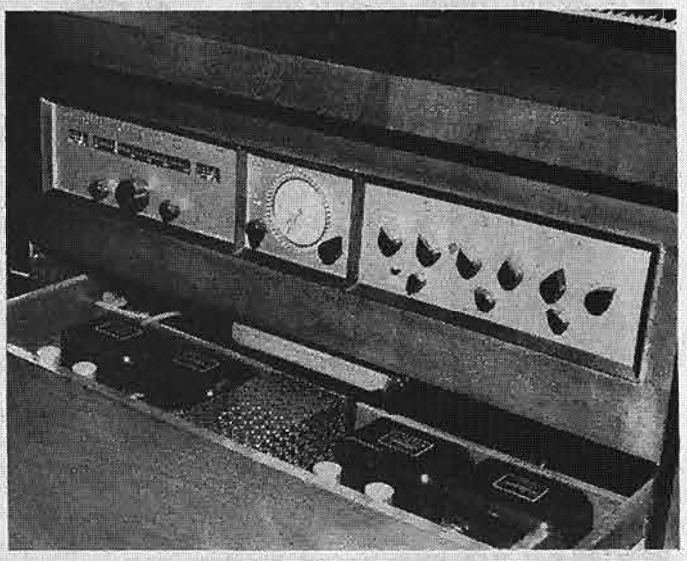
Left, general view of Music Corner from the front. The horn opening at the left accommodates a JBL 375 tweeter and acoustical lens. The control panel is fitted with edge-lighted Lucite panels, and the tape and phono cabinet is shown with doors closed, contrasting with the cover photo in which the doors are open.

Below, detail of center unit, with amplifier deck open, showing two McIntosh 60-watt amplifiers. All channels are switched at the timer panel, and when second channel is activated, the related power amplifier and blower are turned on.



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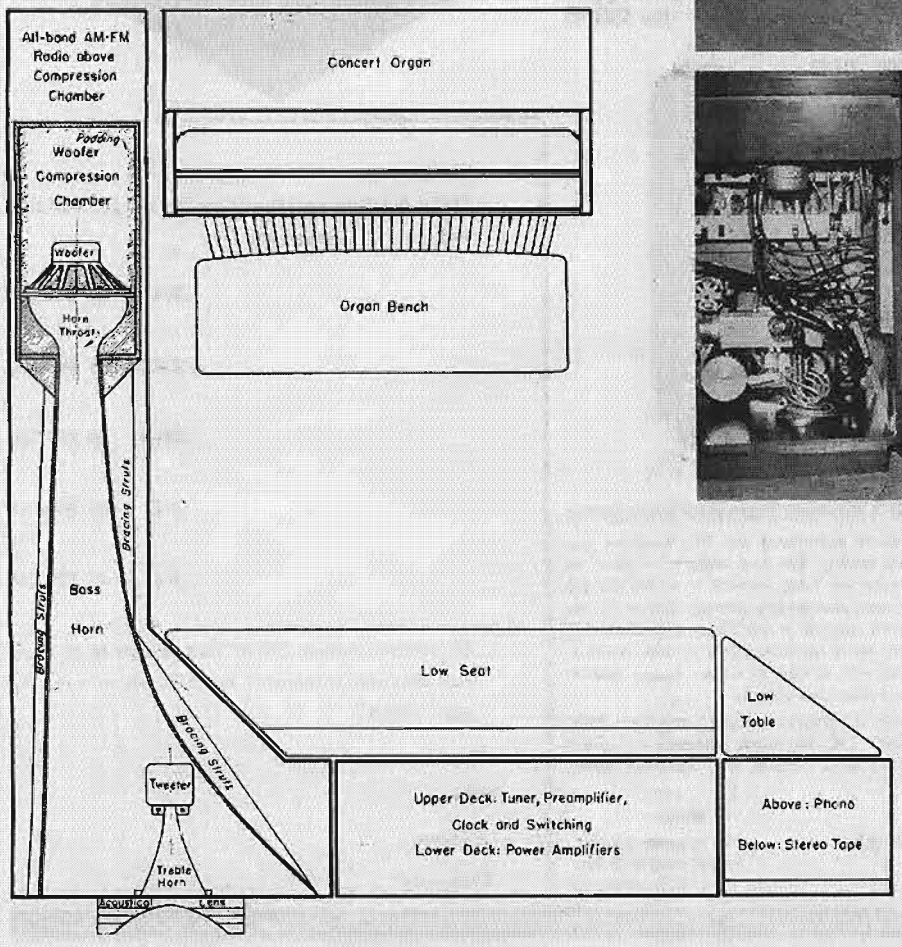
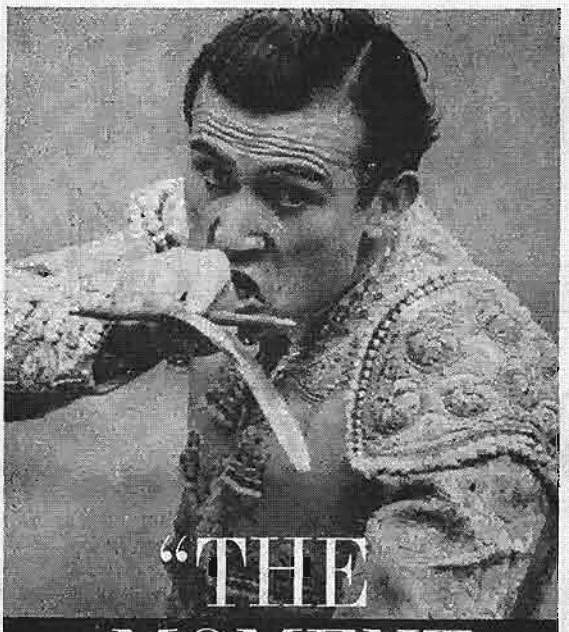
Above, rear of cabinets, showing component arrangement and wiring. Note neatness of interconnecting cables—an example worth studying by anyone engaged in hi-fi installation, either for his own use or commercially.



Left, system layout diagram. Speaker components used are those of the JBL Hartsfield and Paragon enclosures—woofer, 150-4C, tweeter-midrange, 375, with 500-cps crossover. Additional speaker, not shown, has similar matched components except that bass reflex cabinet is used for portability and rearrangement advantages.



Juan Montero, matador.
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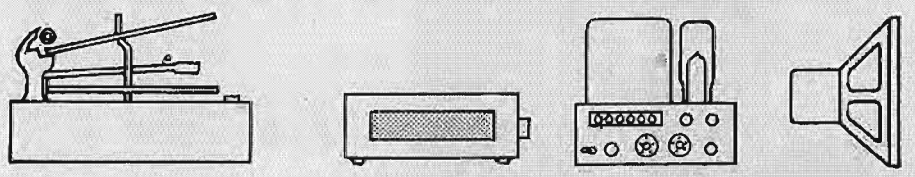


- "DUAL" Model 1006 Record Changer
- General Electric Stereo Classic Amplifier Model MS-4000
- Connoisseur Type B Transcription Turntable
- Glaser-Steers Record Changer Cover
- "Microlift" Pickup Arm Control
- Kingdom "Omega" Speaker System

DUAL MODEL 1006 RECORD CHANGER

Offering a host of new features and a convenient form of operation, the Dual (pronounced Du-al) Model 1006 is the latest record changer to be introduced to the high-fidelity market. This unit employs the center-drop principle, with a sturdy spindle which causes all the records but the bottom one to be lifted slightly so as to remove all weight from the record to be dropped—then the remaining records are lowered into position for dropping the next one.

The set-down position is determined by a patented roller-feeler device, in which two small rubber rollers are extended below the stylus and when the arm is lowered (at a radius of about 3 inches) the arm is led outwards to the edge by one of the rollers and as it reaches the outside, it "fixes" the set-down position. Then the arm raises again, the wheels retract, and the arm lowers to the record at the correct place, regardless of the diameter—be it 7, 10, 12, or 11½ inches. Since the set-down position is determined by the record itself, records may be stacked in any order or any diameter.

The pickup cartridge is carried on a molded plastic plate which may be changed readily—on turning a small knob on the arm the plate practically drops into your hand—allowing for a smooth styling of the arm without discontinuity for a removable head. Four separate wires are provided, and the unit is equipped with two audio output cables. For playing monophonic records with a stereo cartridge, the two "hot" leads are shorted together by a switch located near the base of the arm. The cartridge mounting plate will accommodate most pickups, but because of the feeler rollers (which must clear the stylus while playing and yet must extend below the stylus during the change cycle) some stereo pickups cannot be used because of their height—among them being the ESL and the Stereotwin.

Figure 1 shows the Dual 1006, and at the front will be noted three push buttons —STOP, START, and REPEAT—which provide a variety of operations. After putting on one record or a stack, one simply pushes the START button and the unit starts, plays the record(s), stops, and shuts itself off, retracting the idler so there is no pressure on the motor shaft which can cause "flats." If one wishes to stop in the middle of a record, intending to start again with that same record, one pushes the REPEAT and STOP buttons. The arm goes to the rest and the unit stops. To start again, one pushes the START and REPEAT buttons together, and the same record is played again from the beginning. To repeat the record after it finishes playing, press the REPEAT button; to repeat immediately, press REPEAT and START buttons simultaneously. To use manually, put in the short spindle, push the MANUAL button (just back of the other three) and place the arm on the record manually. Except during the change cycle the arm is freed completely by an ingenious clutch arrangement.

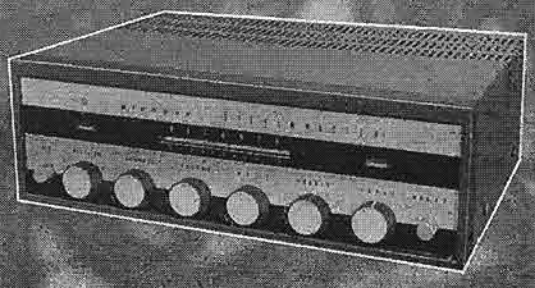
Fig. 1. "Dual" Model 1006 Record changer.

Alongside the arm rest is a built-in stylus gauge which is a simple dial indicator actuated by a "weighing platform" into which the edge of the arm is hooked. This is a useful feature for those who are likely to use different cartridges because it provides an immediate check. On the unit we observed the indicated stylus force about half the actual value as measured by an independent gauge. Once checked, however, the built-in gauge could be used as a guide.

The turntable used with the standard 1006 weighs 3 lbs. 9 oz. For those who wish it, a heavier turntable is also available as an extra. Ball bearings are used freely in the unit—double sets on both axes of the arm, two in the motor, and the usual turntable thrust bearing. The motor is sturdy, and is fitted with a balanced rotor, vacuum impregnated field coils, and tightly staked laminations, which together with the suspension used results in a rumble level measured at −36 db, in accordance with the NARTB standard method of measurement. This standard specifies that rumble shall be rated in db below 1.4 cm/sec stylus velocity at 100 cps, which corresponds to 7 cm/sec at 1000 cps with standard equalization. We made this measurement in a simplified manner, but the result approximates the NARTB standard. We used a D & R Flutter and Rumble test record, which has three bands —3000 cps with zero per cent flutter, 3000 cps with 1.5 per cent flutter, and an unmodulated band for the rumble test. The 3000-cps band is recorded at a level of 5.8 cm/sec, so by recording the output of this band, and then taking a second reading while playing the unmodulated band, the difference can be used to determine the NARTB figure. 5.8 cm/sec is approximately 1.5 db below 1.4 cm/sec at 100 cps, and since we measured a difference of 34.5 db, the standard value computes to −36 db. The acceptable rumble for a reproducing turntable is −35 db, in NARTB standards.

Flutter and wow measured at 0.25 per cent, which is essentially inaudible. The hum field from the motor, which in itself is built to minimize hum fields, is further shielded by the heavy steel turntable, and no trouble was encountered from this source. The unit tracks reliably at 3 grams stylus force, and actuates the trip consistently. Aside from being attractive, the Dual 1006 is also a good performer. F-25

PIONEER AUDIOMASTER, STEREOMASTER LEAD THE VAN OF EVERY HI-FI AMPLIFIER



FM-R301 SM-R150

pioneer

AUDIOMASTER FM-R 301

Standard type amplifier with FM/AM tuner, best suitable for home use.

* True Hi-Fi FM reception from 80 to 108 megacycles
* Indicator simplified
* Rumble filter switch provided on front panel
* Easy to use, very attractively designed

SPECIFICATIONS

Tubes: 2-6AQ8A, 2-6BA6, 6AU6, 3-12AX7, 2-6AR5, 5R-K16, 6E5M, 2-1NA9
Frequency Ranges: BC 535-1,605 Kc
SW 3.8-12 Mc
FM 80-108 Mc
Frequency Response: 30-30,000 cps
Output: 7.5 W
Inputs: LOW 5-30 mV AUX 200 mV & up
HIGH 30-100 mV TAPE 5-30 mV
XTAL 80-300 mV
Dimensions: $5\frac{1}{2}'' \times 14\frac{1}{8}'' \times 11\frac{3}{4}''$

STEREOMASTER SM-R150

With 3 Functions as Stereo, Monophonic and High & Low Channel Amplifiers

PIONEER's all-new STEREOMASTER SM-R150 is the most versatile amplifier for reproduction of stereo 45/45 records, stereo tapes and stereo radio broadcasts.

SPECIFICATIONS

Circuitry: 6AR5 push-pull 2 amplifiers involved in one compact chassis
Output: 7.5 watts per channel for stereo (15 watts for monophonic use) without harmonic distortion
Hum: – 53 db below maximum output on input
Frequency Responce: ±0.5 db, 20-20,000 cps
Equalization: RIAA & NARTB (NF type)
Inputs: TAPE, PHONO (MAGNETIC & CRYSTAL), AUX
Channel Filter: Crossover frequency 3.5 Kc 6 db/oct

FUKUIN ELECTRIC
Otowacho, Bunkyoku, Tokyo, Japan

Fig. 2. General Electric Stereo Classic Amplifier, Model MS-4000.

GENERAL ELECTRIC MODEL MS-4000 STEREO CLASSIC AMPLIFIER

Each new amplifier which appears offers its own features and advantages, and since performance of most high fidelity units is held to as high a standard as possible, there is little to choose from except these features and the over-all appearance. This General Electric Stereo Classic amplifier, Model MS-4000 is certainly attractive, and the arrangement and functions of the controls is "comfortable" to use.

From the circuit standpoint, each channel of this amplifier employs a feedback-equalized preamp stage using a low-noise 7025/12AX7, with equalization being shifted for phono and tape head inputs. Two phono inputs are provided, and the input selector is marked TAPE, MONO (Records), STEREO (Records), TUNER, and AUX. In the MONO record position, a separate input jack is fed into the A channel only, but both channels may be paralleled by the MODE switch. It appears from the schematic that a change of a jumper on the selector switch would connect both preamp stages to the monophonic pickup so it would not be necessary to move the MODE control, if the user wanted this feature. This would apply to the AUX input too, which is also monophonic, feeding the A channel. The TUNER input is stereophonic. For playing monophonic records with a stereo pickup, the two channels may be paralleled by the MODE switch, which also can reverse the channels. This switch is marked clearly to show how monophonic records are to be played—either through the A channel (normal) or through the B channel (reverse), or through both in parallel. This should be a handy feature for those who find difficulty in figuring out what switches to operate to get a desired result. The SELECTOR and MODE switches are at the left with the large knobs as shown in *Fig.* 2. To the right are five other knobs, all smaller, two slide switches, and two holes in the panel—through one can be seen the pilot light, and through the other is a small-screwdriver-operated input level control for the tuner input, ganged for both channels. One slide switch controls the a.c. power, and the other controls a high-pass filter in both channels simultaneously.

The remainder of each channel consists of a 12AX7 in a Baxandall tone-control circuit, followed by a 6BA8A (pentode-triode) in an amplifier-phase splitter circuit and a pair of 6973's as tetrodes in the output stage. The B channel has the normal 4, 8, and 16-ohm outputs, while the A channel has normal 4 and 16-ohm outputs and a pair of terminals labeled 8A and 8B. These are connected to the 8-ohm output tap and ground through a DPDT switch which serves as a phase changer in the speaker line. This switch is at the back of the amplifier. Again inspecting the schematic, it seems that it would be simple to change the internal connections so that the phase reversing switch would operate on either of the other two output impedances.

The 6973 output tubes are relatively new, but are capable of 20 watts output with distortion well below 1 per cent, and the MS-4000 amplifier employs two pair of them—resulting in a total output of 40 watts with the two sections paralleled, or of 20 watts in each channel.

The power supply is unique in that it uses two rectifier tubes—a GZ-34 working from 350-volt taps on the power transformer and supplying voltages to all circuits except the output screens, which are fed from a 6X4 working from 250-volt taps on the power transformer secondary and into a separate filter circuit. The two preamps and the two tone-control amplifiers are fed with d.c. to the heaters, resulting in a hum/noise level measured at 54 db below 1 watt on the phono input and 64 db below 1 watt on the high-level inputs.

Performance

Input signals for a 1-watt output measured at 0.82 mv on the phono inputs, 0.73 mv on the tape-head input, and .046 volts at the tuner and auxiliary inputs. Bass and treble controls provide a range from +13 to −17 db at 30 cps and from +12 to −15 db at 20,000 cps. The rumble filter introduces a progressive droop beginning at 100 cps and reaching −8 db at 30 cps. The contour control provides a variable shunt across the capacitors in a tapped volume control circuit, and provide a boost of 13 db at 50 cps when the volume control is 20 db down from the top, and a boost of 20 db when the volume control is 40 db down from the top. Two per cent intermodulation distortion was measured at 26 watts in one channel and 24 watts in the other.

Over-all sound quality with the controls flat is clean and crisp at good room volume, and the tone controls—of the variable turnover Baxandall type which we consider the most desirable of continuously variable controls—give adequate changes without introducing "chestiness" or "thinness."

The amplifier is compact for all its power output, measuring 5½ in. high, 15 in. wide, and 12 in. deep (less knobs). It is an amplifier which we would consider "comfortable" to use. F-26

CONNOISSEUR TYPE B TRANSCRIPTION TURNTABLE

The recently introduced Type B Connoisseur turntable retains all of the good features of the previous model, adds some new ones, and has been refined in many important particulars. Of the features that are retained, one of the most desirable is the speed-change control and vernier speed adjustment which are at the left rear of the motor plate and separate from the on-off switch, which is at the front edge of the plate. This eliminates the possibility of selecting the wrong speed when turning the power on. This model uses black knobs for these functions, but we prefer to replace the power knob with a cold water faucet handle of the lever type (cold, because one can then imagine that the C stands for Connoisseur; in France, of course, one would use the hot water handle).

The heavy cast aluminium (the Connoisseur is made in England) turntable is retained, but there the similarity ends, apparently. The main turntable shaft rests on a Teflon thrust bearing, and the journal itself is an adjustable split bearing of Graflon, a graphite-impregnated Nylon.

Fig. 3. The new Connoisseur Type B turntable.

NEW 30-WATT STEREOPHONIC PREAMPLIFIER-AMPLIFIER

BY Pilot

$129.50
Slightly Higher in the West

THE Pilot 240

THROUGHOUT THE LAST 40 YEARS, PILOT has made it possible for every audio enthusiast and music lover to possess the quality equipment most suited to his requirements. Now, PILOT announces another new stereophonic preamplifier-amplifier—the 240, rated at 30 watts total (15 watts per channel, music power). We are sure you will agree that, feature by feature, the new PILOT 240 represents *the best quality value in its class.* Designed and engineered to professional standards, the PILOT 240 includes:

- **4 independent tone controls** — Exclusive Pilot TroLoK mechanically locks the Bass controls together and the Treble controls together, at your option, to permit **simultaneous** (ganged) adjustment of Bass and Treble for **both** channels.
- **Three pairs of high level inputs** for permanent simultaneous connection of FM-AM tuner, Multiplex Adapter and Tape Recorder.
- **Two pairs of low level inputs** for permanent connection of record changer and turntable.
- **Non-shorting inputs** throughout permit recording and playback using a permanently connected tape recorder without short circuiting the tape recording signal, or the necessity for changing of plugs.
- **Direct tape playback facilities** are provided by connecting the tape head to one of the phono inputs. NARTB tape equalization is provided at calibrated positions on the tone controls.
- **Amplifier terminals** permit you to connect a set of extension speakers in another room. Front panel Speaker switch conveniently selects either the main or extension system, or both.
- **Electronic Crossover** feeds low frequencies to Channel A and high frequencies to Channel B for monophonic bi-amplifier use.
- **Loudness Switch** modifies the frequency response for enhanced listening at low sound levels.
- **Exclusive PILOT automatic shut-off** switch enables the record changer, at your option, to turn off the complete system after the last record has played.
- **Provides automatic cancellation** of undesired vertical response of a stereo cartridge when playing a monophonic recording, with Mode switch set to Mono—and eliminates necessity for separate Stereo-Mono switch.
- **11 Front Panel Controls** — Input Selector, Mode (including Stereo Reverse), Dual TroLoK Tone Controls (Treble Channel A, Treble Channel B, Bass Channel A, Bass Channel B), Stereo Balance, Master Volume, Speakers, Automatic Shut-off, and Loudness.
- **Specifications** — Power Output: 30 watts total; 15 watts per channel, music power (in accordance with proposed IHFM standards). Sensitivity for full output: 3 mv for phono record changer, phono turntable; 110 mv for FM-AM, multiplex, tape recorder. Harmonic Distortion: 1%. Hum and Noise: 80 db below full output. Frequency Response: ±1 db 20-20,000 cycles.
- **Dramatic design** — brushed-brass escutcheon with 24K gold-plated frame and heavy duty knobs. Supplied complete with black vinyl-clad steel enclosure.
- **Price** — $129.50 including enclosure. Slightly Higher in the West

WRITE TODAY FOR THE COMPLETE PILOT STEREOPHONIC COMPONENT CATALOG

PILOT RADIO CORPORATION • 37-04 36th STREET • L. I. CITY 1, N. Y.

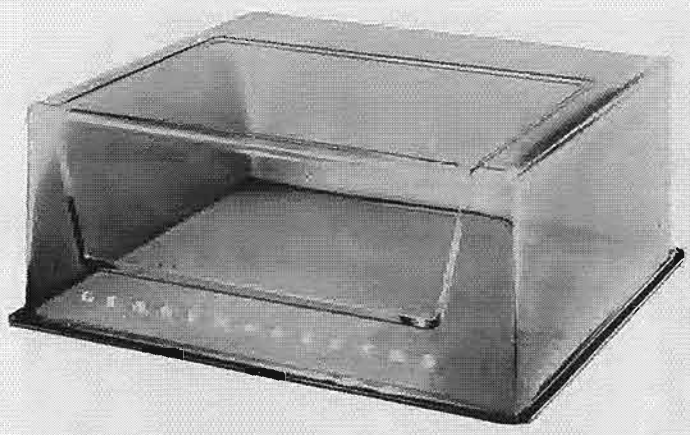


Fig. 4. Plastic record-changer cover by Glaser-Steers.

The adjustment permits compensation for wear, thus keeping the bearing at optimum for a long life. The adjustment is made by adjusting the split bushing to the point where the shaft is just free enough to lift out of the bearing when the platter is lifted up. This makes an almost ideal bearing for this purpose, and results in very low rumble content.

The hysteresis-synchronous motor employs the same type of bearings, and the motor itself is very flexibly supported on rubber mountings. The motor shaft is stepped and tapered on each step to provide the vernier adjustment of speed, with a range of about ±2 per cent on each of the three speeds.

The idler wheel is quite narrow, and is mounted on a plate which is also very flexibly attached to the main chassis.

Another new feature is the stroboscope, which is viewed through an opening just in front of the turntable, which can be seen in *Fig.* 3. The illuminated stroboscope disc is mounted on the underside of the platter and is viewed through a mirror.

Using the technique described earlier, the rumble level of the Type B Connoisseur was measured at 53.5 db below a stylus velocity of 1.4 cm/sec at 100 cps—considerably better than NARTB standards. This, together with wow and flutter of less than 0.15 per cent, results in an exceptionally fine turntable for critical applications.

Fortunately, the error of the earlier stroboscope supplied with the Connoisseur —which had the wrong number of lines in the 45-rpm band—has been corrected.

In physical specifications, the unit measures 13½ in. from front to back, and it is 15¾ in. wide; it requires a clearance of 3¾ in. above the tope of the mounting board and 3¼ in. below. F-27

GLASER-STEERS RECORD CHANGER COVER

The current trend for using components of a high-fi system in their own housings often means that a record changer or turntable may be exposed to dust practically all of its natural life, and while the changer itself could "take it," everyone agrees that dust is not good for records under any circumstances. Furthermore, when a changer is operated in the open, it is often possible to hear "needle talk" throughout the music.

Recognizing these problems, Glaser-Steers has come up with a simple solution —an attractive transparent solid plastic cover for changer and records, as shown in *Fig.* 4. Soft plastic covers, such as one uses for typewriters, may droop down on the records while they are playing and cause speed variations or interfere with the change cycle. The hard cover cannot do this, naturally, but with its foam rubber strip around the bottom it remains in place, clear of records and mechanism. The strip is also an effective sound deadener,

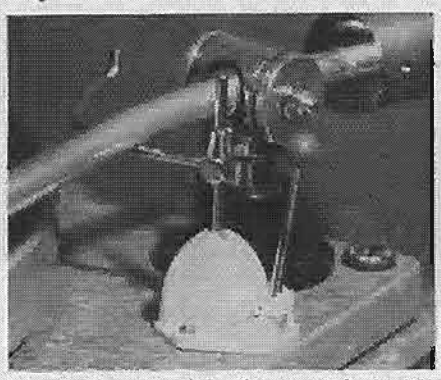


Fig. 5. The Microlift, shown with an ESL arm.

and no needle talk can be heard when the cover is in place.

This is an excellent accessory and no home that has an exposed record changer should be without one. F-28

"MICROLIFT" PHONO ARM CONTROL

In the days of six-ounce stylus forces (yes, the old Capehart actually worked at six ounces) it was easy to lower a pickup to the record gently because of the natural gravitational resistance offered to the hand by so much mass. Now, however, the 1- to 3-gram stylus forces make handling the pickup arm about as tricky as dropping a dried pea into a cup from six feet up in a high wind. The Microlift—another British importation—eliminates this difficulty. This device, shown in *Fig.* 5, mounts on the main plate of a turntable adjacent to the arm and raises or lowers the arm to the record gently and accurately. The curved arm is adjustable for height, and a quarter-turn of the actuating lever raises the pickup arm about ⅛ in. at the point of contact—which means about ½ in. at the stylus tip. Since the lift is straight up and down, it may be used for cueing with considerable accuracy, and the pickup may be raised and lowered without any possibility of sliding across several precious grooves in the process.

This item is another which should be standard equipment wherever a manual turntable is used and where the user likes to take good care of his records. Mechanically it is very simple—the spring-loaded vertical rod is raised and lowered by a Nylon cam on the hand-lever shaft, resulting in a smooth action without any backlash in its operation. The Microlift mounts to the motor board at turntable chassis by two screws. F-29

KINGDOM "OMEGA" SPEAKER SYSTEM

One of the newest of the small speaker enclosures in the Omega, introduced by Kingdom Products Ltd. This unit, measuring 15 in. wide, 26 in. high, and 11½ in. deep, offers excellent tone quality with a remarkable range, considering its small size. The cabinet itself is made of 1¼-in. plywood, well lined with rock wool, and completely enclosed. Three speaker units are used—one 12-in. cone and two 2½-in. tweeters, together with two capacitors serving as high-pass filters for the tweeters.

Using Vol. 1 of the "King of Instruments" series—in which a scale ranging from 16 to 8000 cps is played on an organ, —the sounds during the lowest octave appeared to become musical at B, approximately 31 cps.

Because of the heavy cabinet construction, the low-frequency performance compares favorably with more costly units. At the upper end, usable output was heard up to 13,000 cps, and measurable output was noted to 16,000.

The Omega is finished in various woods, with the oiled walnut model giving the impression of high-quality furniture. The grille covering is modern in design, and the over-all appearance would fit most decorative schemes satisfactorily. The placement of the high-frequency speakers —one at each sideof the center-mounted woofer—makes its possible to use the speaker either vertically or horizontally. F-30

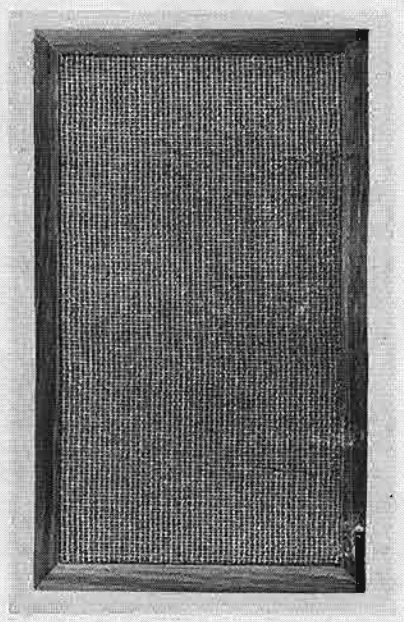


Fig. 6. Kingdom "Omega" speaker system.

A CONQUEST OF SPACE

The Harmony Trio Speakers

Here is a complete three channel stereo speaker system — better than you have ever heard at any price — which gives the full stereo effect in every part of any room. And yet it consists of only two booksize speakers and a hideaway bass that is completely concealed from view. Sound impossible? Well it was, until Weathers developed the Harmony Speakers utilizing the principle of Variable Mass—the first major breakthrough in speaker design in twenty years. Now space need no longer be a barrier to speaker performance. Stop in at your dealer and see why.

System Features:

Three channels. A full range speaker for each of the stereo channels and a non-directional *Hide-away* bass. The smallest and most efficient stereo speaker system available. Fits any size room. Blends with any decor.

Component Features:
Harmony Speaker.
Size: 11" x 9¼" x 3⅝".
Response: 70 to 15,000 cycles.
Finish: Black leatherette. Golden grille.
Hideaway Bass.
Size: 16½" x 16½" x 5½".
Response: 30 to 100 cycles.
Finish: Ebony.

Individual Harmony Speaker $29.75
Hideaway Bass $69.50
Complete System:
Harmony Trio $119.50

Made in U.S.A.
Patent Applied For

Weathers Industries
DIVISION OF ADVANCE INDUSTRIES, INC.

66 E. Gloucester Pike, Barrington, N. J.
Export: Joseph Plasencia, Inc., 401 Broadway, New York 13, N. Y.

Recording the pizzicato movement of the Bartók after a long, grueling session to determine recording techniques most suitable for the special problems involved. It is 3:00 A.M. the day of the concert.

LIVE *vs.* RECORDED CONCERT *at* CARNEGIE RECITAL HALL

Leonard Sorkin, first violinist of the Fine Arts Quartet, listens critically to trial recording.

On January 10th, 1959, a "Live vs. Recorded" concert was given in New York City; protagonists were the internationally famous Fine Arts Quartet and a pair of AR-3 speaker systems in stereo, driven by Dynakit preamplifiers and Mark III amplifiers.

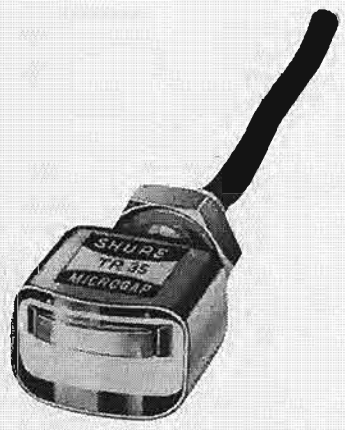
At pre-determined intervals the members of the Quartet would lay down their bows, allowing reproduced sound to substitute for the live music. After a minute or so they would take over again "live" without interrupting the musical continuity. (A carefully synchronized stereo tape had been made the night before in the same hall by Concertapes, Inc., for whom the Fine Arts Quartet records exclusively.)

Excerpts from reviews of this concert appear on the facing page.

The formal concert, during one of the "live" portions

Advertisement

upper half of the tape and the other on the lower half, as illustrated in *Fig.* 8. A substantial number of recorded tapes were sold for the staggered-head arrangement. The individual who invested in staggered tapes may be loath to write off this investment, preferring instead to add another playback head in order to be able to reproduce his staggered tapes correctly. Thus he would have a stacked head for playing conventional stereo tapes, and he would use one section of this head together with the extra playback head to reproduce his staggered tapes. If he were to



Half-track monophonic head (Shure TR-35).

play staggered tapes with a stacked head, there would be a relatively enormous lack of synchronization between the two channels. The discrepancy would be 1/6 second at 7.5 ips, whereas a number of experts consider that the two channels must maintain synchronization within .0001 second for proper stereo effect.

The recordist wishing to achieve special effects may have to add one or more heads to those already on his tape machine. Two of the best known of these special effects are sound-on-sound and echo effect.

In the case of sound on sound, it is necessary to place the playback head before the erase head, as shown in *Fig.* 9. The sequence is as follows. The first recording is made. The tape is rewound. The recorded tape is reproduced by the playback head, and this signal is monitored by the performer by means of earphones. At the same time the performer makes a second recording. The first signal (from the playback head) and the second recording signal are combined in a mixer and fed to the record head. Meanwhile, the tape has been erased by the erase head. The clean tape that reaches the record head receives the combination of the first and second signals. This process can be repeated as many times as desired; however, noise on the tape will increase each time, so there is a limit to the procedure. While it is not strictly necessary to add an extra playback head for sound-on-sound recording, it is quite inconvenient to have to transfer the playback head from its normal position (following the erase and record heads) to a position before the erase head each time that one wishes to create this special effect. Accordingly, the individual who plans to do an appreciable amount of sound-on-sound recording customarily will add an extra playback head prior to the erase head.

Figure 10 illustrates how the tape recorder may be used to achieve an echo effect. Part of the signal picked up by the playback head is fed back to the record head, and is therefore repeated in the manner of an echo. One can obtain superior results, more akin to the natural echo, by adding additional playback heads, each one feeding part of the signal back to the record head. The amount of signal fed back is decreased at each successful head. Æ

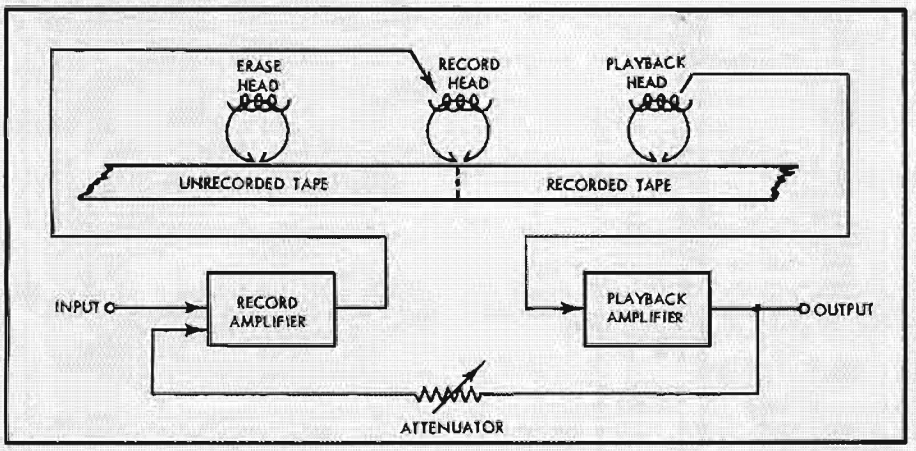


Fig. 10. Method of producing an echo effect in recording.

AUDIO ETC

(*from page 18*)

amps died on me, so soon, I got myself into one of my obstinate moods. Obviously, pilots are impractical, or there would be pilot lights. But they *ought* to be practical and, by golly, I'll find out for sure whether they are or aren't, before I waste any cash on replacement batteries, thank you.

Well, I have a consultant-assistant to help me in just such matters, name of Ray Prohaska. I asked him. We talked. We investigated. We argued, for some weeks on and off. He got down to work and came up with facts and figures—and I said, go ahead. We were off on a fine chase. Two chases.

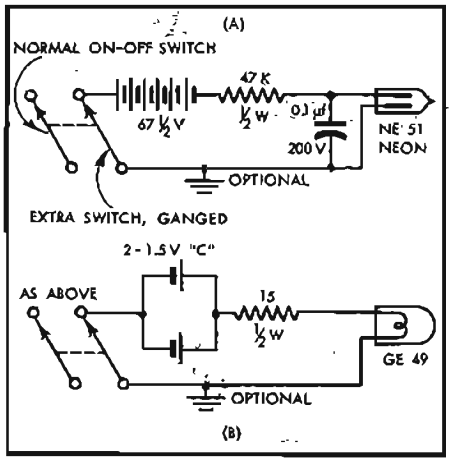
The net result is that right now I have in operation two excellent battery-operated preamps both of which have real, honest-to-goodness, highly visible pilot lights, that go on and off with the regular power switch. Regency, prepare to quail. The idea works!

The pilots are, of course, battery-operated. But they don't drain the regular power supply; we used extra battery power for the indicators. The lights will last plenty long enough for anybody's needs. One of the two types we tried will burn, as we figure it, for about a hundred hours in normal hi-fi operation, with the usual rests between playing periods. But the other type (which turned out to be the most visible) lasts literally thousands of hours without battery replacement—*the shelf life of the battery itself*. Once installed, it operates practically for the life of the preamplifier. How about that!

The pay-off is that these pilot lights don't cost much, even for the home gadgeteer who makes his own conversion at audiophile prices. The more expensive conversion of the two—the long-lasting one—will cost him in parts less than the replacement of a set of burnt-out power batteries. Now I ask you, isn't a conversion that will preserve your main batteries for their full useful life, and is good for a year or two without being touched, worth the cash for anybody?

Sure, if you're one of those seven-day wonders, who never make absent-minded mistakes, you won't need a pilot at all. You'll save money. But who's a seven-day wonder? If we all were, there wouldn't need to be any pilot lights anywhere.

For the manufacturer, of course, the cost of such a pilot light is far less—he installs the extra parts in the first place, without having to replace those already built into a finished unit. We figured out the probable cost of the components in the two pilot light systems at the manufacturer's price and if we are right, there just isn't any excuse for not incorporating these lights into all future production of battery transistor units, even fairly cheap designs. Our cheaper pilot system, for instance (with the 100-hour battery life for the lamp) would cost Regency roughly 40 cents extra in parts. No more than that.



The better system, with semi-infinite battery life, would cost all of 96 cents per unit, over and above present parts, in factory production.

Either one of our two systems could be incorporated into the present Regency HFT-1A production, Both work. The values are different, though, in terms of first cost and of battery life, as well as the space for the extra components. One of our pilots is a flashing neon lamp. The other is a continuous incandescent light.

Flashing Rhythms

Conversion A, the best in my estimation, is the neon light job. It costs more to install but lasts much longer and operates more cheaply, in terms of battery life.

The gadget makes use of a very simple relaxation circuit (Prohaska's idea) that turns the neon bulb on and off to save current, in somewhat the fashion of those portable street warning lights we see at night, though my flasher goes at a much faster rate. The NE 51 neon lamp was mounted neatly through a small hole between the treble and level knobs and just below; when the Regency preamp is turned on (again via the volume control knob), it flashes a fast, dim, but insistent "purr," at, I guess, perhaps fifteen to twenty flashes per second. The values for the flashing speed are adjustable within certain limits, amounting to circuit saturation in one direction.

That speed adjustment was important for me, and we discussed it at length before arriving at a musically ideal flash rate. What was vital was that the flash rate *should not produce a visual rhythm*, to interfere with music listening. At slower flash speeds, such a rhythm would definitely be set up and the sight would be unpleasant for any music listener. Things would be far worse with *two* units, flashing slightly out of phase!

The fast blinking that we achieved is easily visible as a pulsing motion but is definitely too quick to produce any sort of rhythm. It catches your eye remarkably well, but it is not unpleasant to watch. Indeed, this little blinker is the best pilot light I've even seen, bar none.

Life? Around 2000 hours for the neon bulb, and the shelf life of the 67½ volt battery—one to three years of operation. Cost of operation, in terms of battery life, is around a tenth of a cent an hour (Current drain is about 0.1 ma.)

Our conversion involved the components for the relaxation circuit itself, the battery, the bulb and its hole and mounting, plus an extra switch on the volume control. We replaced the original volume control with a new one of this sort; the manufacturer, of course, would use it as original equipment.

Cost of the parts? For the audiofan, the conversion of the Regency HFT-1A to neon pilot operation costs $3.93, as we did it, including the 67½ volt battery (Burgess UX45 or RCA VS 318) at $2.07. The new switched volume control cost $1.37.

For Regency, to build this little neon pilot into its all-transistor unit, the cost of additional parts would be around 96 cents higher than the present costs, as above.

Incandescent

Conversion B, just for comparison, was via a low-voltage incandescent bulb—we wanted to see what could be done in this fashion, since the system is simpler and the parts cost less, notably the battery section, two ordinary low-voltage flash cells. Was there a "flashlight" bulb that would draw a low enough current to be practical? There was. Batteries? We just made it (30¢), as to space.

We used the GE 49, a low-drain type bulb, but oddly enough, it turned out that this bulb was too bright for optimum pilot use—it was ugly and too prominent, as well as causing a too-high drain. Our first set-up would have lasted for roughly 25 hours of operation before the two "C" batteries gave up their ghosts—not bad, except for the inconveninence of the battery change. But after a 15-ohm resistor had been added, the bulb glowed with just the right amber light and the battery life was increased to a probalbe one hundred hours and the bulb life to infinity.

At three hours of hi-fi a day, this pilot would operate, then, for roughly a month. It would tell you, of course, when its batteries were dead and you were left unprotected. New batteries, installed in a few minutes, would cost 30¢.

The first cost of this simpler conversion would be lower; for the home gadgeteer it would take only $2.55 to buy the parts we used, including the same replacement volume control with the extra switch.

For the manufacturer—for Regency—our incandescent pilot light would add a mere 40 cents to the cost of the parts in the HFT-1A preamp. That would seem to be peanuts, to put it mildly.

However, the less obvious values here aren't so favorable. It's a touch and go proposition. You can have longer battery life at negligible cost via larger and/or more 1½ volt cells—but the space they take and their weight are unsuitable, in miniature units. (We barely crammed the two "C" cells into the Regency.) And you'd still have to change the batteries after a couple of months or so in most situations. The bulb itself probably can't be improved upon in the incandescent area.

This isn't the optimum system, in spite of simplicity and low initial cost.

Practical Values

The higher first-off cost of the neon bulb system will sound bad to the manufacturer even at a mere 96 cents, to equip the Regency preamp. But look what you get! The neon is bound to win on points, when you take a second look, in spite of higher cost.

(1) You get a positive, handsome, effective warning signal that will operate

(*Continued on page 72*)

Standard Methods of Measurements for Tuners

The complete text of IHFM-T-100, adopted in December, 1958

TWO PARTS—PART 2

5.00 Requirements and Characteristics of Testing Apparatus

6.03.09 Spurious Response

With the tuner tuned in turn to each of the test frequencies, the signal generator shall be continuously varied over a wide frequency range to discover if the receiver is simultaneously responsive at frequencies other than the test frequency. These other responsive frequencies are called spurious-response frequencies and are most often found in superheterodyne receivers. Each spurious-response frequency is noted and the spurious-response sensitivity test input is measured as in the usable-sensitivity test except that the tuner output with no generator modulation shall be adjusted to the same output as obtained in the usable-sensitivity test with no modulation. This is because the generation of these spurious responses with the tuner may involve a change in observed signal deviation. The ratio of the generator output for spurious-response measurements and the generator output required for the usable-sensitivity test for 30 db usable sensitivity may be computed and expressed in decibels. This is called the spurious-response ratio. This test is properly classified as a selectivity or interference test, although its procedure is that of a sensitivity test. Care shall be taken that the harmonic output of the signal generator is attenuated sufficiently so that it does not affect the observation of the spurious responses of the receiver.

Two particular spurious responses are not covered by this test and will be treated separately.

(*a*) *Image Response*

A superheterodyne tuner is generally responsive to two frequencies whose difference from the local oscillator frequency is equal to the intermediate frequency. One of these is the desired signal frequency and the other is the image frequency. This is a special case of a spurious-response frequency and is tested as such. Its observed characteristics are referred to as the "image-sensitivity test input" and "image ratio." The result shall be expressed in decibels and is to be performed at a signal level corresponding to a 30 db usable sensitivity.

(*b*) *Intermediate Frequency Response*

Another special case of the spurious-response frequency in the superheterodyne receiver is that due to the sensitivity to an intermediate-frequency signal input. The test procedure is the same as for the other spurious responses except that the input is adjusted to the intermediate frequency. The observed characteristics are referred to as the "intermediate-frequency-response sensitivity" and the "intermediate-frequency-response ratio." The results shall be expressed in decibels.

6.03.10 Hum and Noise

Hum and noise of the tuner are produced in two different sections within the tuner. One of them is the audio-frequency circuitry following the volume or level control. Hum and noise is measured as the residual output of the tuner with the level or volume control set to the condition of minimum output. The results are expressed in decibels below 1 volt and are not weighted.

The other causes of hum and noise are found in those sections of the tuner ahead of the volume or level control. For this test, the total output of the tuner is measured when the tuner is tuned to a signal of 1000 microvolts at 98 megacycles and the generator is not modulated. The results are expressed in decibels below the output obtained with standard test modulation.

6.03.11 Frequency Drift

This test is intended to show the variation of the tuned frequency of the receiver. The tests are normally performed with the receiver tuned to the standard mean carrier frequency and the controls set to their normal control settings (automatic frequency control set to minimum frequency control). The variation of frequency is observed with the aid of a beat signal obtained between the signal generator and another oscillator of constant frequency. The frequency of the signal generator is adjusted so that the receiver is correctly tuned. This beat frequency may be measured and recorded. Alternate methods of measurement are possible but the primary measurement shall be a measurement of the change in frequency of the signal generator. One of the alternate methods is to obtain a calibration of detector d.c. output voltage with variation in frequency. Detector output voltage is measured and the corresponding frequency drift is recorded.

The test shall cover the following causes of frequency drift and the results shall describe the operating conditions:

(*a*) The frequency varies with time during the warmup period of the receiver. A curve of frequency drift with time is plotted with time in minutes as abscissas on a logarithmic scale and frequency drift in kilocycles as ordinates on a linear scale. The time is measured from switching the tuner "on," with observations started one minute later. The warmnp drift in kilocycles shall be stated as the maximum drift observed during a two-hour period. If the tuner is intended for different types of installations, these tests should be repeated for the different thermal environmental conditions.

(*b*) The frequency varies with power-supply voltage in a manner that depends upon the rate of variation of this voltage. The line voltage shall be varied from 105 to 125 volts and the resultant frequency drift shall be observed one minute after the voltage change has occurred. The amount of frequency drift for a line voltage change from 105 to 125 volts shall be stated.

(*c*) If the receiver has automatic volume control, the variation of signal-input power affects the oscillator frequency indirectly by way of the control circuit. The frequency drift with variation of signal-input voltage is to be observed after the receiver has been in operation a sufficient length of time to reach temperature stability. The maximum frequency deviation from the signal required to obtain 30 db usable sensitivity to an output of 100,000 microvolts of the signal generator shall be recorded.

The rated frequency drift is defined in section 6.03.13.

6.03.12 Radiation

Radiation of the oscillator and other circuits shall be measured in accordance with the IRE Standards 51 IRE 17S1, 56 IRE 27S1, and their supplements.

6.03.13 Automatic Frequency Control

If the tuner is equipped with automatic frequency control circuits the test of Sections 6.03.02 Usable Sensitivity, 6.03.04 Capture Ratio Test, 6.03.07 Frequency Response, 6.03.08 Distortion, 6.03.11 Frequency Drift, shall also be measured with the automatic frequency control set for a condition of maximum frequency control. The pull-in range of the automatic frequency control is defined as the frequency difference between the signal-generator frequency and the tuned frequency of the tuner which is required to reduce the tuning error to a value of 22.5 kc. This test is to be performed at a signal generator output corresponding to 30 db usable sensitivity. The signal generator output is first adjusted and then the local oscillator frequency of the tuner is measured as in 6.03.11. Care shall be taken that the tuner has reached thermal stability. Then the signal generator is to be tuned to a large frequency difference and is slowly varied toward the tuned frequency of the tuner. The frequency at which the tuner is mistuned by 22.5 kc is recorded and the correct tuned frequency is recorded also. The frequency difference is the pull-in range of the tuner. This test is to be repeated for positive and negative frequency differences and at levels of 20 db above the previous test signals.

It may be desirable to repeat Section 6.03.05 Selectivity Test with the automatic frequency control set to condition of maximum control.

The rated frequency drift is the maximum frequency drift value obtained

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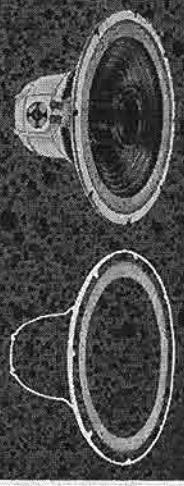

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at the standard mean carrier frequency in the tests of 6.03.11 or 6.03.13. The setting of the automatic frequency control must be stated.

6.03.14 Squelch Control

If the tuner is provided with an adjustable squelch control, the output voltage of the tuner is observed with the tuner tuned to the mean carrier frequency and the signal generator modulated with standard test modulation. The signal generator output is decreased from a large value to a value of output at which there is a 3-db difference in audio output voltage when the squelch control is turned from minimum to maximum. The signal-generator output voltage is recorded. The signal-generator output voltage is further reduced until a 30-db difference is found. This value of generator output voltage is recorded also and the results are expressed in decibels and are called "differential squelch sensitivity." The mean signal generator output voltage is also recorded. The result measured in microvolts is called the "squelch threshold level."

The measurement of hum of Section 6.03.10 shall be repeated with tuners having an automatic squelch control circuit with the squelch control set to position of maximum control and the signal generator having no output (zero microvolts) at the tuned frequency.

7.00 Test Procedures, AM

7.01 Normal Control Settings

Unless otherwise specified, all controls on the tuner shall be set to their normal settings. The volume, or level, control shall be set to the position of maximum audio output (see also section 8.01). The automatic frequency control shall be set to the condition of minimum frequency control. The squelch control shall be set to the condition of maximum sensitivity, providing least suppression of tuner noise. With the exception of the selectivity control, all other controls affecting audio frequency response shall be set to the condition of flattest frequency response as indicated by panel markings.

7.02 Tuning Control

A tuner is tuned to a desired signal when the tuning indicator shows correct tuning with the generator modulated with standard test modulation, and the selectivity control in the position giving maximum selectivity.

If a tuning position is found giving minimum (audio) high-frequency response, the frequency difference shall be stated. If no tuning indicator is incorporated in the tuner, or if no usable indication is obtained, minimum (audio) high-frequency response shall indicate proper tuning. Tuning for minimum (audio) high-frequency response is performed by first tuning approximately and then increasing the modulating frequency until the audio output has decreased 14 db. The tuning control is then finally readjusted slightly for minimum audio output.

It is recommended that the tuning controls be adjusted at an input level corresponding to the usable sensitivity test input giving 20 db usable sensitivity. See Section 3.04.

7.03 Selectivity Control

Many tuner characteristics are affected by the setting of the selectivity control on a tuner having such a control. For initial tuning and performance tests, the selectivity control shall be adjusted to give the highest degree of selectivity. To determine the effect of the selectivity control, tests whose results are affected by its setting shall also be performed at other settings.

7.04 Sensitivity Control

Many receiver characteristics are affected by the setting of the sensitivity control on a tuner having such a control. For initial tuning and performance tests the sensitivity control shall be adjusted to give the highest sensitivity. To determine the effect of the sensitivity controls, tests whose results are affected by its setting shall also be performed at other settings.

7.05 Performance Tests

7.05.01 Tuning Range and Frequency Calibration

The tuner tuning control is set for the respective minimum and maximum carrier frequency in each tuning range which the tuner is capable of receiving with normal operation. At each setting, the signal generator is tuned to the resonant frequency of the receiver and the carrier frequency recorded. This procedure may be extended to obtain a frequency calibration of the dial, if this is required. If any error in frequency calibration is found the error maximum in kilocycles shall be stated.

7.05.02 Usable Sensitivity

This test is performed at each of the standard test frequencies with the signal generator connected to the tuner under test through the standard 200-μμf dummy antenna. The signal generator shall be amplitude modulated with standard test modulation. The controls of the tuner shall be set to the normal control settings. The signal intensity shall then be reduced to the least value which will provide a 20-db rise in indicated output with standard test modulation as compared with the indicated output with standard test modulation measured through a 400-cps null filter. This test serves to indicate the relative freedom of the tuner from objectionable internal receiver noise during pauses in modulation when receiver noise is least likely to be masked by modulation.

The results are expressed in microvolts.

If the tuner is equipped with a selectivity control or a sensitivity control or both, this test is to be repeated with all settings of these controls if step-type controls are used. If continuous controls are used, this test is to be performed at the minimum and maximum settings of these controls.

7.05.03 Volume Sensitivity

This test is performed at each of the standard test frequencies with the signal generator connected through the tuner under test through the standard 200-μμf dummy antenna. The signal generator shall be amplitude modulated with standard test modulation. The signal generator shall be adjusted for an output of 100,000 microvolts. The output voltage of the tuner shall be recorded in decibels with respect to 1 volt. Then the signal generator output shall be reduced to a value at which the audio output of the tuner has been reduced by 20 db.

The results of the volume sensitivity tests are expressed in microvolts.

If the tuner is equipped with either a selectivity or a sensitivity control, or both, this test shall be repeated for all settings of these controls if step-type controls are used. If continuous controls are used, the test shall be made for the minimum and maximum settings of these controls.

The rated sensitivity of a tuner shall be equal to the highest number of microvolts obtained in all tests of sections 7.05.02 and 7.05.03 with the controls set to their normal settings.

7.05.04 Selectivity

The tuner is tuned in succession to each standard frequency as in the usable-sensitivity test. The signal-generator output voltage is adjusted for a 20-db usable-sensitivity test input. The signal generator is then detuned 10 kilocycles each side of resonance, and the output voltage of the signal generator is adjusted until the same audio-frequency output is obtained with standard test modulation. The output voltage of the signal generator is recorded and compared with the signal-generator output voltage required for the 20 db usable sensitivity test input. The ratio of the output voltages may be expressed in decibels and gives the adjacent-channel selectivity for a generator detuning of 10 kilocycles. The alternate-channel selectivity is found with the generator detuned 20 kilocycles.

This test is to be repeated in steps of 10 kilocycles up to 100 kilocycles off resonance, or 80-db selectivity or 100,000-microvolt signal-generator output, whichever is the smaller. This test is to be repeated with the signal generator above and below the tuned frequency of the tuner.

If the tuner is equipped with a selectivity control, this test is to be repeated in all positions of the selectivity control if a step-type control is used. If a continuous selectivity control is used, this test is to be made for the condition of maximum and minimum selectivity.

The rated selectivity shall be the adjacent-channel selectivity at the standard mean carrier frequency with the selectivity control adjusted to give the highest degree of selectivity.

7.05.05 Frequency Response

The frequency-response test shows the manner in which the audio output of the tuner depends on the modulating frequency. It takes into account all the characteristics of the tuner. The tuner is tuned to a signal at the three standard carrier frequencies. The signal generator output is adjusted to 5000 microvolts, amplitude modulated with standard test modulation. The tuner output is measured with all tuner controls set to the normal control settings. The audio output is observed while the modulation frequency is varied continuously from 30 to 15,000 cps. The results are to be compared to the response at 400 cps and are to be expressed in decibels.

This test is to be repeated for all settings of the selectivity control if a step-type control is used. If a continuously adjustable control is used this test is to be repeated at the minimum and maximum settings of this control.

If the results of the frequency-response tests are plotted, semi-logarithmic paper shall be used and a 20-db change on the ordinate shall correspond in length to 1 decade of frequency variation on the abscissa.

If the frequency response changes with volume control setting, this test shall be repeated at selected attenuation differing in steps of 10 db from the position of maximum output. It is not necessary to make the frequency-response test or plot the observations below −20 db or 10% of output voltage, although further observations may be desirable for special purposes.

It may be desirable to repeat the frequency-response tests at an input level corresponding to a signal sensitivity input for 30 db usable sensitivity. Comparing this to the previous tests may show the influence of the automatic-gain-control circuits on frequency response.

The rated frequency response shall be measured at the standard mean carrier frequency and the signal generator set to produce a 5000-microvolt output with the selectivity control of the tuner adjusted to give the lowest degree of selectivity. The lowest and highest modulating frequencies where

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the tuner output has decreased 3 db from the 400 cps output are to be reported. If a 10-kc filter is used the bandwidth of this filter is to be stated. The 10-kc filter bandwidth is defined as the difference of the two frequencies near 10 kc where the audio output of the tuner has been reduced 3 db from the 400-cps output.

7.05.06 Distortion

The test is intended to evaluate the spurious audio-frequency harmonics which appear in the audio output of the tuner during normal operation. Care shall be taken to avoid appreciable distortion occurring in any part of the signal generating equipment or in the output measuring circuit. Distortion measuring equipment is required in the tuner output circuit and shall not appreciably affect the output load condition. This equipment may measure each frequency component individually or may measure all frequency components collectively. A proper tuning of the tuner is important in making distortion tests. No one complete set of conditions can be prescribed for this test because distortion depends on so many details of tuner design and operating condition. Distortion is caused by overloading and by many other phenomena and is present under various operating conditions, especially high degrees of modulation. The following series of tests are intended to show the effect of operating parameters on distortion.

(*a*) *Variation of Output*
The tuner is tuned to the standard mean carrier frequency and a 5000 microvolt signal with standard test modulation is applied. The distortion is noted as the output of the tuner is varied by means of the volume control.

(*b*) *Variation of Modulation*
At the standard mean carrier frequency with the above signal input and a 400-cps modulating signal the modulation is varied from 10% to 95% of maximum and the distortion observed. The volume control is left in its maximum position.

(*c*) *Variation of Input Signal*
The distortion is recorded as the signal input level at the standard mean carrier frequency is modulated at 400 cps is varied. The test is made at both 30% and 90% modulation. The distortion should be recorded as the signal input is varied over the entire range of input voltages (up to 100,000 microvolts) in steps of 20 db starting with an input corresponding to 30 db usable sensitivity. This test indicates distortion due to detector and automatic-volume-control characteristics. It may be desirable to repeat this test with a modulation frequency of 30 cps.

(*d*) *Variation of Modulation Frequency*
To disclose the effect of the modulation frequency on distortion, test in Paragraphs (a) and (b) shall be repeated at several modulation frequencies throughout the audio frequency range. The maximum modulation frequency at which harmonic distortion can be detected by this method is one-half the maximum frequency which can appear in the output.
In making distortion tests at the higher frequency, special apparatus and special test methods (such as simultaneous application of two modulating frequencies) are required. Harmonic distortion measurements are useful and significant up to modulation frequencies of approximately 1000 or 2000 cps. At higher frequencies the selectivity characteristic of the tuner may attenuate the higher distortion products severely and may give rise to considerable errors in measurement.
Measurement of distortion at the higher modulation frequencies will show up deficiencies such as caused by inadequate bandwidth or phase shift of the selective circuits of the tuner or the detector circuit. In this case, the distortion product of most interest is the difference tone obtained when the carrier is modulated by two audio frequency signals differing by less than 500 cps. For this test, a signal generator is modulated to identical modulation percentages by the two different audio frequency signals and the arithmetic sum of both percentages is recorded as the modulation percentage. The total modulation percentage shall be 30% and 90%. The level of the difference tone between the two frequencies is measured in the audio output of the tuner and its value is recorded in decibels below 30% and 90% modulation at 400 cps.

The rated harmonic distortion of the tuner shall be the percentage of distortion measured with the signal generator modulated 90% at 400 cps, the receiver tuned to the standard mean carrier frequency, and the signal generator set to a 5000-microvolt output.

The rated intermodulation distortion of the tuner shall be measured at the same input level and signal frequency as above and the total instantaneous maximum modulation percentage shall be 90% with the signal generator modulated with two signals of identical amplitude and frequencies of 7000 and 7400 cycles per second. The 400-cps output of the tuner shall be measured and shall be expressed in percent of the output of the tuner obtained with 400 cps at 90% modulation.

It may be desirable to repeat these tests at the other standard carrier frequencies and also at the different settings of the selectivity control.

7.05.07 Spurious Response

With the tuner tuned in turn to each of the test frequencies, the signal generator shall be continuously varied over a wide frequency range to discover if the receiver is simultaneously responsive at frequencies other than the test frequency. These other responsive frequencies are called "spurious-response frequencies" and are more often found in superheterodyne receiveds. This spurious-response frequency is noted and the spurious-response sensitivity test input is measured as in the usable-sensitivity test. The ratio of the generator output for spurious-response measurements and the generator output required for the usable-sensitivity test for 20 db signal-to-noise ratio may be computed and expressed in decibels. This is called the spurious-response ratio. This test is properly classified as a selectivity or interference test, although its procedure is that of a sensitivity test. Care should be taken that the harmonic output of the signal generator is attenuated sufficiently so that it does not affect the observation of the spurious responses of the tuner.

Two particular spurious responses are not covered by test and will be treated separately.

(*a*) *Image Response*
A superheterodyne tuner is generally responsive to two frequencies whose difference from the local oscillator frequency is equal to the intermediate frequency. One of these is the desired signal frequency and the other is the image frequency. This is a special case of a spurious-response frequency and is tested as such. Its observed characteristics are referred to as the "image-sensitivity test input" and "image ratio." The result shall be expressed in decibels and is to be performed at a signal level corresponding to a usable sensitivity of 20-db signal-to-noise ratio.

(*b*) *Intermediate Frequency Response*
Another special case of the spurious response in a superheterodyne receiver is that due to the sensitivity to an intermediate-frequency signal input. The test procedure is the same as for the other spurious responses except that the input is adjusted to the intermediate frequency. The observed characteristics are referred to as the "intermediate-frequency-response sensitivity" and the "intermediate-frequency-response ratio." The results shall be expressed in decibels.

7.05.08 Hum and Noise

Hum and noise of the tuner are produced in two different sections within the tuner. One of them is the audio-frequency circuits following the volume or level control. Hum and noise are measured as the residual output of the tuner with the level or volume control set to the condition of minimum output. The results are expressed in decibels below 1 volt and are not weighted.

The other causes of hum and noise are found in those sections of the tuner ahead of the volume or level control. For this test the total output of the tuner is measured when the tuner is tuned to a signal of 5000 microvolts at the mean carrier frequency and the generator is not modulated. The results are expressed in decibels below the output obtained with standard test modulation.

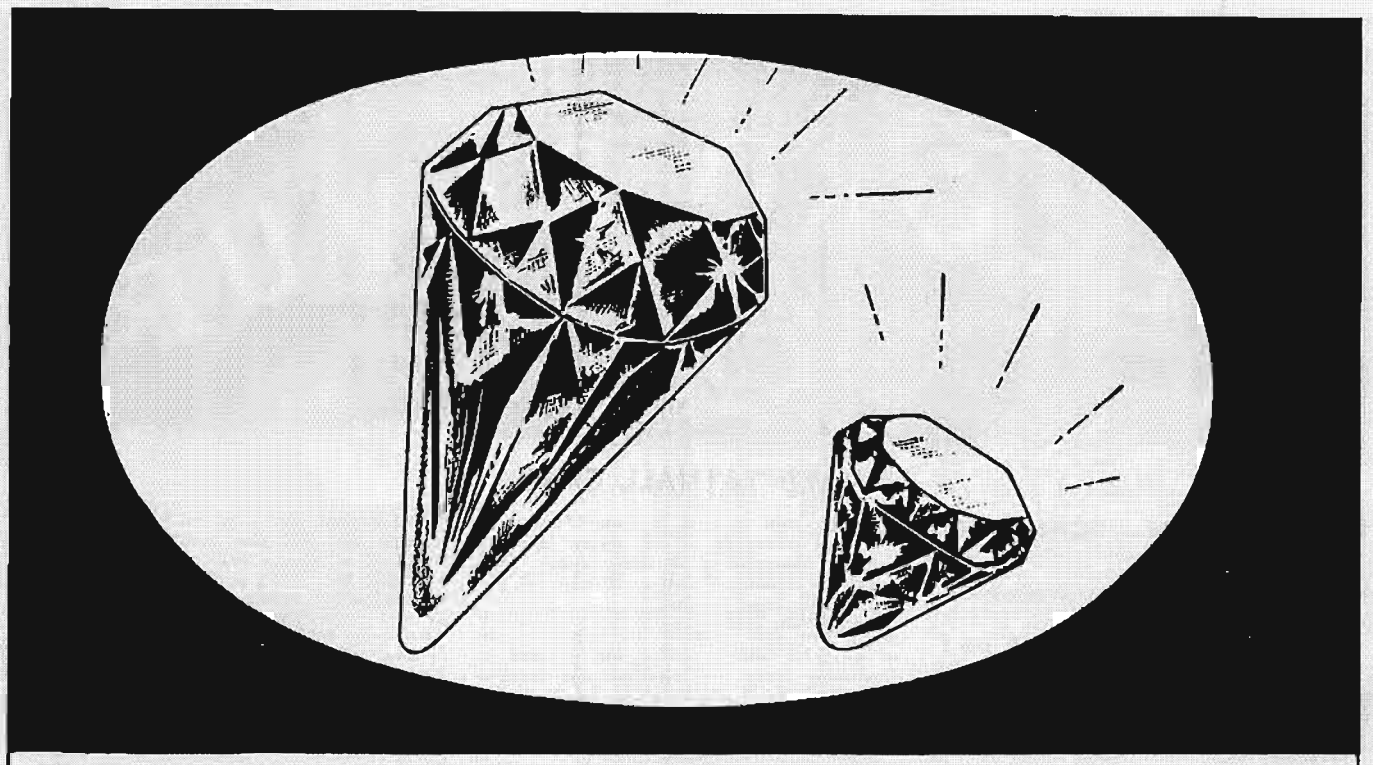
7.05.09 Frequency Drift

This test is intended to show the variation of the tuned frequency of the receiver. The tests are normally performed with the receiver tuned to the standard mean carrier frequency. The variation of frequency is observed with the aid of a beat signal obtained between the signal generator and another oscillator of constant frequency. The frequency of the signal generator is adjusted so that the receiver is correctly tuned. This beat frequency may be measured and recorded. Alternate methods of measurement are possible but the primary measurement shall be a measurement of the change in frequency of the signal generator.

The test shall cover the following causes of frequency drift and the results shall describe the operating conditions:

(*a*) The frequency varies with time during the warmup period of the receiver. A curve of frequency drift is plotted with time in minutes as abscissas on a logarithmic scale and frequency drift in kilocycles as ordinates on a linear scale. The time is measured from switching the tuner "on," with observations started one minute later. The warmup drift in kilocycles shall be stated as the maxi-

(*Continued on page 71*)



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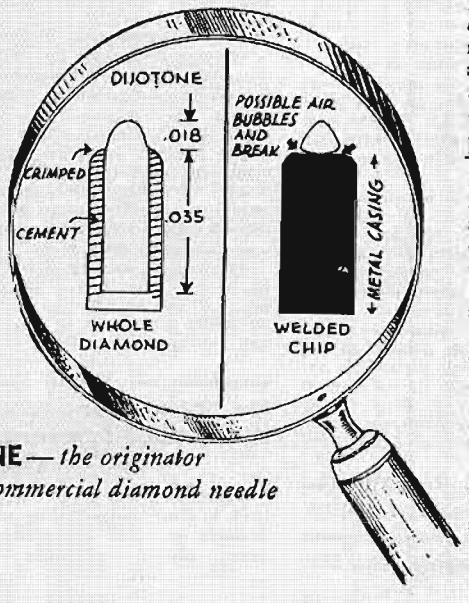

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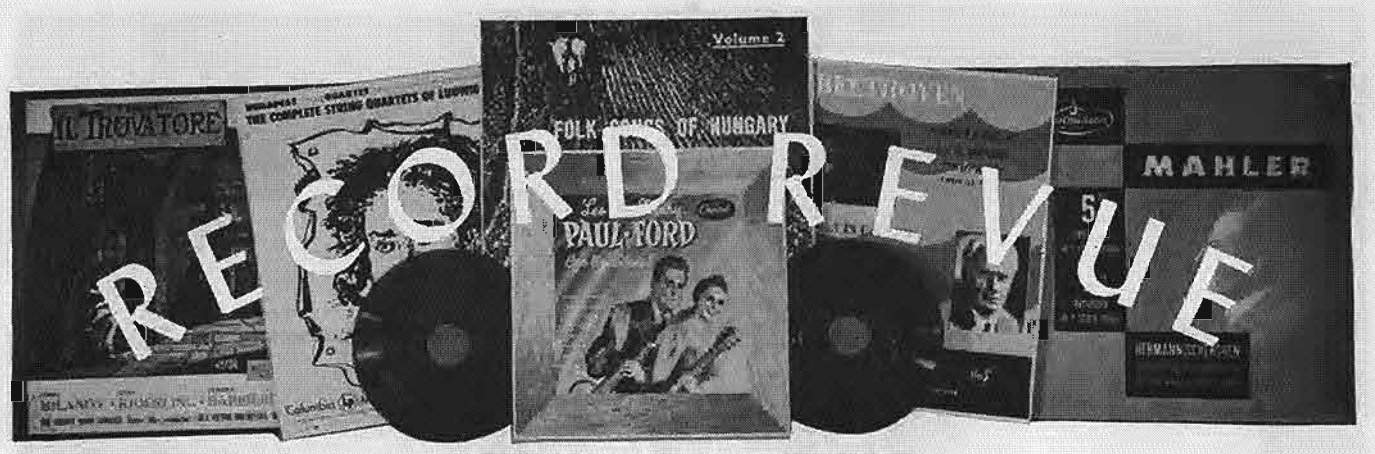

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With its 40,000 pipes, 883 stops, six manuals, etcetc., this machine might do almost anything for any organist, especially if he had twelve hands and five feet. For Al Melgard, here, it plays relatively gently, gently like a hippopotamus at play, let's say. The strings are like string beans, the quavering sang-pipes sing dizzily, the reedy stops bray like herds of donkeys. A fine sound, all in all, and the extras are there, too, from castanets on up.

Mr. Melgard tends to a rather deliberate pace and a certain clumsiness, perhaps because of that enormous eight seconds or so of reverberation with which he must contend. (We are close-up and we don't hear it much.) This is no George Wright whirlwind. But, for a stadium, the place isn't bad, nor the music.

Next time you hear this organ there'll be another convention going on—shades of FDR. (And *do* I remember this very monster, then, bellowing over the crowds of delegates.)

The King of Organs. Bill Floyd. Wurlitzer at the Paramount, New York.

Cook 1150 stereo

No hippopotamus here—this organ moves as fast as lightning under Mr. Floyd's sophisticated fingers and toes. His style is, relatively, quite modern within the theatre organ tradition, the harmonies thick and fast and fairly complex, swing style.

This is one of the old and famous Cook stereos, once heard on the old two-band stereo discs and on Cook tapes, if I am right. I don't know what has happened to the new Cook disc line since last fall when I got this and several others. Not a word since. The record is made via microfusion (powdered vinyl) in transparent blue. It's good, but no better than standard pressings as far as I can hear. Noise level is slightly higher than is now normal for black.

Alas, the disc is 'way off-center, my copy.

Funny—Cook's old two-track stereo is done in a style that's already a bit out of date in sound—widespread, picked up fairly far back in the theatre, without the smooth, close-up edge that we are now used to in our stereo. Purely a matter of taste; but tastes change.

Leon Berry at the Giant Wurlitzer, Vol. 3. **Audio Fidelity AFLP 1844**

This one I have in mono form and I've lost the cover—it was in somebody else's envelope. No matter—my message is brief. This Wurlitzer, not identified on the record label, is obviously mounted in a large closet. (Mr. Berry's basement, actually.) There's no appreciable liveness, anyhow.

That makes for an impression of intimacy and, at the same time, a wonderful clinical look-see into the organ's tonal machinery. This player really pulls out his stops (touches his little colored stop-tabs, to be more accurate) and you'll hear cymbals, xylophone, bells and anything else you wish to mention. A good, close-up study of theatre organ tone and the same goes, no doubt, for the other volumes in the series, which presumably will be endless so long as you keep buying. Superbi-fi, needless to say.

Buxtehude: Complete Organ Works, Vol. 1. Jorgen Ernst Hansen. Organ of Christianborg Chapel, Copenhagen.

Haydn Society HS 9054

The Haydn Society is back, after some years of the stillness of death, and a new flow of interesting music has started up again from this once-leading small LP outfit. This organ record may remind you of the pioneer "Baroque" organ recordings from Haydn Society by the Dane, Finn Viderø, made at Sarø in Denmark in the early LP days. This man is a pupil of Viderø and a lively, if somewhat metronomical player, confident, brash, accurate, not very subtle in his expression but always impeccably correct in the execution of the style.

Buxtehude needs such a lively approach—he can use a certain boisterous feeling, speaking in figurative terms, of course. He was a strong, bright, outgoing personality, full of humor, a grand showman as well as a sensitive musician. The solemn, antiquarian approach of some organists towards this kind of music is death for Buxtehude. Better any day an accurate, brilliant, outgoing organist like this than a plodder, even if he is a bit metronomic.

The organ dates from 1826, which is very late for a "classic" organ, but its sound is of the right Buxtehude sort, complete with whistles, "chiffs," snarls, hoots and a generally steam-calliope tone quality. Real Baroque—the 1826 builder must have been very old-fashioned in his tastes. It's a big instrument and does have a somewhat more massive sound than the earlier classic instruments, as far as one can tell from the recording, but there isn't any high-pressure Romanticism to be found in it. That would have come a bit later in the nineteenth century, at least in Denmark.

The King of Instruments, Vol. XIII—The Organ in the Mother Church. Frederick Jagel, tenor, Ruth Barrett Phelps, organist. **Washington WAS XIII**

What a romantic contrast! I took a look at the Mother Church organ (Christian Science) a couple of summers ago when I was in Boston. Impressive, if slightly gaudy. The sound of it can be summed up in a word—reverent. Indeed, the whole atmosphere of the Mother Church itself is reverent, with polite ladies waiting for your visit, to escort you around and give you a spiel in low voices about its wonders, including the organ. A far cry from the world of the jolly Buxtehude—but one of his works, a Chaconne in E Minor (also on the Haydn Society disc) somehow gets into this recital, even so. It is, of course, transmogrified, the color and verve replaced by a subdued and respectable dignity. Quite nice, but I'd never have recognized Buxtehude if I hadn't read the label!

This organ lends itself to the sort of sentimental sacred music that began with Mendelssohn, and Mr. Jagel sings several almost tearful items from that composer, to sweet, soft, lush organ background. Mendelssohn was enough, however, and I had to stop at the later Jagel items, which were more than I could take. But the Fantasie in A of César Franck was lovely on this organ and most musically played, too. Just goes to show what style can do.

Washington Records has taken over the Aeolian-Skinner "King of Instruments "series, of which this is the thirteenth.

Bach: Organ Music. (Toccatas and Fugues in C, D mi., F, Fantasia and Fugue in G mi.) Fernando Germani, organ of St. Laurens, Alkmaar.

Capitol-EMI G-7111

Four of the biggest Bach organ pieces are played on this record and the splendid old Dutch organ in the cheese market town of Alkmaar is a glorious instrument on which to play them. (Deutsche Grammophon has also recorded the organ, with the blind organist Helmut Walcha—see Archive catalogue).

This organist with the Italian name, about whom I have no information, does a good job on these big works, playing with sturdy energy and sureness, a fairly metronomic beat. The recorded sound is good, but two minor failings must be noted, (a) there are some unfortunate tape "edits" to be heard, where none should be audible, and (b) the organ is out of tune in some stops. (It's in tune for Deutsche Grammophon.) Don't know what got into EMI.

The organ as now restored is almost exactly as it was rebuilt in 1725, (using many much older pipes)—the music was composed within a few years of this same date. Good combination!

Mendelssohn: Organ Sonata #4 in B Flat. Widor: Organ Symphony #6 in G Minor. Albert Schweitzer, organist.

Columbia ML 5290

Though Schweitzer was long known as both a Bach specialist and a Bach organist, actually his musical training was at the extreme opposite, in Paris of the late nineteenth century where the high-Romantic school of French organ music was at its prime, following César Franck. In his recent recordings Schweitzer has gone back to this school—his last was of César Franck—and his playing immediately strikes a more authentic note. The Schweitzer Bach is now rather fundamentally out of style (though

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

still timelessly noble in conception) but the Schweitzer Mendelssohn and Widor are right on the beam.

The organ here isn't specified but it is decidedly not a "Baroque" or "Classic" instrument! Quite right. This is music in the Romantic tradition, for a big, blurry, grandiose organ replete with swell boxes and masses of nicked pipes, imitating a large orchestra in its impact if not in tone color. Schweitzer's fast movements on this organ are somewhat stiff-muscled and far from fluent and even with tape editing (we can assume), there are slips of the finger and the foot. But Schweitzer always did play that way; he's been the horror of the academic organist for a half century! The slow movements show him at his best, a really noble and expressive musician who can bring out the most profound emotional levels in the music where others merely play the surface, impeccably. A grand old man, no doubt about it.

The Organ Concertos of Handel, Vol. 2 (Nos. 7-12, Op. 7, #1-#6.) E. Power Biggs; London Philharmonic, Sir Adrian Boult. **Columbia WAS 604 (2) stereo**

I missed the first volume of this interesting three-volume set and so, too, I missed the detailed descriptive booklet that Columbia thriftily offers only in Volume 1. Thus I don't have the immediate answers to several nice questions that the music has raised in my speculative mind. I can use my imagination to good effect, though, and so can you.

This, you see, is a typically Biggs-style project; for the organ itself is one that Handel actually played upon—indeed, he designed it—and it has remained virtually unchanged since Handel's day, 200 years. But old organs bring problems, over and above the question of reliability in action.

First, this organ is located at an out-of-town estate, the Earl of Aylesford's in Great Packington. Yet here we have the London Philharmonic in all its majesty, playing—by the sound of it—in a London-sized concert hall. Did the orchestra travel to the organ, en masse? And if so, is this fine, big liveness the natural one at the organ's private-estate location, which seems surprising, or is it by chance a product of Columbia's fine, big New York echo chambers? Could be either!

Or—speculation continues in my mind—is it possible that the orchestra stayed at its home base—played in a London hall or studio—and the organ was spiritually transported thither via tapes, the two elements recorded separately? Possible, though not probable. Mr. Biggs could have played his part first—maybe—and the orchestra could have accompanied the tape playback. Not a very artistic way to do it, but such things get done these days often enough, and successfully.

Then there's the matter of pitch. Do I recall recently having read an account of this recording that spoke of the lower pitch that prevailed in Handel's day and the strangeness of hearing a Concerto in D minor come out in say, C-sharp? I dunno—but I checked this album, not having absolute pitch myself, and I find that it is precisely at modern pitch. It's the same, anyhow, as the Cleveland Symphony, the Vienna Philharmonic, etcetc.

Now has the organ been tuned higher? Or was the tape playback speeded up? Did the London Philharmonic play on pitch—modern pitch? It probably had to, for it is usually impossible to tune the wind instruments down far enough, even though the strings can always be let out a bit. Anyhow, the record is up to modern pitch and the organ matches the orchestra, however it was done.[1]

Answers to these questions are easily determined, but I find it more fun to guess. (Go get Volume 1 and you can find out for yourself.)

As to the playing, it is pleasing, musical, and more or less in style. I say that because, I must confess, there are for my ear a good many hints of the old-fashioned, "non-authentic" Handel in Mr. Boult's London Philharmonic playing. Mr. Biggs would, of course, tend to the more "authentic" playing style since that is his special field; how far he could convince Sir Adrian B.—and how far Sir A. could convince his professional symphony players—is a question. Anyhow, they compromised successfully and the getting-together is generally harmonious throughout.

[1] Later—I hear the pipes were actually sawed off to tune the organ higher—then patched back on again for posterity!

2. BIG STUFF

Tchaikowsky: Symphony #5. Boston Symphony, Monteux..

RCA Victor LSC 2239 stereo

Ah! Now here is the kind of record that brings me to full confidence in the tremendous value of stereo recording—not to mention hi-fi and, indeed, recording itself. Just terrific.

First, old Papa Monteux is surely one of the greatest conductors of the last fifty years, perhaps less flamboyant but a far wider, more resourceful, more effective conductor even than the famed Toscanini. This is such a superb performance, down to the last detail and in the over-all sureness of shaping at every level, that I am sure it is the sort which at the end of a concert would bring cheers, yells, stamping of feet, bravos from any audience. It's not merely brilliant and electric—much more than that, it has every bit of that sharp, clean, impeccable styling that is a French specialty, without a trace of over-tension, sloppiness, vulgarity (so easy in Tchaikowsky), and yet every note at its most pointed, for the total impact, right to the end. And the greatest facet of all this, to my mind, is Monteux's superb understanding of Romantic *rubato*, that emotional unevenness of tempo that can make or ruin a big piece like this—that *must* be present and yet is horrible if done without understanding and experience. Papa Monteux is second to nobody in this—not even the great Mengelberg, who was surely the most profound master of this technique to live into the era of recorded performance.

You don't need to know a thing to be thrilled by this Monteux Tchaikowsky; but the more you know about the music, the more you'll be amazed.

Second, RCA's stereo is a pleasure to listen to—so positive, natural, definite, so easily and well balanced for the right musical effect. I guessed this was a triple-track job without looking; it has the clarity of middle, the even nearness all the way across, that is typical of well-done three-track stereo. It is so reassuring, here, to be able to locate the first violins where they belong, the brass, all the rest, without vagueness and yet without a trace of exaggeration either, every part of the orchestra clearly in spatial balance with the rest, the whole texture of sound beautifully clarified by the stereo separation. Just wonderful.

Tchaikowsky: Symphony #5. Oslo Philharmonic, Odd Gruner-Hegge.

RCA Camden CAS 489 stereo

This one is a price bargain—for the symphony is plenty long enough to fill two sides, even at the fairly rapid pace it takes on in this version.

A new recording, and I wonder whether RCA took it over from the Norwegians or sent out an RCA team complete with RCA half-inch, three-track Ampexes? In any case, the sound is mostly excellent, for a good stereo effect with sharp, clean details and a pleasing over-all liveness. I say "mostly" because I get the impression that the very loudest portions of this very loud symphony are a bit overloaded, here and there, with a slight hangover feel to the drum-punches. (It's a faint shadow of the effect we used to get in the old broadcasting days via severe limiter action. The big drums, instead of going BOOM, sort of go BOO-WOOM, if you see what I mean.) Slight, at worst, and I suspect that most of it is Tchaikowsky's fault for writing music that can be whomped up to the extreme intensity of this performance.

Don't think this Oslo team is a mere hired outfit turning out potboilers on order! The performance reeks of personality; it is very much an "interpretation" and in a way, rather a self-conscious one. It demands your attention in no uncertain terms and if you are an old Tchaikowsky fan you may be startled at some of the streamlined speeding here combined with highly emotional playing and lots of *rubato* (slowings-down for effect). Nope, this isn't the old fashioned, long-drawn out Tchaikowsky one little bit. Strictly modern, in a highly Romantic sort of way.

Tchaikowsky: Symphony #3 ("Polish"). Vienna State Opera Orch., Swarowsky.

Urania USD 1026 stereo

This is the third disc in a trilogy of the early Tchaikowsky symphonies (the First, Second and Third, subtitled "Winter Dreams," "Little Russian" and "Polish") that to my mind ranks collectively near the top in over-all recorded value. Here's the other recent one,—

Tchaikowsky: Symphony #1 ("Winter Dreams"). Vienna Philharmusica Symphony, Swarowsky

Urania USD 1010 stereo

I'm not clear as to what this "Philharmusica" orchestra is—orchestras of Viennese habitation seem to proliferate into more and fancier names as time goes on yet I suspect that, most of the time, the same familiar players are doing most of the work. In any case, the State Opera Orchestra is generally taken to be the Vienna Philharmonic in a second and independent corporate existence; the Philharmusica might combine a few of these dual-title boys with members of the Vienna Pro Musica Orchestra, if such an outfit exists.

You may herewith forget all that, and take my word that this, too, is a top-rank stereo of beautifully recorded, well-played Tchaikowsky, not too hysterical, yet full of busy, expressive life. These records are particularly good in the orchestral details. Within the large, golden liveness, the individual strands of the musical fabric are both clear and natural, a difficult combination to hit. The strings are smooth and well blended, though close; oboes, clarinets, percussion, are sharply defined but never exaggerated. A real feat of stereo recording, I'd call it, and the technical quality of the sound is as fine as you'll hear at this stage in the game.

What's more, you'll enjoy the brash, gamey flavor of this youthful Tchaikowsky, full of his characteristic big melodies, his heady orchestrations, fancy rhythms, but lighter, less portentous than the late and more familiar symphonies. Maybe this music isn't as "great" but to my mind it makes just as effective listening. Try all three of these Uranias.

Haydn: Symphony #94 ("Surprise"). Oslo Philharmonic, Olvin Fjeldstad.

RCA Camden CAS 481 stereo

This is a bargain, too, but in ways unexpected. Yes, it is "low-priced"—but since the symphony is spread out over two whole sides, whereas every other LP recording that I know gets it onto a single side, the actual cost of the music is about the same as in standard lines.

For the hi-fi man, the bargain aspect comes in the quality, both musical and technical. This stereo series is new recording, of course, not a reissue of "oldie" stuff as with many Camdens. The short length of play here is an advantage in terms of wide, clear, unforced groove cutting, with no trouble at all in the inner grooves and an easy stylus travel throughout. Fine, big stereo sound, sharp and well separated in the details.

The Oslo orchestra, in spite of RCA's implied downgrading via the Camden label is a first rate band and its playing is positive, strong, expressive. This is one of the better recorded "Surprise" performances. It favors a big, symphonic effect, rather than the small-orchestra authenticity of many recent versions, but the playing is lively, clean and thoroughly musical.

Beethoven: Violin Concerto. Heifetz; Boston Symphony, Munch.

RCA Victor LSC 1992 stereo

The stereo disc reissues are quietly building up; this recording came out on stereo tape (at the fabulous price of $19, if I

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remember rightly) back in early 1957, and probably was recorded early in 1956. Here it is on stereo disc for one third as much as its earlier cost on tape, which is enough to recommend it.

The recording was dual-track, has the usual big, convincing RCA sound (not as big as the tapes made in Chicago at the same time, with Reiner), the usual close-up RCA placement of the soloist, squarely in the middle, and the slight indefiniteness, so to speak, in the central area of the orchestra, the *very* slight emphasis on the side areas and on the wall-bounce from the auditorium, that characterize the older two-track technique. Newer, three-track RCA stereo in the same hall has a more even spread, a somewhat closer effect for the individual orchestral sounds, a sharper sense of detail, especially from the center of the orchestra.

A funny performance, this, and not exactly the all-time classic that you might think, reading the cover notes. For one thing, the tempo is so fast that old-timers will be really startled. The familiar Beethoven leisure, so spaciously strung out in most earlier performances of this work, is just not apparent here; things move along in a rapid, business-like way, beginning with the almost indecent haste of the famous solo drum taps that open the concerto, going straight on to the hurried-up holds in the last movement—those pauses which ordinarily are practically dead stops, here are mere hasty acknowledgements. Could this be a late reflection of Toscanini? I don't think so, for Toscanini was never cool and business-like in *his* high-speed Beethoven!

My guess is that Munch is the speed man; it is his somewhat metronomic beat that keeps things going here and chills a good deal of the musical ardor in the process. Heifetz, a good trouper, adjusts himself to the faster speed with a fine flair and with plenty of top fiddling, only an occasional absent-minded slur, from too much familiarity with the music.

Only at the climactic return of the opening passage of the first movement did I feel that this performance really blazed out—that was good, that part. But the long, slow, ornamental second movement is a metronomic fiddle exercise, unimaginatively played, casting no Beethoven spell at all. Maybe Heifetz himself was bored, in his highly competent way.

Orff: Carmina Burana. Houston Symphony, Houston Chorale, Stokowski.
Capitol SPAR 8470 stereo

The enormously popular Orff work is recorded here in the performance that first brought it to U.S. attention, with Stokowski's flamboyant ministrations, several years back. The music is plenty striking on its own; Stokowski makes it really hum.

Orff is a strange composer. He's a leading German and a famous and influential teacher whose methods have affected all sorts of composers of many a nation. His music, for most of us, is the antithesis of the German—it's exciting, dramatic, minus all the traditional German virtues of structure, counterpoint, large-scale architecture—and turgidity! Orff is all color, all display; his effects are transparent as air and as sharp as ultraviolet. And as for structure, his music is just a long chain of enchanting, striking new ideas, each one made dramatic mainly by high-powered repetition. Germany practically invented musical key-modulation—but Orff stays put, in one key, until you are fairly hypnotized. It's both subtle music and obvious music—a pleasant combination, decidedly.

Orff's inspiration, as some listeners will discover, comes first of all from the music of Medieval Europe. (His texts tend to run to Latin, and he likes the early Medieval rhymed sort.) But the Orff idea of "Medieval" is not exactly the usual one—his concept is wild, racey, dynamic, earthly, full of strong rhythms, lusty color, folksy tunes. Pretty strong stuff and a lot better than some of the more musicological reconstructions of actual older music that we now hear.

Above all, Orff has a fabulous way with voices— chorus, solo, and speaking. Singers just can't sing Orff without getting highly excited, and this excitement is immediately transferred to every listener. All this Stokowski knows full well. And so you'll find this a very stimulating record, any way you look at it.

3. TITILLATIONS

The Immortal Sir Harry Lauder.
RCA Camden CAL 479

This is astonishing! I had no idea that such excellent sound quality might lurk in the masters for those endless, scratchy old Lauder records that sold everywhere and were played to death in droves when I was a very small kid.

I remember Sir Harry—on records—most vividly. We still have a pile of his discs somewhere in a barn and a few of them still play, more or less. One of my father's distinguished friends, a college president for a quarter century, used to break into Lauder (slightly out of tune) whenever there was an outdoor picnic or a fireside get-together where we would listen to him. Surely, anybody over 40 must remember that familiar ha-ha-haa with the upward inflection, the chuckles that couldn't be suppressed, the laugh that broke up every song in the middle—and the famous story "asides" that interrupted confidentially in the midst of the music, while the band respectfully waited for the chorus. It was nicely calculated and wonderful showmanship right down to the kilt and the pseudo-Scotch accent that managed always to be intelligible, even to the Amurricans. He was good, Lauder.

Anyhow, here's Sir Harry back again, loud, clear, hearty and darned near hi-fi. Amazing. There's hardly a trace of background noise; the bass is big (oom-pah style), the brass is loud and melodious and the voice itself is almost distortionless, a big, rich tenor with enough sibilant S sounds to make every word intelligible. No faint echo of the dim, distant past here! Sir Harry practically walks right into your room. And the original records were probably all of them acoustical, at that. A fine reissue.

Come Fill Your Glass With Us. Irish Songs of Drinking and Blackguarding. Patrick, Tom, Liam Clancy; Tommy Makem, Jack Keenan, with instrs.
Tradition TLP 1032

The Irish! These fellows (with one exception and he just plays banjo and guitar) are real Irish and the songs they sing and play here are the easy-going drinking and good-time songs they knew as kids—which wasn't so very long ago. What an excellent record! Unassuming, minus airs and graces, yet sung with gusto and friendliness and plenty of style, it'll melt anybody's heart, even a simon-pure folklorist. For my money, they put the Weavers to shame.

The three Clancys, bass, baritonish and tenorish, are variously involved in acting, folksong collecting, producing, and what-not (they run Tradition records more or less, I gather) but there's time left for this sort of thing, and I'm all for it. All of them, and Irish Tommy Makem, have excellent natural voices, and each has his solo here, with guitar-banjo back-ground and a lively accompaniment from tin whistle and harmonica—which they play with musical finesse of a high order, when they aren't singing. Hi-fi—of course.

Old Music Box Waltz Melodies.
Bornand RCB-4 (mono)

Bornand sends me this, reminding me that I once enthused over the first Bornand music box recording as a remarkable novelty. It surely was, and the proof is merely that music box records are all over the place now. This is a Tenth Anniversary disc but, since the label reserves all rights as of October, 1955, I'm not exactly clear as to the present stretch of time back to the First—was it 1945, on 78? Guess it must have been.

A batch of hi-fi waltz tunes here, played on a half dozen music box monsters, the kind with low, low bass as well as tinkling highs. The company has other discs, graded as to size from single 78's (for those of us who haven't yet discovered the LP) through 45's, ten-inch, 12-inch 33's—no stereo as yet and just as well. (*Bornand Music Box Co., 139 4th Ave., Pelham, N. Y.*)

De Banfield: Lord Byron's Love Letter. Libretto by Tennessee Williams. Varnay, Ribla, Carlin, Carruba, Academy Symphony Orch. of Rome, Rescigno.

RCA Victor LM 2258

Ugh. This is one of those dreadful (so I hear them) folksy American operas sung in low-brow English by vast, bosomy, Italian-style sopranos and bellowing Caruso tenors, where one keeps feeling, rather violently, that if only they'd all stop yelling we might be able to figure out what they're trying to say. The music is utterly conventional, without style, grotesquely unsuited to any sort of effort by the terse and stageworthy Tennessee Williams, who ought to have kept himself out of this dismal affair.

Sorry, but if RCA is going to send out records of this worth, it's up to us to review them as we hear 'em! (The story is something about a couple of old N'Yorleans gals who have a love letter from Lord Byron that the tourists come in to see. Faded Suthunn aristocracy and all that.)

The New York Taxi Driver. Recorded by Tony Schwartz. Narr. by Dwight Weist.

Columbia ML 5309

Tony Schwartz is a full-time New Yorker with a positive genius for candid recording. He never goes anywhere without a small portable tape recorder (currently a Swiss model) and he never, if I am right, plays tricks on his subject; they always know they are being recorded.

It's all the more amazing, then, that Tony gets such utterly easy, natural, fluent comment from the people of New York—including taxi drivers. The Schwartz recordings are heard week in and week out on radio and have been collected in numerous records for Folkways; it looks as though Schwartz was about to graduate into big-company work. But there are a few problems.

Come to think of it, maybe it's just as well that the occasional narrator here, a standard-voiced big-company announcer, has such idiotic stuff to read and does it in such a de-humanized, commercial-sounding manner. It makes the taxi men sound all the better. Don't think *they* aren't human! Fortunately, the narrator only breaks in once in a blue moon, and mainly for vocal contrast and a moment of peace and quiet after the noises of New York's streets.

As for the boys, they aren't always too easy to understand, what with Bronx accents, auto horns, meters, transmissions, and what-not. But under the circumstances they do brilliantly and you'll get the gist of their amazing talk even the first time over. Of course, taxi drivers are famous for their conversation—even more famous than barbers. Of course, they have to yell to be heard. But to get the "feel" of a way of life, so graphically presented, onto a set of tape recordings, is something to marvel at. Nobody but Tony would even think of it, let alone collect countless hours and hours of taxi stuff as a base for these excerpts.

The montage at the beginning, I suggest, is the poorest part of the whole and the least understandable what with a constant interchange of voices, each man overlapping the next after a few sentences (via trick editing). Don't be discouraged. The next sections take you through single subjects—it's amazing what quantities of material Schwartz got on a given subject like women, hold-ups, home life (particularly poignant), art, psychiatry, policemen, New York geography. And then there are several quite long stories where the drivers' personalities come through almost luminously.

A unique record—for New Yorkers, who'll feel utterly at home, and for out-of-towners, who will probably be utterly bewildered.

The Herd Rides Again . . . in Stereo. Woody Herman.

Everest SDBR 1003 stereo

This is a composite recreation of the sound of the famous "Herds" of the mid-forties

(*Continued on page 67*)

CHARLES A. ROBERTSON*

STEREOPHONIC

Ahmed Abdul-Malik: Jazz Sahara
Riverside RLP1121
Mohammed El-Bakkar: The Magic Carpet
Audio Fidelity AFSD5895

Jazz embraced Oriental effects about the time a Chinese restaurant first hired a dance band, employing them with more or less authenticity and subtlety ever since. Largely dependent upon transitory fashions in temple blocks, tom-toms, and gongs, the imprints left are sometimes dim. But when combined with compositions the caliber of Ellington's *Caravan*, they blaze a continuous trail to the more serious approach now being made by musicians on both coasts. It may lead across the Pacific, on a course followed by Chico Hamilton, or to the Middle East, the direction favored by Dizzy Gillespie and others living close to the Atlantic seaboard. Much of their progress is limited to the grafting of new tonal colors and rhythmic devices to Western forms, with Yusef Lateef being the most venturesome to date.

Ahmed Abdul-Malik is convinced a closer union would be realized by working from the more flexible patterns and greater melodic improvisation possible in this chord-free music. In four compositions created for his album, he makes the first tentative steps toward what he believes can be a vast new area of advancement for jazz. Born in Brooklyn of Sudanese descent, he is peculiarly fitted to contrive such a blend, having played at Greek, Syrian and Gypsy weddings as a youth. Most recently bassist with Thelonious Monk, he gained wide jazz experience under Art Blakey, Coleman Hawkins, and Randy Weston. Before forming his own Eastern group, he increased his knowledge of the subject by working for Djmal Aslan and Mohammed El-Bakkar. His ambition is to obtain a fellowship or grant and visit North Africa for further studies.

In addition to providing a bass line in support of Johnny Griffin, whose improvising on tenor sax supplies much of the jazz interest, he is able to solo on the *oud*. He also uses this lute-like instrument in ensemble passages with Naim Karacand, violin, and Jack Ghanaim, who plays the 72-stringed *kanoon*. Al Harewood adds a jazz drum setup to tambourine and *darabeka*, a metal vase with skin stretched across the top. Griffin sticks close to the blues, but seems more at ease than in many of his previous efforts. Enjoying considerable freedom, he manages the veteran's trick of appearing to play himself into a corner and out again.

In making comparisons, it might be presumed that the jollity and popular mood of Mohammed El-Bakkar's latest LP, the fourth in a series, would serve to prepare unaccustomed ears for Ahmed's considered endeavors. The exact opposite is apparently the case, however, as Ahmed's primary purpose is to provide an introduction to the enormous potential of the music. He concentrates on those aspects best suited to jazz, using them with skill and restraint so they may be readily understood. After becoming acquainted with his theories, it is easier to delve beneath such surface manifestations as El-Bakkar's impassioned vocals and the borrowing of cha cha rhythm for one number. Both albums afford an unusual listening experience, especially in stereo, and are excellently recorded.

Dukes Of Dixieland: Up The Mississippi
Audio Fidelity AFSD5892

If they ever heard it disputed that jazz came up the Mississippi, at least the Dukes of Dixieland harbor no doubts about their own origins. And they have yet to desert their New Orleans heritage for an album of show tunes or popular trivia. Their only gimmick is good sound and it is paying off at a healthy rate. Since the release of their last LP, they enjoyed the opportunity of proving to New Yorkers that what comes from the loudspeakers is really true. The clubowner who met their weekly $3,000 fee, a sum previously unheard of for Dixieland in Manhattan, did a record business and booked a return engagement, which was also very successful. Needless to say, none of their salary will be in bricks from Haverstraw, N. Y., another reputed birthplace, although they might give up a few nights of work to be able to hear the old 101st Ranch band which came North shortly after World War I. The circus traveled by rail and could have pitched its tents next to that legendary brickyard.

The Assuntos make the trip in leisurely stages, via such landmarks as *Riverside Blues*, *Old Man River*, and *Down By The Riverside*. A rigid test of your equipment occurs during the trombone and tuba duet on *Dear Old Southland*. When other companies provide a more difficult hurdle in runout grooves, you may question the wisdom of purchasing a cartridge able to negotiate these passages at 2 grams. Some still persist in cutting an obstacle which sends a light pickup back for an encore on the last chorus. What will convince them that tracking under 2 grams is no longer a novelty? Perhaps the Dukes playing a dozen tunes in stereo on their ninth album will help you forget about bricks and runout grooves.

Dicky Wells: Bones For The King
Felsted SJA2006

A blues written by Dicky Wells as a tribute to the late Tommy Dorsey explains the album title, and it introduces in turn fellow trombonists who are masters of the idiom. George Matthews, Benny Morton, Vic Dickenson, and Wells form a novel quartet, made unique by the addition of Skip Hall, organ, Major Holley, bass, and drummer Jo Jones. It allows for brisk exchanges that are quite arresting in stereo, and no other medium could convey as well the humorous repartee during *Sweet Daddy Spo-de-o*. The difficulty arises from placing the organ too much in one channel. This is a feat which even London is unable to perform successfully at present. So you can try your luck at removing it from its confines and juggling it into reasonable balance with the other channel, or play safe with the monophonic version.

There is no such conflict on the second side, where a more conventional lineup swings into action and speaks the language taught by Basie. Guitarist Everett Barksdale is added, and Hall returns to piano behind Buck Clayton, Rudy Rutherford, and Buddy Tate. Not to forget the leader's stop time chorus on his own *Come And Get It*.

Budd Johnson: Blues A La Mode
Felsted SJA2007

The last but not the least of the dividends from Stanley Dance's visit to this country places Budd Johnson's name on an LP as leader for the first time. If the journey served no other purpose, the effort would be worth while. In some ways it is the most attractive and unpretentious of the lot. Dance evidently asked the leaders to bring originals and play as they liked. Six of his own themes, half of them blues, comprise Johnson's reply, wrapped in his extremely mellow tenor-sax work.

His quintet companion is Charlie Shavers, who celebrates a release from trumpet display pieces by the most relaxed playing he has done in some time. Trombonist Vic Dickenson and Al Sears, baritone sax, add their voices in the septet. Bert Keyes' organ is well handled in stereo, as is pianist Ray Bryant's plunging left hand and Joe Benjamin's bass. Nothing momentous happens, unless you so rate a drum solo from Jo Jones, but that apparently was not the intention.

Hank Jones: Porgy And Bess
Capitol ST1175
Miles Davis: Porgy And Bess
Columbia CS8085
Mundell Lowe: Porgy And Bess
Camden CAS490

Some day in the future Gershwin's folk opera score will enter public domain, but it is hard to believe a larger flood of LP's will follow the event than that attendant on the film version. The music is treated to varying degrees of modernity in the three up for notice, with Hank Jones being generally most interesting and cohesive. Al Cohn sketches unusual settings for the quartet, allowing brilliant interplay between the pianist and a supporting cast of Kenny Burrell, guitar, Milt Hinton, bass, and drummer Elvin Jones in a number of percussive roles. Two extracts not always cited are *I Can't Sit Down*, and *I Ain't Got No Shame*. The stereo sound is superb and will fit any living room.

Miles Davis, again collaborating with arranger Gil Evans, makes each interpretation a little gem. They are required reading for students of the modern school. In the absence of competing soloists, the emphasis on his horns, both trumpet and flugelhorn, may be a little wearing to others. It leads to a sameness not alleviated by a balance favoring Davis over the other eighteen orchestra members. Try it in easy stages—it will be well worth your time, particularly for *Gone*, *Buzzard Song* and *Here Come de Honey Man*.

Mundell Lowe leads a septet, billed as All Stars, in low-priced stereo. But the only point where economy enters into the production is the limiting of a second session of three numbers to a trio. With players the stature of Ben Webster, Art Farmer, and Tony Scott in the studio, Lowe could be a bit more retiring. Titles not listed in the two other albums are *Redheaded Woman*, and *It Takes A Long Pull To Get There*.

Bob Prince: Charleston 1970
Warner Bros. WS1276
Red Nichols: At Marineland
Capitol ST1163

Diehards of Dixieland persuasion should be delighted with these two items. The first adds proof to their contention that good Dixieland requires a special talent and many young modernists lack it or never have bothered to develop it. Bob Prince's idea is to contrast passages arranged in modern style with choruses resurrected from the '20's. He pulls off many surprises along the way, and the tentette manages to convey what is written with considerable aplomb. But trumpeter Donald Byrd is quite lost in the ad-lib portions, where only Milt Hinton, bass, and

* *732 The Parkway, Mamaroneck, N. Y.*

Don Butterfield, tuba, seem to know what is going on. Of the four new titles, one turns out to be *Then I'll Be Happy*. The moral is not to attempt a spoof until certain it will turn out better than the original. It takes practice to be as corny as Pee Wee Hunt.

A live performance finds Red Nichols having a wonderful time in the Porpoise Room at Marineland, a Pacific resort more noted for television's "Sea Hunt" than jazz. The Five Pennies are unaugmented in this outing and revive *Entry of the Gladiators*, *Carol.na in the Morning*, and *Lonesome Lovesick*. The cornetist is up to his old trick of following a mediocre chorus by one as good as they come. If he only could be as consistent as his clarinetist, Bill Wood, or trombonist Pete Beilmann, the Nichols' story might be different. His splendid tone is benefited by the recording, and Joe Rushton, playing bass saxophone, sounds as big as life in stereo.

Jack Teagarden: Shades Of Night
Capitol ST1143

A woodwind choir is selected to surround the big, rounded tone of Jack Teagarden's trombone in stereo, as he creates a dreamy mood. The tempos are geared to solo meandering, with ample time for considered thoughts on *Cabin in the Sky*, *Autumn Leaves*, and *Alone Together*. Sid Feller sketches the backgrounds in lightly and they can be conveniently disregarded or not, depending upon your tolerance for minor intrusions. Someday Jess Stacy and Teagarden may be reunited on a similar date, but a visit is paid to such old friends as *Diane*, *Junk Man*, and *Street of Tears*.

Yma Sumac: Fuego del Ande
Capitol ST1169

Jo Basile: Argentine Tangos
Audio Fidelity AFLP1869

The pride of the Incas, Yma Sumac, brings her four-octave range to stereo in a dozen authentic folk songs of South America. Only one, *Virgins of the Sun*, is sung without lyrics in her exotic vocalese, a greater emphasis being placed on the stories told in *Enchanted Lake*, *One-Eyed Rooster*, and *My Pigeon*. As might be expected, the medium makes her vocal projection appear more stunning than ever, although it is used less for effect than on other occasions. The arrangements are by Moises Vivanco, who leads the orchestra and manages to keep four electric guitars and assorted percussion under control. Among the several rhythms is the *huayno*, dating from 1000 B. C. and sounding remarkably like boogie woogie, as well as a tango.

Jo Basile offers an alternate reading of this last tempo, one adapted to the Parisian tango parlors where its 20th-century revival began. Centered among strings, his accordion puts more bite than usual into such danceable items as *A Media Luz*, *Jalousie*, and *El Choclo*.

The Caballeros: Viva!
Hifirecord R816

Since the success of "T Town," their first album from across the border, The Caballeros have moved on to the Desert Inn in Las Vegas. Their forte continues to be Mexican folk music and ballads, excellently played in arrangements by Ruben Guevera, guitarist and leader of the quartet. On one side are guitar and the full, rich sound of marimbas, balanced on the other by piano and accordion. Percussions are heard in the middle and close-miking adjusts the stereo spread to the size of a comfortable living room. The same effect, without as much depth, is to be found on the fine monophonic version.

Al Melgard: Chicago Stadium Organ, Vol. 2
Audio Fidelity AFSD5887

Don Baker: Sophisticated Pipes
Capitol ST1171

Resuming his concert at the Chicago Stadium organ, Al Melgard discloses a second quota of splendorous effects and a sweeping insight into its tremendous power. None of the reverberation time is clipped off the ending of any of a dozen numbers, and its depth, especially in stereo, is illustrative of the pains taken by the engineers. The program is light but varied, indulging in such caprices as *Londonderry Air*, *Mexican Dance*, *Sugar Blues*, and *Baruska Polka*. (See Canby's comments, page 54.)

Don Baker's instrument, the Robert Morton organ housed in the Lorin Whitney studios at Glendale, California, is hardly as mammoth, boasting 2,000 pipes as compared to a total of 40,000. It proves to be capacious enough, however, for Richard Rodgers' *Slaughter on Tenth Avenue*, with its full-bass paraphrase of *Three Blind Mice*. The remainder of his repertoire is equally as challenging, and includes Alfred Newman's *Street Scene*, *Park Avenue Fantasy*, and *Manhattan Serenade*. Both albums offer contrasting values, and are brilliantly achieved in stereo.

MONOPHONIC

Negro Folk Songs And Tunes
Folkways FG3526

Josh White: Chain Gang Songs, Spirituals, and Blues **Elektra 158**

Elizabeth Cotton, a 59-year-old housekeeper for the Seeger family, harks back to the tunes and country rhythms of a childhood spent in the vicinity of Chapel Hill, North Carolina. Encouraged by her employers, she remembers the spirit and context of most, although the words of some still escape her. But not those to *Freight Train*, a song she calls her own, having passed it on to Peggy Seegar, whence it went to Nancy Whiskey and the hit parade. Much of the interest lies in her guitar and banjo picking, however, and Mike Seeger describes her methods in the notes. The recording balance also favors the instruments over her sweet but faint voice. Students of both can learn a great deal from *Wilson Rag*, and her Vastopol and Spanish Flang-dang tunings. For the blues enthusiast there are *Going Down the Road*, and *I Don't Love Nobody*.

Josh White, the man who first made such material palatable to many, claims his just

due on the liner of his collection, stating, "I've tried to make the songs clear; and I feel if I and some other hadn't done that and helped people understand what the stories say, we wouldn't have as much interest in folk music as we do now. Another thing I have tried to show is that folk songs are conversations. You don't have to shout. Sure they did in the open in the South; but now you can get into the intimacy of what this music says. It ought to be as if I were just talking to you."

The last remark is a fair estimate of both his style and the arrangements he provides for the voices of his four male accompanists. He reassembles many chain gang songs from memory, capturing the smoldering fury and tension of *Crying Who? Crying You, Trouble,* and *Going Home, Boys.* His daughter, Beverly, joins in on a lovely *Mary Had a Baby,* before entering into the cheerful abandon of *Every Time I Feel the Spirit.*

George Lewis Of New Orleans
Riverside RLP12-283
Chris Barber: Petite Fleur **LLP1001**

Rudi Blesh, in his book "Shining Trumpets," chronicles the revival of early New Orleans jazz and his visit to the city to record George Lewis in 1946. An essential study, it is recommended as a supplement to this reissue of items first released on his Circle label. It explains why the sound suffers from the use of portable equipment, although the remastering improves on the originals. Six marching numbers by the Original Zenith Brass Band are still unsurpassed as representations of the real thing, and there is no substitute today for the drumming of Baby Dodds. Both he and Lewis also are in the group which accompanies Sister Berenice Phillips, an authentic singer of older Jubilee hymns, and Harold Lewis on the second side.

A new edition of Blesh's volume would require a section on the traditionalist movement in England, where the response to Lewis continues to be great. It culminated a decade later in the Chris Barber band, whose clarinetist, Monty Sunshine, bases his limpid style directly on Lewis. The popular appeal of the title tune brought the band and this 1956 recording to this country in the Spring. Sunshine seems well on the way to adding Lewis' creative strength to his liquid tone. On *Wild Cat Blues,* his banjoist is Lonnie Donegan, another who collected the hit parade geldt not likely to be paid Lewis in his lifetime. The liner notes cleverly skirt any mention of his name, but the sound has the resonance of a large hall.

Red Garland: All Kinds Of Weather
Prestige 7148
Fats Waller: One Never Knows, Do One?
RCA Victor LPM1503

When jazz historians trace trends in piano styles, the section usually allotted to the Harlem stride school ends with the citation of Fats Waller as its crowning representative. His debt to James P. Johnson and others is pointed out, and then the chapter and an era are brought to a close. Rarely does his name reappear as having influenced younger pianists and, unhappily, none of them has successfully incorporated all his many attributes. Of late, his exuberance and ready wit have cropped up in performances of Red Garland, notably on *Billy Boy,* with Miles Davis and in his own albums. The most recent is full of yet another element. In the notes accompanying sixteen reissues from his father's legacy, it is expressed by Maurice Waller, who remembers sitting "listening to him play at home until four in the morning, sometimes. That's when he wasn't entertaining, just playing. From these evenings I know what he was trying to say."

That this side of his art was too seldom displayed in public or on records is often lamented by collectors of jazz piano. Garland gives a good idea of what a few of these moments might be like if Waller were alive today and improvising on such old favorites as *Rain, Summertime,* and *Stormy Weather.* While it is true that Paul Chambers, bass, and Art Taylor, drums, take much of the burden off the left hand, he is one of the few still capable of using it with dynamic effect. Always melodic, he also has a taste for the neglected ballad, including an apt and seasonal *Spring Will Be A Little Late This Year.*

Besides ripping into pop tunes with characteristic vigor, Waller shows what a left hand once meant in solos on *Georgia On My Mind,* and *Carolina Shout.* Al Casey, Gene Sedric, Herman Autrey, and Harry Dial are numbered among his companions and the sound is nicely refurbished.

Horace Silver: Finger Poppin'
Blue Note 4008

The title tune is Horace Silver's current display piece and it is just as well to have it preserved in this recording as the fast-moving intricacies can scarcely be absorbed in a club performance. The pianist's slower compositions are equally memorable, especially a smoky blues, *Come On Home,* and a moody ballad, *You Happened My Way,* which calls out for a set of lyrics. They are played by his present quintet, now touring France, with new members Blue Mitchell, trumpet, and Junior Cook, tenor sax.

A reminder that too long an interval has passed since Silver's last solo album is contained in *Sweet Stuff,* a trio number with bassist Gene Taylor and drummer Louis Hayes. Strongly lyrical, it exposes another aspect of his talent in the best moments of the set. His other originals are a medium blues, a samba, and a fast jump tune to end it all.

Sonny Rollins: Newk's Time
Blue Note 4001
Harry Edison: Sweetings
Roulette R52023

Just what is meant by the personality of a jazzman, as opposed to the jazz personality, can be deduced from a study of Sonny Rollins and Harry Edison. Although they go separate ways to achieve their ends, each makes his

point through persuasiveness of style and ideas rather than individual dominance. A leading figure on tenor sax, Rollins still lays the creative process bare in every performance, inviting the listener to participate in his musical progress. This can be a challange, as in Kenny Dorham's *Asiatic Race*, or lead to the pure delight of *Namely You*, and *Wonderful! Wonderful!* A high point is *Surrey With The Fringe On Top*, where his only partner is Philly Joe Jones. He returns the compliment by dedicating a blues to the drummer, on which he is abetted by pianist Wynton Kelly and bassist Doug Watkins in effective solos.

Harry "Sweets" Edison left Count Basie when the ranks dispersed in 1950, eventually finding lucrative employment in Los Angeles studios, where the muted tones of his trumpet backed countless vocalists. An urge to open up his horn and appear on his own, last fall, led him to leave these comfortable surroundings behind. With Jimmy Forrest, tenor sax, and a varied rhythm section, he again brings his intimate style to full flower on seven tuneful standards, and four originals. One evolves his nickname into the album title, and another, *Centerpiece*, performs a similar function for *Willow Weep For Me*.

Chico Hamilton: Ellington Suite
World Pacific WP1258

First let it be said that this is the original Chico Hamilton group, with Paul Horn added on flute and alto sax, engaged in a project which drew its attention back when the Quintet was formed in 1955. Ellington compositions figured in the drummer's programs from the beginning, and now eleven of the most melodic are given an orderly arrangement by bassist Carson Smith. They derive from what many consider to be his best period, a point midway in his career which saw the development of *Take The A Train, Perdido, In A Mellotone, Azure*, and *In A Sentimental Mood*. At least, it is the best period to explore in a time when even the composer's present organization is unable to recapture the intensity of his earlier works.

Buddy Collette, limiting himself to tenor and alto sax, shows his close affinity to Ellington and proves again that he would make a valuable adjunct to the band. Jim Hall's solo guitar passages hold much interest, while the sound is enriched by the full cello tone of Fred Katz. Smith connects each piece and the performance is uninterrupted. The best from the Quintet in ages, it will probably remain so, unless Hamilton holds another reunion and returns to Ellington, this time with Collette also playing clarinet.

André Previn Plays Songs By Vernon Duke **Contemporary C3558**
Freddie Gambrell: Piano **World Pacific WP1256**

Both albums are noteworthy for pianists who, rather than take liberties with tried and familiar tunes, find fresh conceptions to renew them. Some are wholly transformed in the process, a treatment heartily approved by Vernon Duke, who admits to one supervisory suggestion in his liner notes—an admonition that André Previn "go berserk" on *April in Paris*. The composer also applauds the inclusion of the verse, along with the neglected *Ages Ago*, and *Round About*. Whenever you hear one of the ten songs in the set after this, you are likely to find yourself returning to Previn for further elucidation. It should be stressed that the piano is solo, a distinction necessary when trio and quartet efforts are falling into the category. It is Previn's first such venture, and he does have a left hand.

Freddie Gambrell, borne up by the plaudits for his first appearance, is not quite as startling in his second. The blues are left behind for a program designed to please the managers of plush bistros where he might like to play. If that goal is reached, this LP will be a bargain compared to the tab, and there is much to enjoy in *Anything Goes, Without A Song*, and *Indian Love Call*. His three originals, along the same vein, offer a waltz, moonlight ramblings on *Opus 116*, and a cute *Who You?* The piano dynamics and Ben Tucker's bass viol are handsomely recorded.

Basie Reunion **Prestige 7147**
Count Basie & Joe Williams: Memories Ad-Lib **Roulette R52021**

After bringing Shad Collins back to the studios for one pleasing tribute to Basie, Prestige becomes more ambitious on an encore, adding a second trumpet in Buck Clayton. Jack Washington's baritone sax, imported from Oklahoma, joins the tenor sax of Paul Quinichette, and Eddie Jones replaces the late Walter Page on bass. Some of the sharp impact of the first session is lost in the process, but the octet is better equipped to handle *John's Idea*, and *Roseland Shuffle*. The trumpet duo carries away the honors, generating sparkling choruses on Buster Smith's *Blues I Like To Hear*, and Clayton's *Love Jumped Out*. Congratulations are in order on a fresh combination of present and former Basie personnel and it is hoped this series will continue to explore numerous other possibilities.

Basie opens one avenue by staging a reunion of his own—one informal enough to extract rare guitar interludes from Freddie Green. Alumnus Harry Edison is welcomed back to the East Coast, and his trumpet obbligatos soar gracefully behind the vocal line. The dozen songs are memorable hits of another day, polished to a rich lustre in Joe Williams' best ballad style, and include *All Of Me, Call Me Darling*, and *Sometimes I'm Happy*. Lonceford graduates George Duvivier, bass, and Jimmie Crawford, drums, complete the party. But jazz fans will return to it time and again for those few choruses from Green, who enhances both discs.

Ed McCurdy: When Dalliance Was In Flower, Vol. 3 **Elektra 160**
A Night At The Ash Grove **World Pacific WP1254**

The fifteen assaults upon a maiden's virtue encased here reveal that Ed McCurdy merely scratched the surface of his subject in the two preceding volumes. He delves a little deeper this time into the mores of a bygone age, as a perusal of the enclosed text will show, and comes up with some of his most effective work in the series. He accompanies his lusty baritone voice on guitar, with Erik Darling adding the support of either guitar or banjo. The more serious student might note that a symbolic reference to nails in *Old Brass To Mend*, a Tinker's tale, turns up a few centuries later in Cripple Clarence Lofton's *You've Done Tore Your Play House Down*.

As an antidote to this revelry there is Barbara Dane's doleful imprecation *Away! Away! With Rum, By Gum!* Complete with Salvation Army bass drum, it introduces a typical evening of coffee house music in Los Angeles. Other folk singers on the program at the Ash Grove are Rolf Cahn, Lynn Gold, and the team of Bud Dashiell and Travis Edmonson. Heard as accompanists are Carl Granich, Sol Gold, and Carl Sandbag. They engage in a lively summary of all the unexpected things likely to happen in the vicinity of an espresso machine.

Italy: Its Sounds And People
Capitol T10186

The tolling in Vatican City of the great bell of St. Peter's Basilica begins the first tour in sounds of Italy to be recorded. It extends from the Swiss border, where a Lombardy choir sings an Alpine folk song, to Naples in the South for a view of the harbor. There is a choice of a Vespa or Fiat to escape the Rome traffic and travel out the Via Appia Antica, past roistering flocks of swallows, to hear the nightingales. The Milan subway leads to Corpus Domini ceremonies at the Cathedral in which Columbus once worshiped. Abbruzzo shepherds dance to a lively mazurka and Sicilians engage in a tarantella. Also the usual airport, railroad terminal and more bells, from St. John Lateran, St. Paul Outside The Walls and St. Mary Major. Produced by Dave Dexter in collaboration with Roger Degoy of La Voce del Padrone, it is narrated by Annabella Carta. Æ

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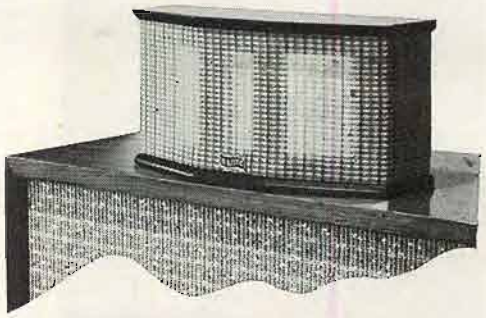

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ABOUT MUSIC

Audio in the Theatre

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The customer in this true conversation might seem a bit uninformed in our audio-enlightened age, but don't judge him too severely. He may have little more than a hazy idea as to what constitutes an authentic stereo recording, but he seems roughly aware of basic differences between monophonic and stereophonic sound. And, as any record salesman will tell you, the average record buyer thinks of the stereo disc as having made obsolete the "hi-fi" record.

Dedicated audio enthusiasts wince at these now familiar manifestations of the prevailing ignorance over the meaning of stereo and sound reproduction generally. Lack of knowledge on the part of the general public can be excused. There is no excuse, however, for the failure of those people engaged in the business of entertainment to take full advantage of the enormous strides which the manufacturers of audio equipment and the sound engineers have made over the years toward better and truer sound reproducing techniques.

Have you ever noticed the reaction of a movie audience to a film that is poorly focused? Before the operator has had a chance to grab the focusing knob, foot-stamping, whistles, catcalls, and raucous shouts fill the theatre. But offer this same audience galloping audio distortion and it will sit back, thoroughly relaxed, contentedly munching chocolate-covered peanuts.

Where it concerns audio in public places, the general public is strangely oblivious to the most flagrant abuses.

Speech Reinforcement

Some six years ago, the diminutive French popular singer, Edith Piaf, made her Carnegie Hall debut. Those who were not familiar with her career in the Parisian "music-halls" thought that she had made a serious mistake in hiring such a large hall for her one-man show. How could she hold an audience's attention for an entire evening; and wouldn't her warm and vibrant personality be dissipated in Carnegie Hall's vast oceans of space? The critics proved wrong on both counts. *La Même Piaf* appeared on stage wearing her simple black dress. With her hair combed in no special manner, she looked the antithesis of the "glamour girl." But she needed no accessories to conquer her public; even before she began her first number, she had each person in the hall sitting on the edge of his seat, thoroughly captivated by Piaf's wonderfully expressive features.

For this listener, however, the spell was broken once the concert began. Piaf, it seems, thought it necessary to employ a microphone throughout the program, though there was no need for electronic amplification. The orchestra was placed discreetly behind a curtain toward the rear of the stage; but even if it were right out there alongside her, Piaf would never have been in real trouble. In any contest betweeen the *chanteuse* and a band, the former's impressive lung power would easily have enabled her to soar above the competition. Apart from the fact that the microphone could have been dispensed with, Piaf, unlike such skilled microphone manipulators as Jean Sablon, misused the instrument. In fact, she did everything but bite it; her "p's" exploded like minor charges of TNT, her "s's" resembled an overworked boiler, and her high notes shattered like the cymbal clashes of the Coldstream Guards. The result was a sonic nightmare created by the artist's unprofessional use of the microphone and the poor quality of the playback system in the hall. This unfortunate pattern of audio distress is a familiar part of the night club and theatrical world.

One of the more disturbing aspects of the contemporary legitimate theatre is the use of tape and disc recording for background and incidental music. Off-Broadway producers frequently utilize classical records, seldom with any marked success. For example, Respighi's highly evocative "Pines Near A Catacomb" from *Pines of Rome* preceded Act II of *The Playboy of the Western World* at the Cherry Lane Theatre's revival of Sean O'Casey's play a few years ago. The choice of Respighi's score could not have been more inappropriate to the Irish subject. To make matters worse, the playback equipment was of shockingly poor quality; the record itself sounded as if it had been borrowed from a circulating disc library; and the system was being played at an abnormally high level for a theatre whose seating capacity is approximately 300.

On-Broadway productions have their audio problems, too, despite higher budgets. When Paul Bowles composed evocative incidental music for Tennessee Williams' *Sweet Bird Of Youth*, the entire score was recorded in advance of the play's opening to be played back in recorded form during the run of the production. Bowles' intention was to convey the special haunting "music" of a lazy Gulf town. He would have succeeded brilliantly were it not for

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

the fact that an inferior playback system and an unreasonable choice of playback level combined to transform the subtle effects he aimed for into loud and vulgar sounds.

Last month, the Bolshoi Theatre Ballet Company concluded its triumphant New York visit. One of the highlights of its run was Prokofiev's *Romeo and Juliet*. The crush for tickets was overwhelming, and several hundred thousand requests for seats were actually turned down. One of New York's art movie houses jumped on the Bolshoi bandwagon by presenting a filmed version of Prokofief's ballet with the same company. The sound track was totally unworthy of the film's visual attributes, which were truly impressive.

"Art" Film Sound

It is a sad commentary on the "art" film to note that the sound engineering lavished on a "Western" is usually superior to nearly all "cultural" cinematic efforts, a notable exception being Walt Disney's *Fantasia*. Perhaps the public that attends art movies and the legitimate theatre (as well as opera, ballet, and symphony concerts) is, on the whole, indifferent to good sound reproduction. How else can one account for its permissive attitude towards inferior recording and playback techniques? The answer may be found in the history of recording. In the 80-odd years since Edison devised his tin-foil phonograph, listeners have been content to accept unreasonable facsimiles of "live" performances. To make up for sonic deficiencies, the mind "equalized" the recorded performance. This form of equalization is undoubtedly still being brought to bear, unconsciously of course, in the above-mentioned cases, as well as in countless other similar situations. The fact that the public makes this mental adjustment to mediocre sound indicates that it does not expect good sound—that is, the standard of quality of which today's burgeoning audio world is fully capable of producing. If it expected it, it would certainly demand it. AE

RECORDS

(*from page 59*)

that had America dancing all over the place to the big-band swing sound. But there's more than a recreation here, for the style is still second nature to these players. It's not too late to recreate.

I didn't dance then and would have thought I had never absorbed this kind of music at all. I was really a bit startled, then, to find how familiar it sounded—and how much a thing of the past. It's a plain fact that jazz and pops together have already left this swing phase far behind (even though it can easily be brought back on special occasions) and the stuff we hear today is seldom anything like it. Interestingly dated.

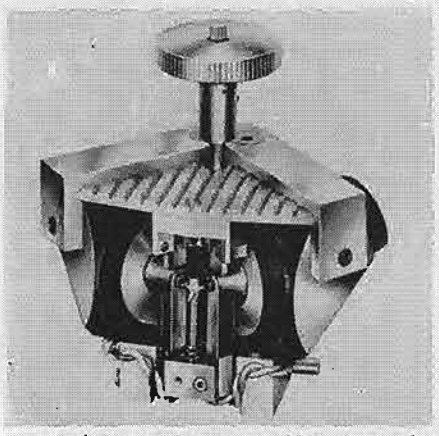
Stereo is good for big-band sound; it's tops for historical realism, bringing out here the very sound of a huge dance hall in vivid terms. The band is right in that hall, spread out from side to side but off from the mikes and, ever so clearly, up on that fancy stage in front of the big floor. Yep, the locale is beautifully suggested—and isn't the locale as important as the swing stuff itself? One couldn't exist without the other. Good job, Everest. AE

NEW PRODUCTS

• **Stable Audio Oscillator.** Stability exceeds 1.0 per cent and frequency response is within ±1.0 db over a range of 30 to 15,000 cps in the new Model 200 audio oscillator recently introduced by Barker & Williamson, Inc., Bristol, Pa. Harmonic

content is very low. The 200 generates a maximum 10-volt output into a 500-ohm load. At 5-volt output distortion is less than 0.2 per cent. Controls are incorporated for adjusting frequency and output. No zero reset or line calibration is required, and dial calibration is accurate to ±3.0 per cent of scale reading. **F-1**

• **Presto Stereo Cutting Head.** This new disc cutting head, Model S1, has absolute stability from 30 to 20,000 cps, giving a totally useful band width without peaks or dips. A new Presto-designed feedback coupling technique permits recording at previously unobtainable levels, with distortion virtually unmeasurable. A unique

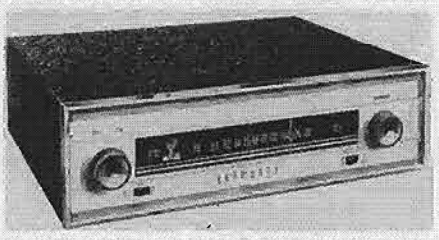


suspension system provides superior cross-talk characteristics. Presto's "Studio Oriented" design permits quick change of stylus, with no jig or fixture required for alignment, and with no need for removing the head from the feed mechanism. The S1 fits all Presto disc recording lathes and all other professional lathes as well, with mounting kits available where necessary. Manufactured by Bogen-Presto Company, Paramus, N. J. **F-2**

• **Pilot Stereo Control-Amplifier.** The new Pilot Model 240 is a modestly priced dual-channel stereo preamplifier-amplifier. Each channel of the unit has five inputs, including two pairs of phono inputs for connec-

tion of both a record changer and a turntable, with provision for the use of either by means of the selector switch. The remaining three pairs of inputs accommodate FM-AM, multiplex, and tape recorder. The exclusive Pilot TroLok tone controls permit treble and bass adjustment for each channel separately, or simultaneous bass and simultaneous treble adjustment for both channels. An automatic shut-off permits the record changer mechanism to also turn off the amplifier after playing the final record in a stack. The 240 has a total power output of 30 watts, 15 watts per channel. Frequency response is 20 to 20,000 cps ± 1.0 db. Harmonic distortion is less than 1.0 per cent. Sensitivity is 3.0 mv for phono and tape-head inputs, 110 mv for tuner and tape recorder. RIAA equalization is automatic, while LP, NAB, AES, and tape head equalization is provided at calibrated points on the tone controls. The nine front-panel controls for the 240 include: Input Selector, Mode (including Stereo Reverse), Volume/Power On-Off, Loudness, Stereo Balance, Bass, Treble, Automatic Shut-Off, and Speaker Selector. Manufactured by Pilot Radio Corporation, 37-04 36th St., Long Island City 1, N. Y. **F-3**

• **Sherwood FM Tuner.** The new Model S-3000 II FM tuner features "Inter-Channel Hush," a new circuitry which adds to the convenience of FM tuning by muting the noisy "hash" normally heard between stations on highly sensitive tuners. The instrument is also provided with a front panel control to adjust the degree of silencing without affecting the tuner's sensitivity. The Sherwood FM tuner circuit

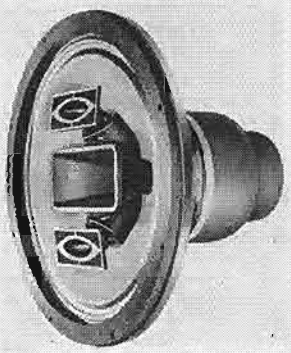


is extremely sensitive, stated by the manufacturer to be 0.95 microvolt for 20 db quieting. Automatic frequency control with 18 db correction simplifies accurate tuning. Front panel AFC disabling switch is incorporated for use when receiving a weak station adjacent to a strong signal. Frequency response of the S-3000 II is 20 to 20,000 cps ± 0.5 db. Both intermodulation and harmonic distortion are well under 0.5 per cent at 100 per cent modulation. Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Ill. **F-4**

• **Stromberg-Carlson Stereo Preamp.** A complete stereo control center, this new preamplifier, Model ASE-434, features Stromberg-Carlson's "Stereo Tone Balance" signal. This enables the user, simply by flicking a switch, to introduce an audible signal into each stereo channel, so that the two channels can be balanced under

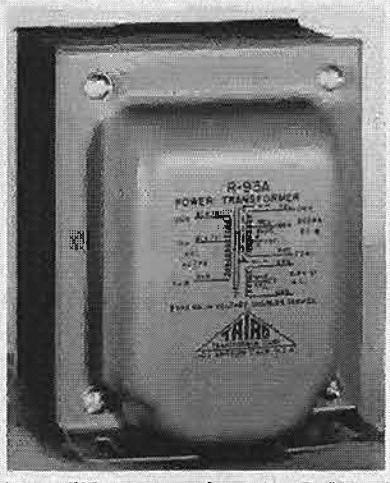
actual operating environment. Separate bass, treble, and volume controls are provided for each channel. Selection of RIAA or NARTB equalization is provided by switch settings, and scratch and rumble filters may be switched in or out. A phantom output (mixed A and B) is also provided. Manufactured by the Stromberg-Carlson Division of General Dynamics Corporation, Rochester 3, N. Y. **F-5**

• **Goodmans Speaker Systems.** Two new speaker systems recently introduced into the American market are the "Tetraxiom" and the "Triaxiom," unitized 4- and 3-way systems, respectively. The Tetraxiom, illustrated, is entirely unique in both design and construction, while the Triaxiom is more conventional. Both systems utilize the new "Rigidflex" cone, with a flexible, free-floating edge and rigid center to provide pure piston action. The two Tetraxiom models announced are rated at 40 and 50 watts, respectively, and are stated by the manufacturer to have smooth response from 20 to 20,000 cps, with usable output to 35,000 cps. They are composed of four independent, concentrically placed radiators, each designed for maximum performance within its portion of the audio spectrum. Two Trebax



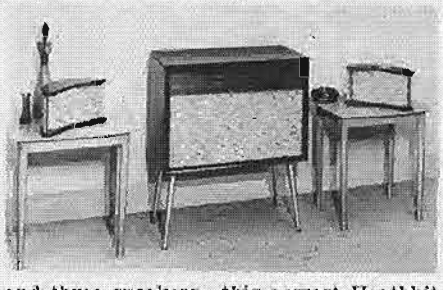
tweeters are angled to the polar axis for wide dispersion of the highs. All Tetraxiom and Triaxiom models are built on rigid die-cast chassis to maintain optimum alignment of the high-precision radiators. Goodmans speakers are distributed in the United States by Rockbar Corporation, 650 Halstead Ave., Mamaroneck, N. Y. **F-6**

• **Triad Power Transformer.** Development of voltage-doubler circuits using silicon rectifier power supplies is facilitated with the new Triad Type R-93A power transformer. It provides taps on both primary and secondary windings to allow several variations of output voltage, and is electrostatically shielded. Rated at 110/120 volts 60-cycle primary, and 150/160/170



volts at 500 ma secondary, the R-93A also supplies filament power of 6.3 volts at 6.0 amps, center-tapped for hum reduction. In a voltage-doubler circuit, the maximum d.c. available for preamps and amplifiers is 250 ma at approximately 480 volts. A product of Triad Transformer Corporation, 4055 Redwood Ave., Venice, Calif. **F-7**

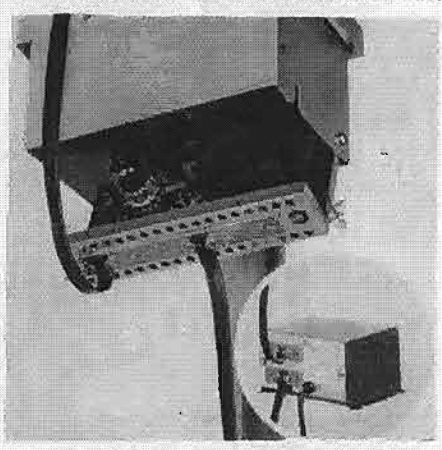
• **Heathkit Stereo System.** Complete in every detail—including cabinetry, stereo amplifier, record changer, stereo cartridge



and three speakers—this newest Heathkit stereo package can be ready to play after only a few hours assembly time. The

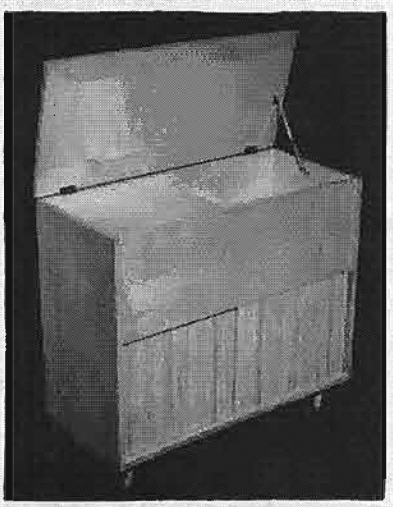
amplifier employed is the "sum and difference" amplifier developed by CBS Laboratories and first described publicly in the October, 1958, issue of AUDIO. It is licensed exclusively in kit form by Heathkit. The system utilizes a centrally located woofer, mounted in the equipment console, for reproduction of the non-directional low frequencies, and two external "wing" speakers for the higher frequencies which provide stereo effect. The amplifier employs only four tubes and is extremely easy to assemble. Controls consist of on-off switch, bass and treble, input selector switch, and level-balancing adjustment. Available in either birch or mahogany, the SD-1 stereo kit represents excellent value in both performance and styling. Full information will be mailed free upon request to The Heath Company, Benton Harbor, Mich. **F-8**

• **Blonder-Tongue FM Booster.** This is the first broad-band FM amplifier to utilize the low-noise, high-gain and long-life characteristics of the new Type 6ER5 frame-grid tube. Developed to improve reception of even the most sensitive FM tuners, the unit delivers 16 db uniform gain on all stations in the 88–108-mc range. The amplifier may be located up to 600 feet from the remote control unit



near the FM receiver. Built-in multiplex circuits permit simultaneous transmission of a.c. and r.f. over a single 300-ohm line. The booster is housed in a lightweight aluminum cabinet for weather protection, with a swing-down chassis for easy maintenance. The amplifier weighs less than five pounds and the remote unit weighs only two-and-one-half pounds. A descriptive bulletin, Form HAC-100-39, on all Blonder-Tongue consumer FM products is available on request. Write Blonder-Tongue Laboratories, Inc., 9 Alling St., Newark 2, N. J. **F-9**

• **Hi-Fi Cabinetry.** A new line of equipment cabinets and speaker enclosures, to be sold direct to consumers only, has been introduced by Homewood Industries, Inc.,



26 Court St., Brooklyn 1, N. Y. Available both in kit form and factory assembled, most units are built of selected birch and poplar, although some are made of walnut and oiled walnut as well. Featured in the line is a 36-in.-wide equipment cabinet,

Sound Talk

by John K. Hilliard
Director of Advanced Engineering

LOUDSPEAKER EFFICIENCY

Loudspeaker efficiency is an important design factor that is often overlooked or misunderstood by those who enjoy high fidelity. It is only logical to assume that any device should be engineered to be as efficient as possible whether it is an auto engine, an amplifier or a loudspeaker.

Speakers which have very low efficiency were not designed with that feature in mind. Rather this low efficiency is a by-product of one of the simpler and less expensive engineering methods used to achieve bass response and low distortion.

Such designs, in an effort to achieve greater bass and low distortion, utilize a heavy cone which has inherently low resonance. This heavier mass provides greater bass but carries with it the high price of poor transient response, loss of mid and high-range efficiency and smoothness, and heavier amplifier requirements.

Many speakers following this design approach require as much as 16 times the amplifier power to obtain the same listening levels as more efficient units. Ten watts versus 160 watts seems like an extreme design compromise. Few, if any, of the stereo amplifiers will provide sufficient power for full dynamic range at normal listening levels with such low efficiency speakers.

With a more carefully integrated design approach, and the acoustical laboratories necessary to truly evaluate results, it is not necessary to make this compromise to achieve bass. A properly designed magnetic structure will provide a strong flux throughout a long air gap. Cones, with their compliance and voice-coil designed for long linear excursion throughout the audio range, will operate in this high flux with great efficiency. Such a design has low distortion and good bass without any compromise in efficiency or transient response.

All ALTEC speakers are the result of such integrated design principles. Their bass reproduction is in proper balance with the rest of the audio spectrum. Their distortion and transient response have received careful attention. Their efficiency is as high as present engineering art permits.

It should be remembered that a good loudspeaker design need not sacrifice a part of the whole performance in order to provide a single outstanding feature.

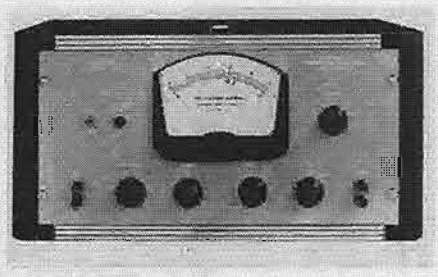
Listen critically at all levels of loudness. You will readily distinguish the superiority of ALTEC loudspeakers.

Write for free catalogue: **ALTEC LANSING CORPORATION**, Dept. 6-A, 1515 S. Manchester Avenue, Anaheim, Calif., 161 Sixth Avenue, New York 13, N. Y. 12-59

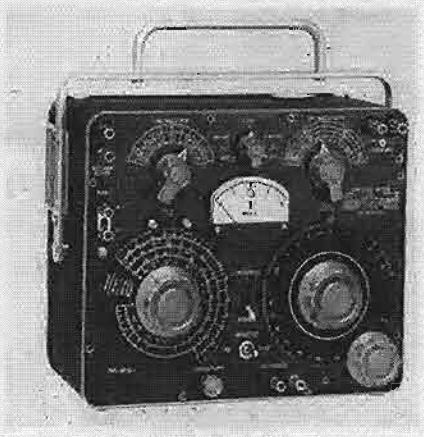
Circle 70A

factory assembled, suitable for housing all standard components. An assortment of matching speaker enclosure kits feature assembly short-cuts to assure trouble-free construction. All bracing cleats are pre-attached at the factory. A free illustrated catalog will be mailed upon written request. **P-10**

• **Flutter Meter.** This sensitive measuring device was engineered to comply with the standards set by the Society of Motion Picture and Television Engineers for flutter and wow. It is designed to fill the need for a rapid and accurate method of obtaining visual indication of wow and flutter content of all types of tape recorders and playback equipment including 33-1/3-, 45-, and 78-rpm discs and 16- and 35-mm sound film mechanisms. A built in preamplifier and input attenuator will accept potentials ranging from 1.0 millivolt to 100 volts. Flutter and wow are measured through high- and low-pass filters, respectively. A built-in 3000-cps oscillator permits the instrument to be used without the need for calibration and the use of external oscillators. A three-range filter is included to study and isolate flutter and wow components. Three scales—0.3, 1.0, and 3.0 per cent are calibrated for flutter and wow. Significant readings can be made down to 0.01 per cent with reliability. Controls on the panel consist of an input voltage selector, a vernier calibration adjustment, a capacitance balancing control to compensate for differences in linear speeds of tape mechanisms, turntables and film equipment, a filter selector and a scale selector switch. Complete technical specifications may be obtained by writing to Amplifier Corp. of America, Instrument Division, 398 Brodway, New York 13, N. Y. **P-11**



• **Universal Impedance Bridge.** The Type 1650-A impedance bridge is a highly accurate instrument for the measurement of the inductance and storage factor, Q, of inductors, the capacitance and dissipation factor, D, of capacitors, and the a.c. and d.c. resistance of all types of resistors. It replaces General Radio's popular Type 650-A impedance bridge, offering wider range and greater accuracy. The new model has completely new electrical and mechanical design. One important feature of the 1650-A is "Orthonull," an exclusive new mechanical-ganging device which facilitates measurement of low-Q inductors and high-D capacitors. Orthonull makes easy many low-Q measurements which are practically impossible with some impedance bridges. The instrument is completely self-contained and portable, with battery-powered, low-drain, completely transistorized oscillator and detector. Manufactured by General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass. **P-12**



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STANDARDS

(*from page 52*)

mum drift observed during a two-hour period. If the tuner is intended for different types of installations these tests should be repeated for the different thermal environmental conditions.

(*b*) The frequency varies with power supply voltage in a manner that depends upon the rate of variation of this voltage. The line voltage shall be varied from 105 to 125 volts and the results of frequency drift shall be observed one minute after the voltage change has occurred. The amount of frequency drift to a line voltage change from 105 to 125 volts shall be stated.

(*c*) If the receiver has automatic volume control, the variation of signal-input power affects the oscillator frequency indirectly by way of control circuit. The frequency drift with variation of signal-input voltage is to be observed after the receiver has been in operation a sufficient length of time to reach temperature stability. The maximum frequency deviation from the signal required to obtain 30 db usable sensitivity to an output of 100,000 microvolts of the signal generator shall be recorded.

The rated frequency drift is the maximum frequency drift value obtained at the standard mean carrier frequency in the tests of 7.05.09.

7.05.10 Squelch Control

If the tuner is provided with an adjustable squelch control the tests of Section 6.03.14 are to be repeated with the understanding that AM terminology is used.

7.05.11 Loop Antenna

If the tuner is equipped with a loop antenna the tests of Sections 7.05.02, 7.05.03, 7.05.04, 7.05.05, 7.05.07, 7.05.08, are to be repeated with the loop antenna placed in a known electric field. It is understood that in the foregoing sections the word "microvolts" is to be replaced by the words "microvolts per meter." For generation of a known electric field, reference is made to the IRE Standard On Method of Testing Amplitude Modulation Broadcast Receivers, 1948, and supplements.

8.00 Test Procedures, AM-FM Tuners

8.01 Normal Control Settings

If an AM-FM tuner is constructed to provide, not only for the reception of radio signals but is also used to reproduce recorded signals from records, tape, etc., it has been usual engineering practice to provide an excess of audio-frequency amplification in these tuners or receivers. If the test procedure of Sections 6.00 and 7.00 are followed, serious harmonic distortion will occur and the test results will be meaningless. For tuners and receivers of such a construction the normal control settings shall be as shown in Sections 6.01 and 7.01 except that the volume control be adjusted to an attenuation of 20 db and the other controls affecting audio-frequency response shall be adjusted for the condition of flattest response as indicated by panel markings.

If this tuner contains a power output stage, the rated load resistance shall be the

recommended load resistance (for example, 16 ohms).

8.02 Performance Tests

Since it is not within the scope of this Standard to test all the characteristics of the audio amplifier circuits, these tests will not be covered in this Standard. For tests on audio amplifier circuits, reference is made to the appropriate IHFM Standard.

All the tests described in Sections 6.00 and 7.00 are to be made on AM/FM tuners. Because of the added complexity of AM/FM tuners, some additional tests have to be made.

8.02.01 Cross-Talk

With the tuner connected for the reception of frequency-modulated signals, the tuner is connected to a signal generator equipped with the 300-ohm dummy antenna. The signal generator shall be frequency modulated with standard test modulation and be tuned to a mean carrier frequency. The signal generator output shall be adjusted 20 db higher than required for 30 db usable sensitivity. The signal generator modulation shall then be switched off.

Without touching the tuning controls of the tuner the tuner shall now be switched for the reception of amplitude-modulated signals and an AM signal generator modulated with standard test modulation shall be adjusted in frequency so that maximum audio output is obtained with the weakest possible input signal. The output voltage of the AM signal generator shall now be adjusted to 100,000 microvolts. The tuner is now switched back for reception of frequency modulated signals and the total audio output is recorded. Then the FM signal generator is modulated with standard test modulation and the audio output is recorded again. The ratio of the two output voltages is called the AM-to-FM cross-talk ratio and shall be expressed in decibels.

By a similar procedure the FM-to-AM cross-talk ratio may be measured except that the signal generator output shall be 20 db higher than required for 20 db usable AM sensitivity.

If the tuner is equipped with audio circuits for the reproduction of recorded signals, the FM-to-Phono cross-talk ratio or the AM-to-Phono cross-talk ratio or similar ratios may be measured by a similar procedure. AE

AUDIO ETC

(*from page 46*)

automatically with the main ON-OFF switch *for years at a time* without any attention.

(2) The battery itself—the main bulk—is small and compact, taking up much less space than the flashlight cells in the other system—and in terms of its hugely long operating life, it actually costs less.

(3) It gives the better warning light and, indeed, is one of the most effective pilot lights of any sort.

(4) An odd extra value, at least in our conversion, is that the neon lamp is visible over a much wider angle of view than the incandescent, and so offers more protection—its first duty.

(The neon light is a thin "finger" almost a quarter-inch long from front to rear of the bulb. The incandescent filament is much shorter and is placed well back in its bulb; from the side, it is hidden by the front panel surface of the preamp.)

Now I can well imagine that the professionals in this manufacturing area will be shaking their heads at all this. They'll point to costs, to the necessity of selling hi-fi at reasonable prices and to the mark-

up aspect that exaggerates the small first cost of such a feature into a big extra price rise at the consumer level. And, I expect, they'll bring out their final argument, that the consumer doesn't want this kind of extra gadgetry—or not at extra cost.

I can answer such questionings by suggesting, first, that the makers don't know how the consumer feels, or would feel (especially after a few dead batteries) with a bit of straightforward selling as to the clear value of a positive pilot light. If he thinks it's worth it, he'll pay the price all right, even up to four or five dollars extra in a piece of quality equipment such as the Regency preamplifier. The pilot light, remember, removes the biggest disadvantage of the battery-operated component, leaving its compactness and other virtues intact. This applies to any sort of battery equipment you can name—excepting only the subminiature transistor radios, where there isn't enough space, and low-priced units where marketing won't allow even for such a basic extra.

(Frankly, if a unit were so "cheap" as to preclude use of a pilot light, I wouldn't buy it anyhow, myself.)

As for Regency, it's possible that the HFT-1A might be offered with and without the pilot light, on a trial basis. Good salesmanship could shoot some really hot arguments to the consumer in favor of the pilot-light model, at a higher price. Isn't advertising always talking of its educational duty? Well—here's your chance to educate, boys!

"Anybody ever see an 'ordinary' preamplifier without a pilot light?" That's what competition will say, when somebody jumps the gun and comes out with my pilot-lighted battery model—which is hereby offered for free, by self and Prohaska, to all who maybe want to try. (We didn't bother to find whether we were the first and I dearly hope that somebody like RCA doesn't ask me for a licence fee.) Help yourself!

Æ

PARTS LIST FOR REGENCY PILOT LIGHTS

A. Neon flasher

New potentiometer	.93
DPST switch to fit	.44
NE 51 Neon lamp	.18
67½ volt battery (Burgess UX45; RCA VS-18	2.07
Capacitor 0.1 μf at 200 v.	.21
Resistor 47k, ½ w.	.10
Audiofan net cost:	$3.93

(Socket for bulb, if used, in addition.)

B. Incandescent continuous

New potentiometer (as above)	.93
DPST switch to fit (as above)	.44
GE 49 low-drain lamp	.18
Resistor 15 ohms, ½ w.	.10(?)
2 "C" flashlight cells	.30
2 "C" clips	.60
Audiofan net cost:	$2.55

(Bulb socket not included)

AUDIOCLINIC

(*from page 4*)

ous problems. Two separate one-quarter track erase heads are necessary. Each of these must be so precisely oriented and connected to switches in such a manner that *only one* track at a time will be erased.

This scheme requires a tape transport mechanism capable of holding four heads. Mechanical and electrical details for this project will be determined by the type of mechanism and by the type of heads employed. Æ

TRIMENSIONAL SPEAKER SYSTEM

(*from page 23*)

above are adjusted to obtain tonal balance.

Some examples of use in difficult locations are shown in *Fig.* 11. It will be noted that this speaker system need not be in the center of the wall. It can also be used in a corner.

When the Trimensional speaker is used for monophonic reproduction, identical signals are fed to the two speaker systems, and the doors are usually folded across the front of the cabinet to reduce the directional characteristics of the side speakers, helping create the impression of a single source. However, when listening to program material that is normally spread out rather than concentrated, such as symphony orchestras, choruses and the like, the doors are best left open, in the usual stereo position. The resulting spreading out of the sound is similar to the effect obtained with multi-speaker systems spaced along the wall, and contributes greatly to realism.

During the design of the Trimensional speaker, considerable concern was felt for correct phasing, because of the combination in one woofer of both bass channels. Terminals were carefully coded to insure correct phasing at all times. Experiments to evaluate the effects of incorrect phasing were conducted.

With monophonic reproduction, things went exactly as expected. With the woofer voice coils in reverse phase, most of the bass disappeared, being bucked out in the speaker electromagnetic structure. With stereo, however, reversing one voice coil had no audible effect! Measurements in a live listening room indicated a possible loss due to incorrect phasing of 1–2 db only, confirming the auditory results.

Further study yielded the explanation. When closely spaced for stereo pickup, both microphones receive signals in the bass range that are virtually identical in level and phase. If such signals are combined in reverse phase, they cancel out. However, the stereo reading techniques generally in current use utilize microphones spaced a considerable distance apart. The combination of wide spacing with the effects of reverberation in the hall or recording studio causes the variations in phase of the signals reaching the microphones to be essentially random. Under these conditions, combining the signals "out of phase" makes very little difference both theoretically and in practice. There are two exceptions to this condition: recordings in which a center channel is electrically mixed equally into the two recorded channels—and recordings made by the "M-S"[2] system. For this reason, it is a good idea to make sure that amplifiers and pickup are properly phased. As stated before, the speaker terminals are coded. The simplest test is to play a monophonic record using a stereo pickup. Reversing the phase of one channel will cause the bass to decrease or increase noticeably. Correct phasing is indicated by the greater amount of bass. *Æ*

[2] E.M.I. Stereosonic system.

TAPE PREAMP

(*from page 20*)

tube sockets as possible. T_2 is fixed to the shield, and this is then riveted into place. All ground returns are insulated, and terminate at the co-ax shells, apart from Gr, and all tube socket spigots are included in the ground loops. The slider of P_4 is joined to the output co-ax spigot, and the rest of the wiring is completed. *Figure* 9 shows the underneath of the finished amplifier, with *Fig.* 10 showing the parts placement.

After checking and re-checking the wiring and connections, and winkling out the odd bits of solder that have collected between the tube socket terminals, the tubes and various plugs may now be inserted, and testing carried out; but note that final preparations include the provision of a 10,000-ohm, 15-watt resistor for operating the "hold-in" solenoid on the deck. This is a neat little device for holding in the switches and linkages, and it provides a quick-release mechanism, by means of a pushbutton and microswitch, to stop the motors. Between 20 and 30 ma are required to energize the coil, and the 10,000-ohm resistor is connected from G to F on the terminal strip, E being joined to ground.

The power cable-form is attached to its supply, after attaching a shielded coaxial lead between the replay output socket and main amplifier input, and the the replay section of the TW/PA2 is tested first, by turning the gain controls on both replay and main power-amplifiers to maximum, and noting whether motorboating occurs. If it does, the cause is almost certainly the connection of R_{20}, R_{21} and so on to the junction of R_6 and R_7 instead of R_2 and R_3. (As nearly all my own wiremen do it the first time they make these amplifiers, there is no need for the amateur to blush!) Having made the necessary corrections, if required, the chassis base is screwed into position, and noise and so on noted. Including the main amplifier, which is

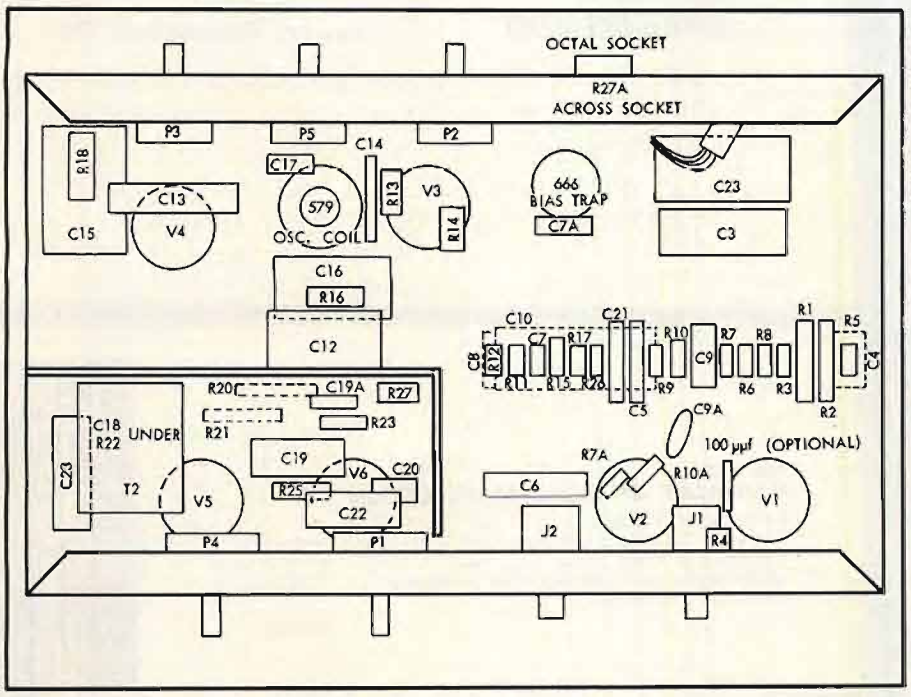

Fig. 10. Parts placement diagram.

assumed to be above suspicion, it should be at least 80 db down, or, from the home-constructors' viewpoint, there should be little or no background at all when playing at maximum power output from a fully modulated tape. The rest of the work on this section is easy, consisting of playing a known good tape and listening to what it sounds like. If it sounds good, all is in order. (It must be confessed, however, that the factory procedure is a little more elaborate.)

Now we come to the recording amplifier. The base is removed, and a VTVM and 'scope are connected between the junction of C_{10}, R_{12} and ground, with the deck switch in the replay position; and a low-level—below 2 mv—sine-wave signal at 1000 cps is fed into the LOW input socket. P_1 is advanced until the VTVM shows between 30 and 35 volts, while the waveform is checked on the scope. It must be of good shape, and if it is, the operator may rest assured that, at the maximum recording signal level of 23 volts, distortion will be negligible. (There is sometimes sharp clipping on either the top or bottom peaks, and if this occurs, suspect the VTVM. Removal of the probe will show whether the VTVM input circuit is responsible.) Increase the gain until the pattern squares at top and bottom, when the meter indication will, after reaching a maximum, drop. If an r.f. trace appears, particularly on the rising edge, it is due to the proximity of the lead from the slider of P_1 to the connection from R_7 to the socket pin. Moving this latter away will cure the trouble, as little as ¼ in. being all that is necessary. If there is still some residual r.f., a capacitor of 25 μμf between anode and grid of V_1 will clear it up quite readily.

Switch the deck to RECORD, turn P_3 to its minimum position, and adjust P_1 until the VTVM shows 23 volts. Adjust P_2 so that the modulation meter needle reaches 0.75 full scale. This is the maximum modulation point, and must not be exceeded, except only on the very heaviest peaks. Remove the input signal, connect the scope between the junction of C_{13} and P_3, advance P_3 until the valve oscillates, and then adjust the frequency of oscillation to 50 kc by means of the core of T_1 and comparison with a 50 kc display previously shown on the scope via the signal generator. This is simpler than the laboratory method, and is sufficiently accurate for most purposes. Advance P_3 until the trace deteriorates, and re-adjust to the maximum level permitting good shape. Transfer the VTVM probe to the junction of R_{11} and L_1, adjust L_1 core for *minimum* indication on the meter, and then take the probe to terminal 2 under the deck, where the indication should be 32-42 volts. Terminal 3 is the next point, and P_5 is adjusted to the recommended bias—usually between 11 and 13 volts—after which P_3 slider position and the oscillator waveform are again checked, while the voltage at terminal 3 is remeasured and, if necessary, reset. The modulation meter is looked at, and if the needle shows a displacement from the zero position with no signal, R_{15} is altered until a stable zero is found. If the displacement is positive, decrease R_{15}; if negative, increase it: but make the alteration a little at a time. Recheck for maximum modulation position, fix the bottom on the chassis, make a test tape or two, and the TW/PA2 is ready for incorporation in your set-up. (But don't forget, if you have a 2B three-head deck, to join the shielding on the replay head lead to the shielding on

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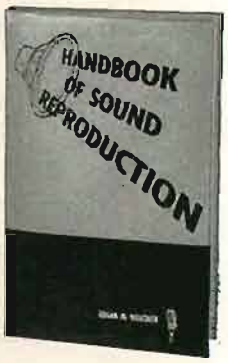

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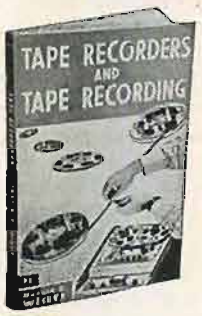

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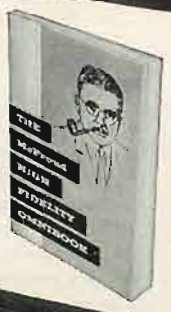

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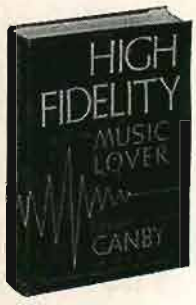

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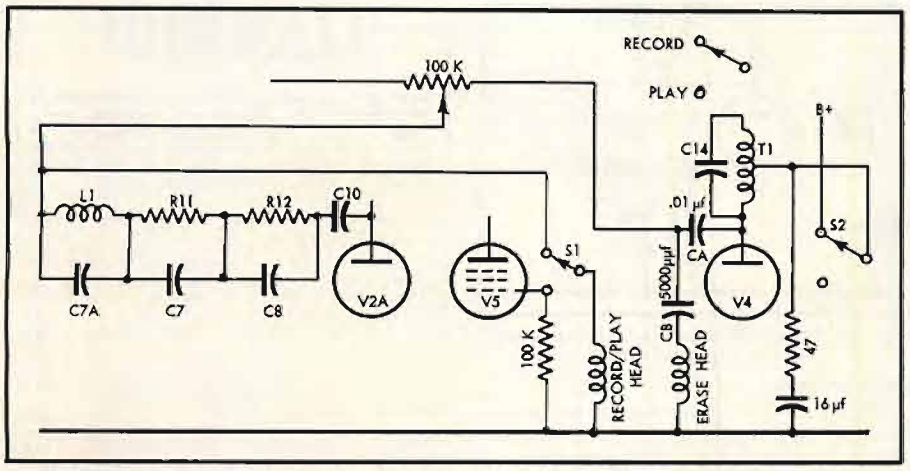

Fig. 11. Modifications for high-impedance heads.

the record head lead. This lead, incidentally, will not be used).

Generally speaking, there is nothing to prevent the constructor making alterations to the circuit, as it is quite tolerant in regard to resistors and capacitors and, to some degree, layout. It is unlikely that performance will be improved, but as interest will be stimulated, experimentation is not to be discouraged. There is, however, one direction in which alteration is bound to have an adverse effect. Be warned! *Do not* try substitutes for the specified tubes. They have been chosen only after a great deal of test and development, and the slight differences present in apparently similar types are sufficient to degrade the performance of the amplifier, which is quite a high-efficiency piece of apparatus. This warning applies particularly to V_1, V_5, and V_6, the EF86, for which, in my opinion, there is no alternative with the same consistency in respect of freedom from hum and microphony.

Appendix

To use the PA2 with decks fitted with high-impedance heads, and without integral switching, the following alterations from the original circuit must be made. In *Fig.* 11, tube numbers and components are as in *Fig.* 1, but the deck references and coding are ignored. S_1, S_2 is a two-pole two-way Mallory-type switch, and the connections are made as shown. The output from the anode of V_{2A} goes, via the equalizing network, to one contact on S_1, while the control grid of V_5, which is tied to ground by a 470k leak, is joined to the other contact. The moving member is connected to the record-replay head. Only one contact of S_2 is used, and this is joined to the point marked (4) in *Fig.* 1. Bias and erase, instead of being drawn from the secondary of T_1, are taken instead from the anode of V_4 through C_A and C_B, adjustment for optimum bias being by way of the potentiometer P, the slider of which is left in permanent connection to L_1, and so on. In the RECORD position, V_{2A} anode is connected, via the equalizing network, to the record-replay head, while V_4 is energized by connection of the oscillator section to the B+ line. In the REPLAY position, the record head output goes to the control grid of V_5. With three-head decks, S_1 is omitted, the connections to the appropriate heads being permanent.

For the TW/PA2, most of the parts will be obtainable from neighborhood jobbers, but certain of them can be had only from Ercona Corporation, 16 West 46th St., New York 36, N. Y. These are:

The deck, the Ferrograph type 2A or 2B

T_1, the oscillator coil, Wright & Weaire type 579

T_2, the tape-head input transformer, Wright & Weaire type 977

L_1, the bias-trap coil, Wright & Weaire type 666.

The meter is a Sifam type M202, 1 ma full-scale deflection, and this type and make should be used if possible, as its ballistics are perfect for monitoring.

The recommended potentiometers are Clarostat type 37.

Suggested for the output transformer is Stancor A3877, and for the power transformer, Stancor PC8403.

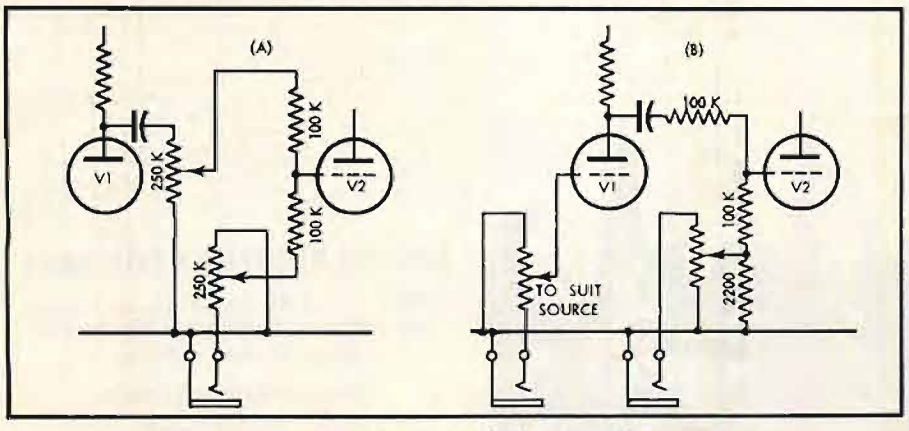

Fig. 12. Two types of mixer circuits.

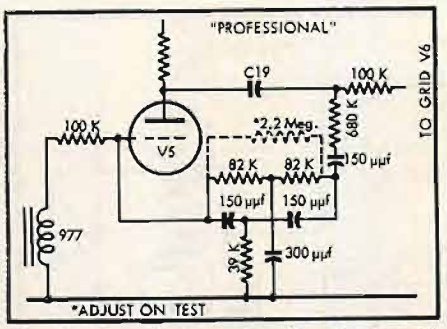

Fig. 13. Equalizer used in "professional" models.

Modifications

Suggestions are given below for one or two possible modifications to the circuit, to enable adaptation for custom purposes.

(A) and (B) of *Fig.* 12 permits of mixing two sources, while *Figs.* 13 and 14 give useful means of replay equalization, *Fig.* 13 in particular allowing very sharp peaking at any selected frequency, for use with restricted range recorded tapes. The formula and details will be found in the November, 1957, issue of AUDIO, but damping of the network by a resistor—2.2 megohms in drawing—selected according to requirements, may be necessary. Æ

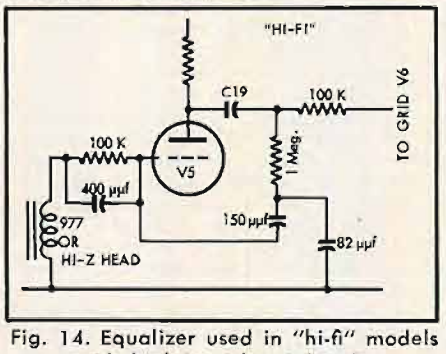

Fig. 14. Equalizer used in "hi-fi" models with high-impedance heads.

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Mr. Thomas, in receiving the award for his company, was himself cited as "Outstanding Business Man of the Year." Everyone in the industry is pleased, not only for JBL, but that one of its organizations is singled out for this honor.

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PROFESSIONAL DIRECTORY

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IHFM FORMS PUBLICATIONS GROUP. Joseph Benjamin, president of the **Institute of High Fidelity Manufacturers,** has announced formation of a publications committee to assist the Institute in promoting hi-fi components. In announcing the group Mr. Benjamin said it "will advise the IHFM on technical matters, trade and merchandising practices, methods of conveying the component story to the public, and other timely subjects. C. G. McProud, editor and publisher of AUDIO, will head the group, with the remainder made up of representatives of other publications covering the components industry.

NAMM STEREO SALES CLINIC. L. M. Sandwick, vice-president in charge of sales, **Pilot Radio Corporation,** will be the first speaker at a special stereo-hi-fi sales clinic to be conducted in connection with the annual trade show of the **National Association of Music Merchants.** The clinic is scheduled for June 24 at 9:30 a.m. in the Hotel New Yorker. Other participants in the clinic will be William A. Fink, sales manager of professional products, **ORRadio Industries,** Irving Rossman, president, **Pentron Corporation,** and a fourth speaker yet to be announced. Rulon A. Ostler, chairman of the NAMM electronics committee, will be chairman.

AR GETS BRITISH PATENT. A British patent on the acoustic suspension system for loudspeakers has been granted **Acoustic Research, Inc.,** manufacturers of AR speaker systems. The new patent is valid for Great Britain, Northern Ireland, and the Isle of Man, and extends the coverage provided by AR's U. S. patent. The company now has one licensee and is understood to be negotiating with other prospective licensees.

PICKERING LIFETIME WARRANTY. Walter O. Stanton, president of **Pickering & Company,** announces that the Stanton Model 371-7D stereo Fluxvalve cartridge and the Model 196 Unipoise arm with integrated pickup now carry a lifetime warranty. "Because each Pickering product is virtually hand-crafted and undergoes the same rigid quality control standards that have established Pickering as a leader in the field of high fidelity for over a decade, we have instituted a warranty without time limit," Mr. Stanton said.

E-V SALES AND PROFITS JUMP. Increases of 75.7 per cent in net profits and 25.4 per cent in sales were reported by **Electro-Voice, Inc.,** in its fiscal year ended February 28, 1959. Both figures are recorded highs. The first E-V public annual report shows net profit at $620,519, or $1.55 per share. This compares with $352,188, or 90 cents per share in the preceding fiscal year. Sales amounted to $11,764,676 compared with $9,379,132. Albert Kahn, E-V president, attributed the increase in sales and earnings largely to the shipment of stereo cartridges in the last half of 1958. He reported overwhelming acceptance of the new low-priced line of Wolverine high-fidelity speakers, and foresaw a strong market position for Electro-Voice in 1959.

ADVERTISING INDEX

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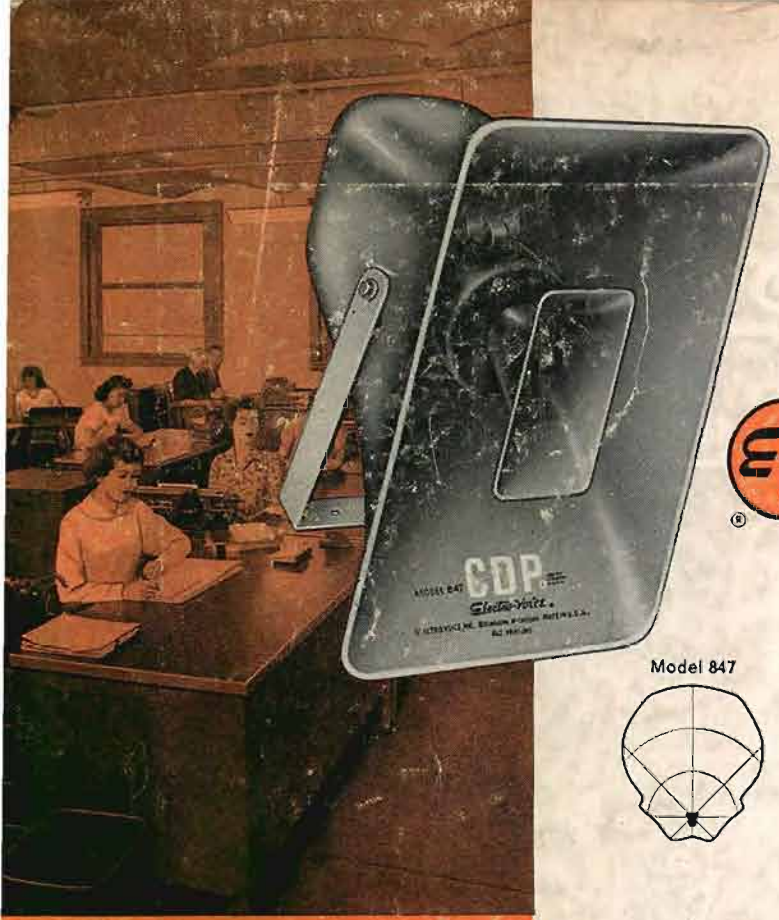

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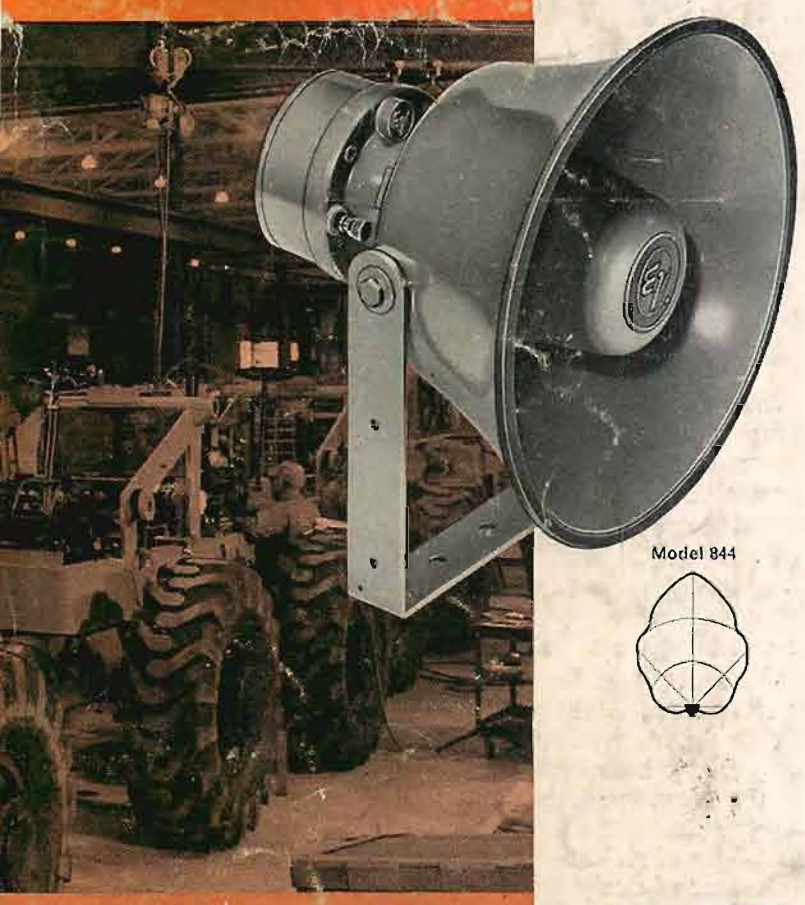

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List Price, $36.00

(Sound pressure level measured at 4 ft. on axis from 500 to 1500 cps with full rated input.)

E-V sound projectors are extra-rugged for long-life service indoors or outdoors. They are weatherproof, blastproof, splashproof. Actual comparison on the job proves their superiority.

*Design Patent 169,904

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No Finer Choice than **Electro-Voice®**

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For large area sound reinforcement: Model 848 30-watt CDP or Model 848LT 30-watt Long-Throw CDP, at $75.00 list. For high-fidelity voice and music: the E-V Musicaster at $80.00 list. Remember too, you get even better sound when you choose an E-V high-fidelity professional microphone from today's most complete line.

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