AUDIO

APRIL, 1958
50¢

...the original magazine about high fidelity!

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PRESTO High-Fidelity Turntables for Home Installations

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

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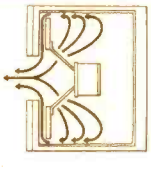
Sounding Board

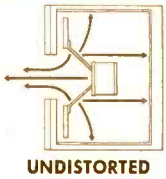
RJ enclosures . . . the entire line restyled . . . RJ patented principles insure the same superb performance!

The R-J enclosure established an entire class of products, and today there are numerous surface imitations, some of them built with exactly the same outside dimensions and appearance. However, it is correct to say that the R-J is distinguished from all other small — size speaker enclosures by a unique internal design, which is covered by two U.S. patents.

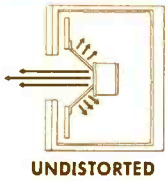
The R-J principle provides a method of controlling the "Q" of the resonator, utilizing a secondary or sub-baffle, upon which the speaker is mounted. The spacing between this sub-baffle and the front baffle provides a duct system through which the resonant sound must pass as it travels between the back cavity and the frontal opening. By controlling the space between these two baffle boards, (the width of the duct), damping or frictional resistance against the movement of air particles is provided. By this means the enclosure provides damping by air loading the speaker, rather than depending upon amplifier damping to keep the speaker cone from over-shooting and ringing. This is highly desirable, since amplifier damping can never be effective enough, depending as it does on the strength of the magnetic field in the air gap of the speaker for its effectiveness. If the speaker does not have a strong enough field, the amplifier is immediately limited in its ability to hold the cone from over-shooting. Furthermore, the normal tendency of the cone to flex cannot be helped by amplifier damping, because flexure of the cone is not reproduced in corresponding voice coil motion. Proper enclosure damping can provide correction for both of these conditions and others, as well. As the speaker cone moves back, the compressed air must pass through the frictional resistance provided by the R-J duct system, and the vis-



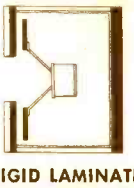
UNDISTORTED BASS
excellent transient response, no "ringing" on, quickly repeated "drum" or "organ" notes. Achieved by frictional damping, as sound is channeled through patented RJ duct system.



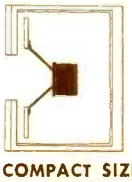
UNDISTORTED MID-RANGE
back waves controlled and absorbed by unusually heavy accoustical padding. Cleaner middle notes are played forward without labyrinths, folds or interference from back waves.



UNDISTORTED TREBLE
the speaker radiates high notes directly and correctly, without obstruction, diversion, or tunnels of any kind. Back waves absorbed by padding.



TRIPLE-RIGID LAMINATE BOARD
of uniform density used for front, rear and baffle. As strong as wood, but three times harder and denser, this special board eliminates spurious resonances due to cabinet surface vibrations.



COMPACT SIZE
only the exclusive RJ patented principles can provide such quality reproduction from a speaker enclosure this size. Any modern speaker performs excellently in an RJ enclosure only slightly larger than the speaker itself.

The Sounding Board

cut along dotted line and save

cosity of this movement holds back the movement of the speaker cone . . . loads the cone. The air is kept from slipping off the cone, and the cone is loaded over its entire face. This prevents flexure and also keeps the cone from overhanging and over-shooting, resulting in clean, precise bass notes. This effect is particularly emphasized in quick repeated drum notes. Furthermore, the R-J enclosure introduces a controlled amount of friction in the frontal aperture which balances the friction in the ducts so as to load both the front and rear faces of the cone.

The most common forms of distortion arising in speaker reproduction are (1) the tendency to over-drive speakers to get more bass reproduction and (2) the tendency of the vibrating speaker cones to "overshoot" or "ring". By the loading principles we have described, the patented R-J reduces the amplitude of the speaker cone movement for a given power output and thereby reduces distortion. Regardless of size, most enclosures which claim good low frequency reproduction emphasize their reproduction qualities on organ-type notes. This is very different from being able to claim generally excellent transient response, since generally they do not provide the damping required to control this type of reproduction, and to achieve the important advantages and better sound which this R-J principle makes possible.

The Pounding Board

5 new RJ Models:

RJ/8 for 8" speakers. Single shelf model 11"h x 23½"l x 10"d. Unfinished Birch Hardwood. $28.50. Mahogany, Walnut or Blond finish. $37.50.

RJ/12 for 12" speaker. Floor model 20"h x 20"l x 16"d. Unfinished Birch Hardwood. $45.00. Mahogany, Walnut or Blond finish. $56.00.

RJ/12-S for 12" speaker. Double shelf model 24"h x 21"l x 10"d. Unfinished Birch Hardwood. $38.50. Mahogany, Walnut or Blond finish. $49.50.

RJ/15 for 15" speaker. Floor model 20"h x 20"l 16"d. Unfinished. Birch Hardwood. $45.00. Mahogany. Walnut or Blond finish. $56.00.

B.I.C. ENDORSED QUALITY

RJ/Super 8 (RJ/Wharfdale). Complete speaker system. Enclosure — same as RJ/8. Wharfdale Super 8/FS/AL, 8" full range speaker installed. Unfinished Birch Hardwood $50.50. Mahogany, Walnut or Blond finish. $59.50.

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For literature on R-J write Department RD18

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PORT WASHINGTON, N. Y.

APRIL, 1958 VOL. 42 No. 4

Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

COVER PHOTO—Part of the "den" of W. H. Keeland, Racine, Wisconsin. The house was designed by Frank Lloyd Wright and it was the problem of Ed Kunze, owner of Edward's Sound Engineering in Racine, to install hi-fi, TV, Teletalk, and Ekotape in keeping with the modern decor of the home. There's more than the photo shows, too. Music can be piped to any room in the house, and there are intercoms everywhere.

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AUDIOCLINIC??

JOSEPH GIOVANELLI*

Current in Power Transformers

Q. *Please tell me how one determines the current capacity of a power transformer. The one in which I am interested has a secondary potential of 700 volts. The resistance of the full secondary is 100 ohms. I cannot believe that the current capacity = E/R = 700/100 = 7 amperes. It looks as though the actual current might be closer to 400 ma. A. R. Boileau, Coronado, Cal.*

A. No satisfactory means are available to you for determining the maximum safe current-handling capacity of your transformer. One thing is certain: Unless that unit is a monster, weighing perhaps 100 pounds, it will be incapable of carrying a secondary current of 7 amps. If you are familiar with the sizes of various types of power transformers, a rough idea of their capacity may be had by a physical examination. The only way to be sure is to locate the manufacturer's name and the model number and consult his catalog. If you knew the wire size and the core's cross-sectional area, you would be able to determine the current-carrying capacity of the secondary winding. However, in order to obtain this information, major surgery would be involved which would, in all likelihood, destroy the transformer, so that the data gathered in your probings would need to be discarded along with the transformer.

The method you propose, i.e., dividing its output voltage by its internal resistance, is clearly not going to give the answer. The current obtained by this means, when multiplied by the internal resistance of the secondary winding, gives us 700 volts dropped across the winding of the transformer, leaving no voltage available for delivery to the external load. Remember that when a resistance is multiplied by the amount of current passing through it, the answer you arrive at represents the amount of voltage lost in the particular circuit under consideration.

Distance from Crossover Networks

Q. *My question is: How far can speakers be operated from their crossover networks, assuming that fairly large wire is used? If the distance over which this operation is permitted is considerable, say 40 feet or more, then why should one not use the same crossover network for a number of speaker combinations? W. E. Dancey, Houston, Texas.*

A. In this column, Jan., 1958, there is a table showing lengths of line *vs.* wire diameter, *vs.* impedance for 0.1-db loss. By using this table as a guide, negligible distortion of the characteristics of the crossover network will result. This is because the resistance of the line is negligible as compared to the nominal impedance of the circuits involved.

One word of caution: If the crossover network is of the non-adjustable type, be sure that all the speaker systems to be used require the same crossover point. If the speakers are to be switched (and this is certainly the best way of handling this project), be sure that the switch contains sufficient positions, one for each speaker system, and enough poles, one for each element of a speaker system.

Multiplexing

Q. *I recently bought an FM tuner on which there is an output marked "multiplex." Can you tell me to what purpose this may be put? R. P. Burns, Havertown, Pennsylvania.*

A. Multiplexing is a system by which two or more programs may be transmitted simultaneously by the same FM transmitter. In one of the several methods now in use, one of the two channels is transmitted in the normal manner, while the intelligence of the other channel occupies a bandwidth of 15 kc. in the supersonic range. This channel is separated from the normal channel at the detector by means of a sharp cutoff high-pass filter. After this separation process, it is heterodyned with another oscillator in such a way that the beats fall into their pitch relationships in the audio spectrum, and can therefore be heard. This is just one of several methods which are in use, or which are under study, for the simultaneous transmission of two or more programs. Until one method is adopted as the standard to be used by all interested parties, little, if any, equipment will be available for detecting the second channel.

The multiplex output is wired to the detector circuit in such manner that the de-emphasis network is bypassed. If your amplifier is poor in high-frequency response, you may connect it to the multiplex output. FM reception will be normal except for an exaggerated emphasis of the highs, which can be helpful in systems where response in that region of the spectrum is poor. Let me make it perfectly clear that connecting your tuner in this manner will not allow you to hear the multiplexed channel. You will hear the FM programs to which you are accustomed, but with an overabundance of highs.

Component Life

Q. *I have a Heath Kit W5M amplifier, and WAP2 preamplifier. When these components were new, the noise level was inaudible unless one searched for it. Now I am beginning to notice a little high-frequency noise. It has not come to an irritating level as yet. It is a case of where before there was none, now there is some. I am assuming that this noise is caused by the gradual breakdown of resistors or capacitors, as I have replaced all the tubes and the noise remains. How long should one expect carbon resistors, paper capacitors, electrolytic capacitors, ceramic capacitors,*

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

Garrard

PRESENTS A NOTEWORTHY ADDITION TO THE WORLD'S FINEST RECORD CHANGERS

A new dual purpose 4-speed record player . . . an automatic intermix changer *and* manual player replacing the highly respected RC121 'Renown". No increase in price.

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RC121/II

$42.50 *less cartridge*

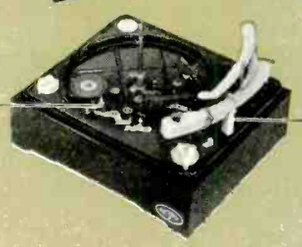
This is the handsome new version of Garrard's most compact, most economical high fidelity changer. It now represents, even more than before, the most adaptable unit of its type, reflecting the special standards of quality and enduring performance that distinguish all Garrard players. The RC121/II incorporates all the basic Garrard "Renown" features and in addition, these refinements:

NEW UNITIZED CONTROL for automatic and full manual operation. An automatic unit . . . yet tone arm is always free and ready for single record play at the turn of the knob! No waiting for cycling. Arm disengaged from the changer mechanism at all times.

NEW TRUE INTERMIX changes 12" and 10" records in any order. Exclusive new spindle positively prevents double record drop. Affords extra protection against center hole wear.

STOP / PAUSE FEATURE. A control that interrupts performance at any point and permits it to be started again without losing groove position; or the record rejected at option of user.

TRUE TURRET DRIVE with over-sized "soft tread" idler wheel presents long-arc heavy traction surface; guarantees just the right torque. Self-neutralizing, pull-away feature keeps idler round and true . . . no wows or flutter. Sensimatic trip re-designed for operation at very low tracking pressures.



NEW CAST ALUMINUM TONE ARM assures freedom from resonance, vibration and structural distortion. Enlarged professional type metal finger lift. Plug-in shell takes all cartridges. New arm rest has safety clip, spring-loaded to guard against mechanical accidents or jamming. Especially convenient stylus pressure and height adjustments.

ALL GARRARD-BUILT "INDUCTION SURGE" MOTOR. Quiet 4-pole shaded type; heavy-duty for minimum vibration and rumble. Dynamically balanced rotor. No hum even with the most sensitive pickups.

Changer comes ready for plug-in, with UL approved line cord and pickup cable fitted with jack.

There's a Garrard for every high fidelity system.

Minimum Cabinet Dimensions: Left to right: 14½", front to rear: 13", above motor board: 5", below motor board: 3⅛".

B. I. C. ENDORSED QUALITY

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$67.50	$54.50	$42.50	$89.00	$24.50	$32.50

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etc., to perform their functions satisfactorily? How long should one expect tubes such as those used in the equipment described, to last under normal conditions? Clyde A. McGoldrick, APO, San Francisco, Cal.

A. The usable life of any component depends its initial quality and upon the conditions to which it is subjected. These might include temperature, moisture, and the degree of closeness to its maximum rated capacity at which it is operated. Resistors operated well within their ratings may last longer than ten years. Waxed paper capacitors may be expected to last about five years, although in many cases their lives are much shorter. With these components, temperature and moisture are most important. I should expect molded paper capacitors to last close to ten years when conservatively operated. Mica and ceramic capacitors may well last more than ten years. The life expectancy of electrolytic capacitors varies greatly. High-grade units may last five to ten years, and sometimes longer, while some units last barely a year.

Tubes are in a class by themselves, and hence will be given special treatment. When used for periods of perhaps an hour or two a day, they may be expected to last three to four years. However, they may last for much longer than that. I have had tubes in my FM tuner for ten years, and still others in my communcations receiver for 12 years, and they are still performing satisfactorily. Rectifier tubes are usually the first to burn out.

Tube life may be greatly lengthened if the proper measures are taken before the tubes are placed in service: Place the tube in a convenient and appropriate socket. Many of you can salvage it from an old chassis or from the junk box. Preferably, the tube should be in a vertical position. Connect the heater terminals to a source of power whose voltage can be varied. Over a period of a week gradually advance the heater voltage from zero to normal. Do not apply plate voltage. Allow the heaters to remain at their normal voltage for another week. The longer the tube has stood on the shelf, the greater will be the need for this aging process. Tube manufacturers have neither time nor facilities for this kind of aging. They connect the heaters of the tube, for a short time, to a source of voltage higher than that recommended for normal use. This process, because of its extremely brief duration, is known as flash aging. Its purpose is to cause the movement of more electrons to the surface of the cathode, thereby improving the emission capabilities of the tube.

Another aid to tube life is never to turn off the equipment. Remember, though, that the money saved on tube replacements will be much less than the electric bill run up by leaving the equipment running.

The data presented here represent information gained while servicing equipment.

No Can Do

Q. I would appreciate a comparison of features and disadvantages of the Fisher 80C preamplifier, McIntosh preamplifier, Marantz Audio Consolette, Fisher 55-watt

(Continued on page 64)

LETTERS

Stylus Force Increase

SIR:

Mr. Canby's remarks about ½-mil *vs.* 1-mil points (January, 1958) constituting a warning against effectually "quadrupling" the force with the sharp needle, makes me admire his common-sense reasoning. It was also logical to use a cactus needle, some twenty years ago, since something had to wear and cactus is softer than shellac. This logic helped to ruin some records, because the points changed shape too fast, etc. Reasoning needs evidence. I want to see the lab results of playing six "identical" records 100 times each—three with ½-mil and three with 1-mil styli, at 2, 4, and 8 grams. It is possible that some of the records may be torn to pieces; it is also possible that the resulting sounds will show no discernible differences.

The significant fact at issue is that Canby is arguing subjectively; apprehensively. Having heard with pleasure J. B. S. Haldane's essay *On Being the Right Size* (most easily available as reprinted in *The World of Mathematics*), I am prepared to be amazed by whatever may be the substance of the proposed lab report.

When using phonograph needles we deal with mechanical forces on an inhumanly small scale, wherein proportions and their effects are doubtless greatly different from our common sense ideas about them. Without knowing the objective facts—and neither does Mr. Canby, or he would cite them—I suggest that the odds might be as high as two to one he is wrong.

GEORGE BARBAROW
Topanga, California

(*Good project for someone.* ED.)

Record Clubs

SIR:

In Mr. Canby's AUDIO ETC for March, the record club is condemned for narrowing the horizon of the record buyer. Mr. Canby reaches this conclusion because he assumes the club member must "submit to a papa-panel of benevolent judges." While I agree with Mr. Canby as to the desirability of broadening rather than narrowing one's area of interest, I wonder just how interest is to begin, if not through one or another kind of guidance by some or other "expert." The point Mr. Canby misses is that those who join clubs do need, or at least feel they need, guidance.

Furthermore, while it would appear that Mr. Canby's distinctions between "great" and "good" music are well taken, the implied great distinction between critics such as himself and the "benevolent papa-panel" judges is in reality only a slight distinction.

I submit, therefore, that the real problem is not at all one of picking the right authority, as Mr. Canby seems to imply when he admonished us to keep an eye on the record reviews. Indeed, the problem is how to diminish our reliance on "authorities," and build our own competent ca-

(*Continued on page 75*)

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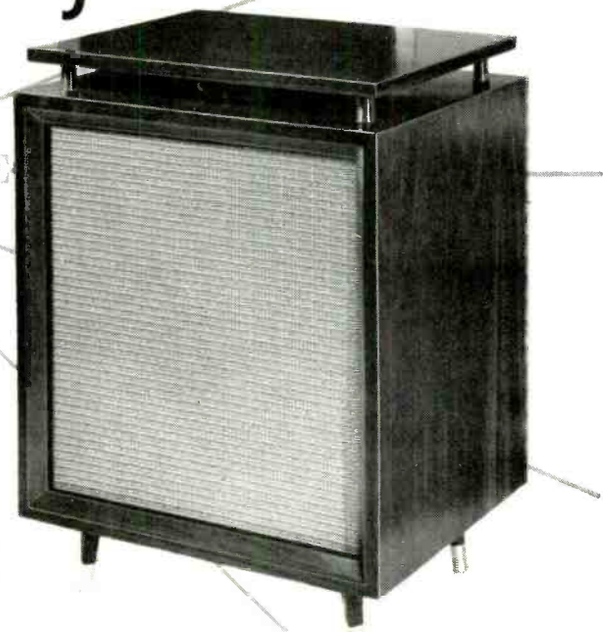
sound in every direction!



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with exclusive circular tweeter
and exclusive phasing switch

. . . and the room shall be filled with music! Because you're using Kingdom COMPASS-1, the new omni-directional speaker system that gives you sound in every direction! Brilliantly designed and engineered, COMPASS-1 combines a 12" woofer, with exclusive circular tweeter, and front and back grilles . . . to gently envelop you in sound, eliminate "dead spots" and provide highest-fidelity reproduction anywhere in a room! Can be used, too, as an end table or room divider!

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SOUND IN EVERY DIRECTION
COMPASS-1

2 FINISHES	Audiophile Net
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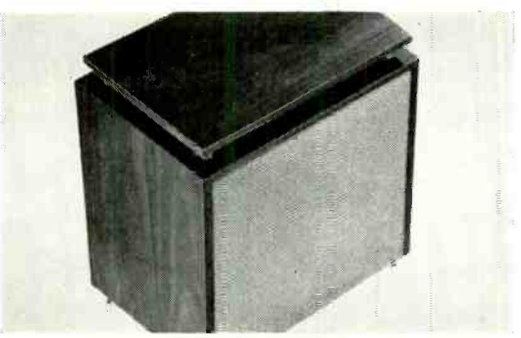
Walnut	**$154.50**



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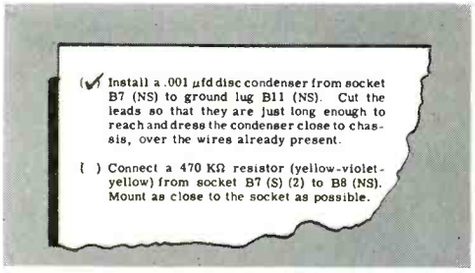

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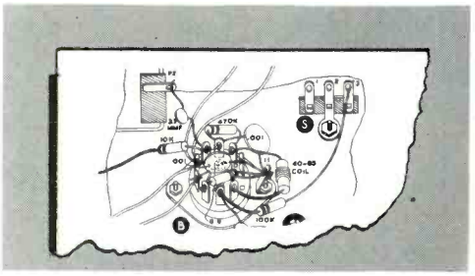
Read the step . . . perform the operation . . . and check it off—it's just that simple! These plainly-worded, easy-to-follow steps cover every assembly operation.



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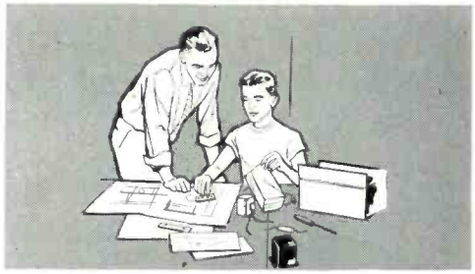
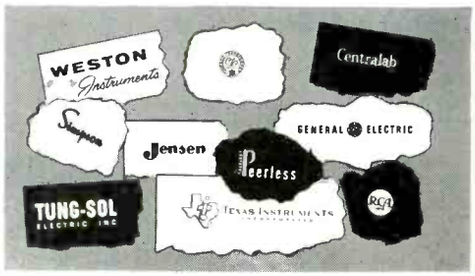


Learn-by-doing Experience For All Ages . . .
Kit construction is not only fun—but it is educational too! You learn about radio, electronic parts and circuits as you build your own equipment.



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Electronic components used in Heathkits come from well-known manufacturers with established reputations. Your assurance of long life and trouble-free service.

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There are many reasons why this attractive amplifier is a tremendous dollar value. You get many extras not expected at this price level. Rich, full range, high fidelity sound reproduction with low distortion and noise . . . plus "modern" styling, making it suitable for use in the open, on a bookcase, or end table. Look at the features offered by the model EA-2: full range frequency response (20—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. Front panel features brushed gold trim and buff knobs with gold inserts. For a real sound thrill the EA-2 will more than meet your expectations. Shpg. Wt. 15 lbs.

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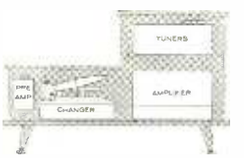
chairside enclosure kit

NEW This beautiful equipment enclosure will make your hi-fi system as attractive as any factory-built professionally-finished unit. Smartly designed for maximum flexibility and compactness consistent with attractive appearance, this enclosure is intended to house the AM and FM tuners (BC-1A and FM-3A) and the WA-P2 preamplifier, along with the majority of record changers, which will fit in the space provided. Adequate space is also provided for any of the Heathkit amplifiers designed to operate with the WA-P2. During construction the tilt-out shelf and lift-top lid can be installed on either right or left side as desired. Cabinet is constructed of sturdy, veneer-surfaced furniture-grade plywood ½" and ¾" thick. All parts are precut and predrilled for easy assembly. Contemporary available in birch or mahogany, traditional in mahogany only. Beautiful hardware supplied to match each style. Dimensions are 18" W x 24" H x 35½" D. Shpg. Wt. 46 lbs.

CE-1C Mahogany
CE-1CB Birch
CONTEMPORARY

CE-1T Mahogany
TRADITIONAL



Be sure to specify model you prefer

$43.95 each

HEATHKIT

high fidelity FM tuner kit

For noise and static free sound reception, this FM tuner is your least expensive source of high fidelity material. Efficient circuit design features stablized oscillator circuit to eliminate drift after warm-up and broadband IF circuits assure full fidelity with high sensitivity. All tunable components are prealigned so it is ready for operation as soon as construction is completed. The edge-illuminated slide rule dial is clearly numbered for easy tuning. Covers complete FM band from 88 to 108 mc. Shpg. Wt. 8 lbs.

MODEL FM-3A $25.95 (with cabinet)

HEATHKIT

broadband AM tuner kit

This tuner differs from an ordinary AM radio in that it has been designed especially for high fidelity. 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. Incorporates automatic volume control, two outputs, and two antenna inputs. An edge-lighted glass slide rule dial allows easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 9 lbs.

MODEL BC-1A $25.95 (with cabinet)

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master control preamplifier kit

Designed as the "master control" for use with any of the Heathkit Williamson-type amplifiers, the WA-P2 provides the necessary compensation, tone, and volume controls to properly amplify and condition a signal before sending it to the amplifier. Extended frequency response of ± 1½ db from 15 to 35,000 CPS will do full justice to the finest program material. Features equalization for LP, RIAA, AES, and early 78 records. Five switch-selected inputs with separate level controls. Separate bass and treble controls, and volume control on front panel. Very attractively styled, and an exceptional dollar value. Shpg. Wt. 7 lbs.

MODEL WA-P2 $19.75 (with cabinet)

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HEATHKIT 25-WATT **HEATHKIT 70-WATT**

MODEL W-5M
$59.75

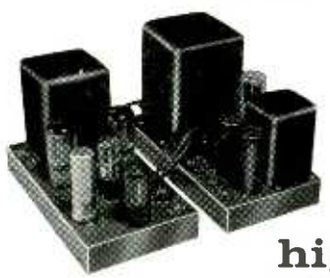
high fidelity amplifier kits

MODEL W-6M
$109.95

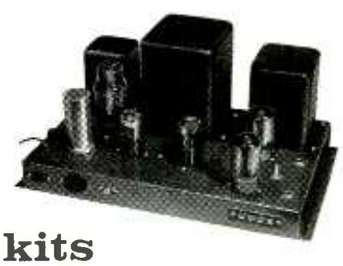
To provide you with an amplifier of top-flight performance, yet at the lowest possible cost, Heath has combined the latest design techniques with the highest quality materials to bring you the W-5M. As a critical listener you will thrill to the near-distortionless reproduction from one of the most outstanding high fidelity amplifiers available today. The high peak-power handling capabilities of the W-5M guarantee you faithful reproduction with any high fidelity system. The W-5M is a must if you desire quality plus economy! Note: Heathkit WA-P2 preamplifier recommended. Shpg. Wt. 31 lbs.

For an amplifier of increased power to keep pace with the growing capacities of your high fidelity system, Heath provides you with the Heathkit W-6M. Recognizing that as loud speaker systems improve and versatility in recordings approach a dynamic range close to the concert hall itself, Heath brings to you an amplifier capable of supplying plenty of reserve power without distortion. If you are looking for a high powered amplifier of outstanding quality, yet at a price well within your reach, the W-6M is for you! Note: Heathkit model WA-P2 preamplifier recommended. Shpg. Wt. 52 lbs.

HEATHKIT DUAL-CHASSIS
MODEL W3-AM
$49.75



HEATHKIT SINGLE-CHASSIS
MODEL W4-AM
$39.75



HEATHKIT

high fidelity amplifier kits

One of the greatest developments in modern hi-fi reproduction was the advent of the Williamson amplifier circuit. Now Heath offers you a 20-watt amplifier incorporating all of the advantages of Williamson circuit simplicity with a quality of performance considered by many to surpass the original Williamson. Affording you flexibility in custom installations, the W3-AM power supply and amplifier stages are on separate chassis allowing them to be mounted side by side or one above the other as you desire. Here is a low cost amplifier of ideal versatility. Shpg. Wt. 29 lbs.

In his search for the "perfect" amplifier, Williamson brought to the world a now-famous circuit which, after eight years, still accounts for by far the largest percentage of power amplifiers in use today. Heath brings to you in the W4-AM a 20-watt amplifier incorporating all the improvements resulting from this unequalled background. Thousands of satisfied users of the Heathkit Williamson-type amplifiers are amazed by its outstanding performance. For many pleasure-filled hours of listening enjoyment this Heathkit is hard to beat. Shpg. Wt. 28 lbs.

HEATHKIT

high fidelity amplifier kit

MODEL A-9C **$35.50**

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HEATHKIT

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MODEL XO-1 **$18.95**

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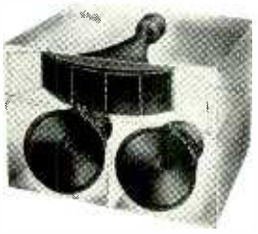
HEATHKIT "LEGATO"

high fidelity speaker system kit

Wrap yourself in a blanket of high fidelity music in its true form. Thrill to sparkling treble tones, rich, resonant bass chords or the spine-tingling clash of percussion instruments in this masterpiece of sound reproduction. In the creation of the Legato no stone has been left unturned to bring you near-perfection in performance and sheer beauty of style. The secret of the Legato's phenomenal success is its unique balance of sound. The careful phasing of high and low frequency drivers takes you on a melodic toboggan ride from the heights of 20,000 CPS into the low 20's without the slightest bump or fade along the way. The elegant simplicity of style will complement your furnishings in any part of the home. No electronic know-how, no woodworking experience required for construction. Just follow clearly illustrated step-by-step instructions. We are proud to present the Legato—we know you will be proud to own it! Shpg. Wt. 195 lbs.



MODEL HH-1-C
(imported white birch)
MODEL HH-1-CM
(African mahogany)
$325.00 each

HEATHKIT
BASIC RANGE

HEATHKIT
RANGE EXTENDING

high fidelity speaker system kits

MODEL SS-1 **$39.95**

A truly outstanding performer for its size, the Heathkit model SS-1 provides you with an excellent basic high fidelity speaker system. The use of an 8" mid-range woofer and a high frequency speaker with flared horn enclosed in an especially designed cabinet allows you to enjoy a quality instrument at a very low cost. Can be used with the Heathkit "range extending" (SS-1B) speaker system. Easily assembled cabinet is made of veneer-surfaced furniture-grade ½" plywood. Impedance 16 ohms. Shpg. Wt. 25 lbs.

MODEL SS-1B **$99.95**

Designed to supply very high and very low frequencies to fill out the response of the basic (SS-1) speaker, this speaker system extends the range of your listening pleasure to practically the entire range of the audio scale. Giving the appearance of a single piece of furniture the two speakers together provide a superbly integrated four speaker system. Impedance 16 ohms. Shpg. Wt. 80 lbs.

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AUDIO ETC.

Edward Tatnall Canby

1. CHAMBER OF HORRORS

I am sometimes absolutely fascinated by the things I see in our own magazine. For instance, in the March issue (NEW PRODUCTS, p. 76) I find myself staring at an incredible object, fraught with no less than frightful possibilities—a *portable anechoic chamber*. The picture shows it very casually, looking like a big refrigerator in a butcher's shop, or maybe like a bank vault, the thick, fat door standing partly open to show the serrated inside soundproofing. My distorted imagination instantly saw a live body being pitched head-first through that door into the horrid interior. Torture chamber! Acoustically speaking, the thing might just as well be a lethal gas chamber, portable and *very* convenient.

It has some ghoulish possibilities, at that. Let me explore them awhile with you.

I recently gave a question-and-answer lecture about hi-fi and recording in general before an ardent group of amateur chamber music players, who inevitably (as I have learned to expect with practicing musicians) expressed their intense distrust and dislike of hi-fi and all its machinations, who felt that the better the "fi", the more musically unrealistic was the sound. *Why*—they wanted to know? Is it all just cynical publicity, this hi-fi business? Did I *really* think that present sound reproduction was faithful to musical sound—because *they* most certainly did not.

I spent a long time explaining to this group what seems to be the inevitable truth about recording—that it is *not* literal; it is not even realistic reproduction of musical sound and never will be, but is instead to be considered as a sound medium on its own, with its own principles, rules, values—separate and very distinct from the principles, rules, values of "live" musical sound. I suggested, as I often do, that the moving picture was the proper analogy; for we accept both the artistic values and the differences between film acting and procedure, and living stage acting. (We don't curse movie producers for their editing technique and the necessary filming of the whole in bits and pieces—but we tend to groan when music is produced for records in the same way, with editing. Why should we?)

A violinist in this chamber music group was particularly insistent that the sound of the violin as recorded, even hi-fi, was simply *not* the sound of a real violin; this disturbed him no end, for the ads led him to believe that hi-fi reproduction should, indeed, reproduce a violin as a violin.

He could not have been righter. A recorded violin sound is *never* the sound of a live fiddle. I explained to him the complexities of one-dimensional "one-ear" monaural sound, of the double liveness that brings the original sound and the original hall reverberation inextricably mixed together and mixes these with the second reverberation of our own listening room; I pointed out that the microphone, in any case, was at a distance from the fiddle it picks up and *is not the fiddle itself*, does not represent the actual sound radiator that a fiddle is, in the flesh. . . .

Absolute

Then I went on (the audience by this time was dropping jaws and goggling eyes right and left) to explain that if this fiddler really wanted a *literal* reproduction of a violin, as from an actual fiddle (not a mike suspended in front of a fiddle), the nearest possible approach would be a recording made in an anechoic chamber the sort that I long ago dubbed for myself an *absolute recording*.

If you play a fiddle in an anechoic chamber and pick up at fairly close range, you do, at least, eliminate the whole range of reverberation effects that add a sense of recorded space and distance to normal recorded sound. Your fiddle, in effect, is suspended in featureless, shapeless space; the ear has no means of determining its location in any dimension at all, via recording.

(Yes, it's true that with two living ears you can determine the *direction* of a sound in an anechoic chamber. But when it is bereft of its normal reverberation aids, the direction-sensing facility of the ear-brain combination isn't very efficient. Even the eyes, which show you where the sound *must* be, don't always convince the ears. You are as likely as not to think you hear the fiddle playing behind you, even though it is in plain sight in front of you.)

To diverge for a moment, absolute recording has been a minor enthusiasm of mine for a long time—but a somewhat impractical one, since very few actual recordings have this quality. There are, to be sure, a good many near-absolute records on the market, if you go out of your way to watch for them. Many harpsichord records, for instance, have so little outside reverberation (the mike is placed practically inside the instrument) that in effect it does not exist and the sound, apart from a tendency to be unbalanced due to the close pickup, *is* the harpsichord itself, disembodied and ready to be reproduced in your living room minus any suggestion of the earlier space in which the instrument played. Contrast that with "normal" recording, where we hear *music in a space*.

Clavichord recordings (an even smaller, closer-up sound), a few very "dead" piano recordings and some guitar records (those which are made close-to in a dead studio) also offer this absolute quality. Some of the more intimate folksinger records do it (but beware of the synthetic echo chamber!), especially recordings of small-voiced singers who play their own guitars or zithers; they are often near-absolute in the recorded sound—that is, with no recorded sense of distance and space.

You'll find a considerable number of absolute recordings in the pops and jazz field. Electronic organs are usually echoless (unless the echo is electronic or added afterwards). After all, you can record an electronic organ in complete silence, feeding its output directly to the recording channel. The player wears earphones. That's absolute recording for you. Recordings of accordions are often miked very close-up, with virtually no reverberation from the room-space, and so are absolute. (Crooners used to be absolute—but now they are lost in a synthetic mammoth-cave echo, at least in rock-and-roll.) In the in-between musical areas, you'll find a good many guitar records that are near-absolute, though some are done at a distance, with considerable liveness.

The absolute recording, to recapitulate here what I may or may not have suggested to you in earlier times, has these interesting features.

1. It has no liveness of its own (or very little) and thus takes on the "color" and liveness of the *reproducing room*, virtually 100 per cent. It is a "virtual image" of the *original sound-source itself*, rather than the sound of the sound-source in a surrounding space.

2. For this reason, the absolute recording is located by the ear not behind, beyond or "in" the loudspeaker, but *at the speaker*. The speaker is the instrument itself, as literally as it is able to be, as a semi-point-source.

3. And finally, for these reasons the absolute recording must be reproduced *at the literal volume of the original sound*, if it is to be true to that sound. Not the loudness, mind you; the actual acoustical wattage of sound radiation.

This isn't too easy a concept to grasp, oddly enough, though it is no more than *really* literal sound reproduction. We are utterly accustomed to figurative, imaginative, suggestive, relative loudness in our sound. An absolute recording of a harpsichord, to be literal, must radiate the same power as the original harpsichord. It *is* the harpsichord. In a small room, this sound is fairly loud. In a concert hall it is virtually inaudible.

The strange thing about this is that, being a literal factor, it is intolerant. The slightest deviation from the literal sound-level produces gross musical distortion.

But stranger still—we usually prefer that gross distortion to the literal sound. We quickly get used to the "distorted" sound of an absolute recording played too

loud (occasionally too soft) and it then takes on an aesthetic pleasure-value that is all its own and unrelated to the original! Hence, you see, we fall right back into non-literal, unrealistic reproduction of sound, which is the normal sort. A topsy-turvy world. Just try the nearest guitar recording, for example, and see whether you don't tend to play it much louder than the sound of an actual guitar in your living room.

Incidentally—Cook's new jazz clavichord illustrates this beautifully. I haven't officially reviewed it, but this'll do as a substitute. (It's Cook 1133, "The New Clavichord," with Red Camp, who improvises jazz on the tiny instrument.) The Cook people are rightly aware of the paradox. The notes say:

"*The record owner . . . is faced with a choice when he plays this record: 1) he may set the volume to zero, then increase it until the instrument is just barely audible, thus reproducing the exact sound of the clavichord . . . or 2) he may run the volume at half mast or better, thus effectively celebrating the last sighs of an antique instrument and the birth of a new one of limitless possibilities.*"

I'll argue around the block with Mr. Cook as those "last sighs"—I've played for hours on a real clavichord and found it a fascinating instrument, as did many of the great minds of the past who did their finest musical thinking via its "private" sound. (It can just about be heard from one side to the other of a medium-sized living room.) But Cook has made the opposing principles nicely clear in his two points. For (1) is clearly absolute recording—and this is, indeed, an absolute recording, very well done, too. (Minimum of false thumps, etc.) But (2) is strictly relative, imaginative, amplified, non-literal, non-faithful *normal* recording.

Even an absolute recording, you see, tends to run into deliberate distortion at our hands—for the very last thing we normally want is *literal* faithfulness to the original sound-source. Take that.

But, to return to my take-off point and to my fiddler friend who was distressed because the sound of the recorded violin didn't sound to him like a real violin—you may understand, now, that I was able to show him how a literal fiddle sound might indeed be reproduced via recording. How? Via an absolute recording.

And how, you may ask, is a fiddler to produce an absolute recording of his violin? How is he to make a sound that will be *only* the violin, that will be a recorded image of the musical sound itself as it emanates from the sound-source, the violin's marvelously resonant sound-box?

I repeat. Just play in an anechoic chamber. And if I'd only had the March AUDIO along with me that day, I could have shown him the picture of the *portable* anechoic chamber now so happily developed and launched on the market.

What—the gadget was intended for testing mikes and such? Come, come! The makers can't be *that* simple-minded? Don't they realize that almost every musician in our land has been howling or grumbling or worrying about that problem of hi-fi faithfulness to his or her musical instrument? Don't they know that there isn't a musician in the land who will admit that "hi-fi" recording is faithful to *him* (or *her*), that the distrust of so-called hi-fi among musicians is something colossal (just ask the nearest musician)—and that all that these people want, to make them supremely happy, is a little gadget that would make it possible for them to make literally faithful recordings of their own sound?

Musicians of the world—this is it! Not so small a gadget, I'll admit; but then neither is a corner horn speaker system. You can't have everything in a nutshell. Now look here, my musician-friends. Let's be reasonable. All you have to buy, in order to have real, literal hi-fi sound of your own true instrument, is a padded box. Just play—and presto, your own tape recorder will take you down for the first time with *real* high fidelity.

The plain fact is that you can't do it any other way, and I don't care how many people tell you your equipment is the latest in fi. No padded box, no fi. You wonder, how big it is? Well, my Lord, it's small; it's *portable*. Can you beat that? How big is the inside of your ear, after all, and that's supposed to be very portable. Bump your head on the padded ceiling? Well, can you stand up in a Thunderbird with the top up? Can't get your midsection through the door? Well, just try getting into a brand new Sweptwing with your fiddle under your arm.

If I were you, Mr. Musician, I'd go right out and buy myself a portable anechoic chamber for my own living room. The door is plain, will match any period style (just like the deep-freeze in the kitchen); there's room for two inside, if you double up properly. Besides, you fiddlers won't need to play any full-bow passages—you can always use a short bow and just bump your arm into one of the convenient V-shaped padded interstices on the inside.

By the way, the company says nothing about air. You'd better buy an air conditioner too, while you're at it. There isn't room inside for you and the air conditioner, unless you throw out the fiddle, which would be like throwing out the baby with the bath, wouldn't it . . . but you can just set up the air pump in your living room window and run a duct over to the anechoic chamber; your nice, cold air will filter out of the pores and cool the living room too.

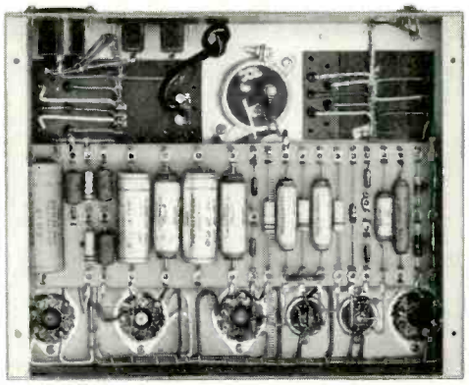
Finally, there's the little matter of medical attention—preferably from your new resident psychiatrist, who will be hired to sit in attendance (outside the chamber) while you do your hi-fi literal recording. Indeed, here we come to the hub and the nub of the entire problem. Like the moon-man of recent fame, you'll have troubles inside that portable chamber. But unlike him you won't have Science at your elbow to keep watch, to take measurements—and you'll lack that essential gadget, the panic-button, that the moon-man was ready to push any time he felt he was going off his nut.

Cold, Clammy Silence

Have you ever been inside an anechoic chamber? I've been inside two of them,

(*Continued on page 56*)

Can You Hear



UNDERSIDE VIEW OF POWER AMPLIFIER

A Decimal Point

REMOTE CONTROL PREAMPLIFIER

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EDITOR'S REVIEW

THE PAST MONTH'S SHOWS

SHOWS WHICH OCCURRED since the March issue was "put to bed" included the Institute's big affair in Los Angeles and an independent event in Washington, with the Rigo show in Denver and the IHFM-sponsored show in San Francisco not quite so recent but still not reported on here. Still to come is the Rigo show in Baltimore.

All of these shows were successful—which should come as a surprise to no one in the industry. The public is still interested in hi fi, still wants to hear and see it (or vice versa), and has already heard enough about stereo discs to clamor to hear them. To those of us who attend these shows regularly, there is a sameness about them, naturally; to the public—the average John Q. type who may only attend one or two in his lifetime, not the dedicated audio fan who would go to one every month if he had an opportunity—they are still novel and exciting.

We feel that the Rigo shows have a different problem than the big national events, and that they have shaken down into a successful pattern. The Washington show, this one being the fourth presented by M. Robert Rogers, has always drawn an interested audience and can be counted successful. The IHFM shows, however, are not yet established as greatly different from the smaller events—except perhaps for number of exhibitors—whereas they should definitely be the outstanding audio events of the year.

We feel that the hours reserved for dealers' contacts with the manufacturers were entirely too few. There should be a whole day for dealers, and *no one* but the dealers and exhibitors should be admitted. Furthermore, we feel that the shows should open not later than 2:00 in the afternoon—the 4:00 o'clock opening leaves too little time for the average visitor who feels that when 6:00 o'clock comes it is time to eat, so he goes out for an hour and a half.

Successful show operation involves an obligation on the part of the organization which presents it to both exhibitors and visitors. In the long run, the organization is the servent of the exhibitors. If exhibitors are not happy there is likely to come a time when they will cease to sign up, or they may break off into splinter groups and start other shows, for no one has a monopoly on show operation. And while there can be no show without exhibitors, neither can there be a successful show without visitors. They, too, must be treated with courtesy and consideration, for after all is said and done, they are potential customers.

Visitor-handling at the Biltmore in Los Angeles is not easy—the hotel is hardly laid out for the purpose. Fire Departments often restrict the number who are allowed on the exhibit floor at a time, which is as it should be, for the safety of all concerned. This is another reason for extending the hours slightly to "dilute" the concentration of visitors.

On the whole, the Los Angeles show would be judged a complete success. But we believe it could have been better.

STEREO AGAIN

This particular subject is one which has become touchy. No one in the record industry—except, of course the indefatigable Sid Frey of Audio Fidelity Records, which now has no less than four Stereodiscs on the market for anyone to buy—seems to be willing to say anything about anything. Not even *off* the record. All we can find out is "No comment." CBS-Columbia has announced in *Home Furnishings Daily* that it will demonstrate its stereo record at the IRE Convention on March 25. What it is we haven't learned. No one seems to have any idea of the date for stereo releases.

On the whole, the entire story of stereo discs has been handled with as little finesse and as little sense of good merchandising as possible. If the intention had been to confuse everyone, discourage sales, and put the entire industry into a tailspin, it would seem that no better method could have been worked out.

Manufacturers of pickups and amplifiers have actually no assurance as to what will be decided upon finally. The consumer hears all about stereo discs but finds out he can't buy any, so he just doesn't buy anything. He is not susceptible to the logical reasoning that the dealer is giving him—that he needs *at least one* amplifier and *one* speaker and *one* turntable or changer regardless of what system is to be used. But, no, he would rather wait.

The record and high fidelity industries should get together—it is up to the former to come to some decision, and soon. Someone has to take the bull by the horns and release records so there is some incentive to buy equipment. Even the networks offered color television to play on color sets as soon as the latter were put on the market. This is a definite case of which comes first, the chicken or the egg. Here's hoping the small record companies have themselves a ball and press—and release—stereo records like crazy.

WHAT WE SAW

Items of particular interest that we saw at the L.A. show included our first experience with the Integrand servo speaker system, which seems to sound as good as the theory behind it; a 500-watt transistor amplifier driving one company's speaker systems (and from the sound volume they must have been using full output); a tape recorder in kit form (not at the show proper, but in one of the rooms of the hotel) soon to be on the market, we were told; and a clarification of our original impression of the James B. Lansing stereo speaker—the Ranger-Paragon—which we described as 18 feet long in the November, 1957, issue but which is only 8 feet, 10 inches long. But at Kierulff's Concerama in the Philharmonic Auditorium it sat in the center of the stage for the third act and gave a marvelous spread of sound—with your eyes shut you could visualize the entire orchestra.

For a greater measure

PHOTOGRAPH BY ROBERT W. MITCHELL

# of listening pleasure...

*Important Quality Features, so necessary for high fidelity reproduction from records.

play your records with the incomparable *fluxvalve*®

PICKERING'S *truly* miniature FLUXVALVE magnetic phonograph cartridge represents the *newest* concept in high fidelity cartridge design since PICKERING introduced the *first* really lightweight high fidelity pickup more than a decade ago.

You get a *full measure of listening pleasure* . . . because the FLUXVALVE has a full range response, flat within 2 db, from 10 to 30,000 cycles. Hermetically sealed, the FLUXVALVE is impervious to any and all of the elements . . . heat, cold, humidity, etc. Moreover, the FLUXVALVE has the exclusive PICKERING *hum rejection* circuit built-in, assuring hum-free performance.

PICKERING'S "T-GUARD," the newest and safest idea in a stylus assembly, is incorporated in all FLUXVALVE models. Change of stylus is done quickly and easily with the comfortable grip of the "T" shaped assembly . . . *no precarious fingernail fumbling* . . . you are always sure the stylus is correctly seated. *The most flexible cartridge in the world,* the FLUXVALVE is the *only* cartridge with the *amazing* ½ mil stylus, and it can be used with *five* interchangeable styli to play any record, at any speed.

Only the FLUXVALVE has 100% IQF*, and it may interest you to know that because of its ability to make *precise* and *reproducible* record measurements, the FLUXVALVE is used for calibrating recording channels and record masters.

BUILD UP THE QUALITY OF YOUR HI-FI SYSTEM WITH A PICKERING FLUXVALVE

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

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

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

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

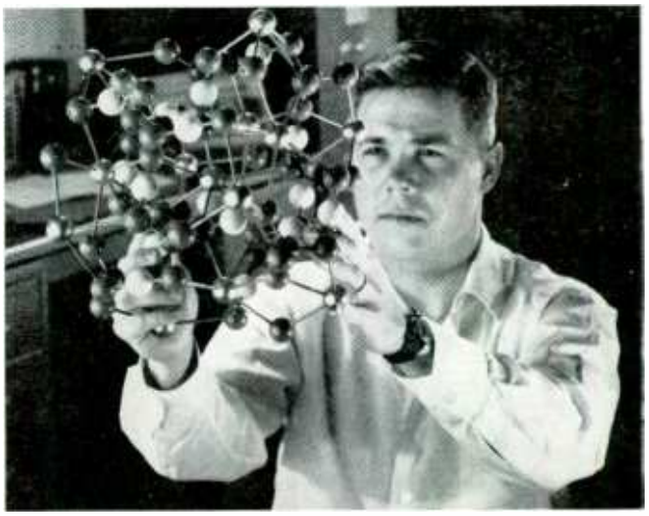
PICKERING & COMPANY, INC., Plainview, N. Y.

Enjoy the quality of a **FLUXVALVE** at your favorite Hi-Fi shop today . . . you **can** hear the difference.
For the dealer nearest you or for complete literature write to Dept. A-48

SYMBOL OF A POWERFUL FORCE

The question mark symbolizes man's inquiring spirit. And nowhere is this spirit cultivated with more enthusiasm than at Bell Telephone Laboratories where, through vigorous research and development, it constantly works to improve electrical communications and also to help national defense in essential military programs.

More than 3000 professional scientists and engineers at Bell Telephone Laboratories are exploring, inventing and developing in many fields: chemistry, mathematics and physics, metallurgy, mechanical engineering, electronics and others. You see the successful results achieved by this organization of inquisitive and highly trained minds in the nationwide telephone system that serves you.



Dr. Walter Brown, physics graduate of Duke and Harvard Universities, bombards crystalline solids with one-million-volt electrons to study the nature of simple defects in crystals. Objective: new knowledge which may help improve transistors and other solid state devices for new and better telephone and military systems.

Peter Sandsmark, from Polytechnic Institute of Brooklyn, and his fellow electrical engineers develop a new microwave radio relay system able to transmit three times as much information as any existing system. Objective: more and better coast-to-coast transmission for telephone conversations and network television.

Bill Whidden, from Polytechnic Institute of Brooklyn, and George Porter, from Georgetown College, study new experimental telephone instruments designed to explore customer interest and demand. Objective: to make your future telephone ever more convenient and useful.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

"M-S" Stereophony and Compatibility

GERHART BORE* and STEPHEN F. TEMMER**

Anyone who has ever heard either track of a stereo tape by itself realizes that it is not a good substitute for a well-recorded monaural tape. The author describes a system which will eliminate this trouble, not only on stereo tapes, but also on stereodiscs and in broadcasting—with particular emphasis on its value in combinations of FM and FM-multiplex.

OUR EARS ENABLE US not only to appreciate sounds according to their intensities and duration, but to pin-point their origin in terms of direction and distance. To determine the direction of sound we utilize several faculties: the ability to calculate the difference in time of arrival of the two initial transient components of a sound at the two ears; the sensitivity to intensity and sound-color differences at the two ears; and, in the case of one ear alone, the perception of the curvature of the wavefront, which for point sources decreases with distance. As a means of measuring, the ear makes use of the phase difference between pressure and velocity, particularly in the low-frequency components and in low-frequency transients, which amounts to 90 deg. at the point of origin, and 0 deg. for plane-wave propagation. In the diffused sound field of enclosed spaces, it is also possible to estimate the distance of the sound source by means of the *intensity difference* between the direct sound and its subsequent reflections from the boundary surfaces.

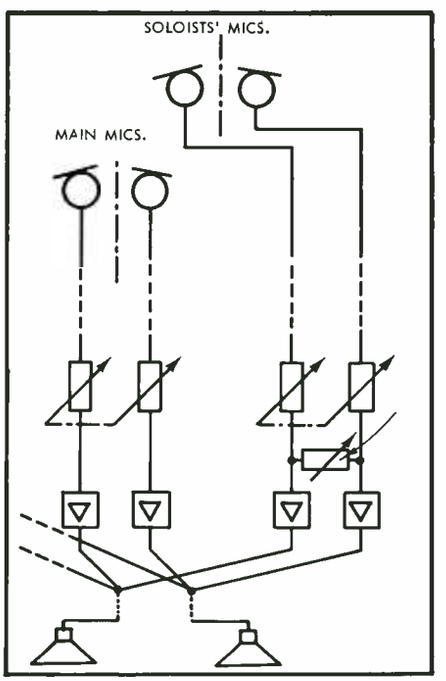


Fig. 1. Block schematic of a normal two-channel transmission system.

Practical Stereophonic Sound Transmission

Normal Classical Two-channel Transmission. In the "classical" method, pick-up is carried out by two microphones accurately matched as to frequency response and polar characteristic. In practice, adequate matching is only attainable in the case of high-grade condenser microphones, free from subsidiary resonances within the transmission band. Cardioid microphones, which have proved particularly satisfactory in stereophonic sound-film systems, are preferred. Thanks to their single-sided directional pattern, the direct sound, so important for localization, can be picked out of the general sound picture from a greater distance. However, microphones with other polar characteristics can be used, according to the nature of the room and method of reproduction. The microphones are used side by side at a spacing of 12 to 48 inches, depending on the size of the working arc desired. If, as is not always necessary in stereophonic pick-up, additional soloists' microphones are employed, these should consist of pairs of microphones placed closer together. A variable attenuator D (*Fig.* 1) in the cross-connection between the soloists' microphones permits a shortening of the "base" along which the soloist appears to move to and fro, so that a small sideways movement of the soloist does not cause an apparent leap from one loudspeaker to the other. The use of a single microphone, the output of which, after amplification by separate amplifiers is arbitrarily mixed into the two channels by hand, is subjectively much less pleasing.

In order to enhance the left-right impression by additional intensity and tone-color differences, a small baffle can be placed between the microphones, or they can be mounted on opposite sides of a sphere, a so-called "dummy head" of 4 to 12 inches diameter. For laterally displaced sound sources, this causes a shadowing of the further microphone leading to a more uniform representation of the sound scene on the reproducing side; the farther a sound source is displaced laterally, the less the incremental difference of path length to the microphones for further displacement. In this region the intensity differences carry the effect and the above-mentioned apparent crowding of sound sources toward the loudspeakers is avoided. In addition, the diffraction of the sound waves around the dummy head or baffle causes an attenuation of the higher frequencies on the far side.

"Intensity" Stereophony. Now let us look at the possibilities of locating sound source directions entirely by intensity difference in the two loudspeakers. In order to do that, we must locate the two

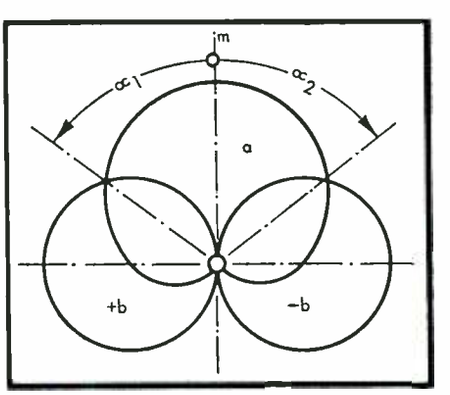


Fig. 2. Polar diagram of a microphone combination for M-S stereophony.

* *George Neumann Laboratories, Berlin, Germany.*
** *President, Gotham Audio Development Corporation, 2 W. 46th St., New York 36, N. Y.*

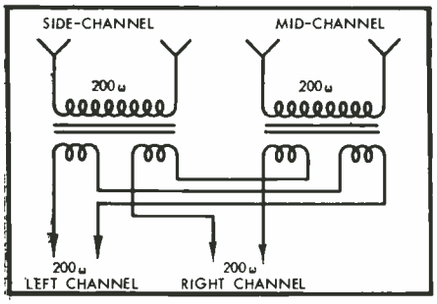


Fig. 3. Electrical sum and difference formation.

microphones at the same point in order to avoid differences of transmission time. They can be arranged very closely one above the other without disadvantage. Microphones with very well-defined polar characteristics must be used. They are rotated in different directions, so that each favors one half of the sound stage. This type of intensity stereophony, however, has no practical value, since the discovery by Lauridsen of "M-S stereophony" achieves a substantially more elegant solution at about the same cost. M-S stereophony means mid-side stereophony. One microphone with cardioid characteristic handles the whole sound picture, exactly as does the principal microphone in a single-channel pick-up. A second microphone having a cosine or figure 8 characteristic is placed closely above or below the first and turned so that its null plane contains the principal axis of reception of the cardioid microphone (*Fig.* 2). If the two microphone outputs a and b are interconnected so that the sum $a+b$ and the difference $a-b$ are formed, as shown diagrammatically in *Fig.* 3, two channels result, in each of which one half of the pick-up area is preferentially received. The arrangement relies on the fact that the two principal axes of a pressure gradient microphone correspond to voltages of opposite polarity. The combining can, for example, be done in the manner shown, by using differential transformers.

If we assume that the instantaneous value of a sound from the left produces a positive voltage b in the cosine microphone, sound sources on the central axis m will give rise to the voltage a in the cardioid microphone only, thus producing a central impression. Sources making an angle α_1, with the central axis, give rise to a voltage $a+b$ in the left loudspeaker and $a-b$ in the right loudspeaker. With $a=b$ only the left loudspeaker is energized, the source appears to the listener to lie in that direction. Similarly, sound sources at an angle α_2 appear to come from the right loudspeaker.

Smaller angles in the transmitting studio correspond to apparent directions between the loudspeakers in the reproducing room. The size of the angle $\alpha_1+\alpha_2$ can be varied, within limits, by changes in relative gain of the microphone channels.

Sources which lie outside the included angle $\alpha_1+\alpha_2$, will be localized more centrally. In this region the output from the cosine microphone predominates causing the loudspeakers to be driven in opposite phase and resulting in indefinite impressions of direction for a centrally situated listener. In this region no sound source should be set up. In this case too, as experience shows, if the quality is to be pleasant, soloists' microphones are necessary, consisting of double microphones arranged as in *Fig.* 4.

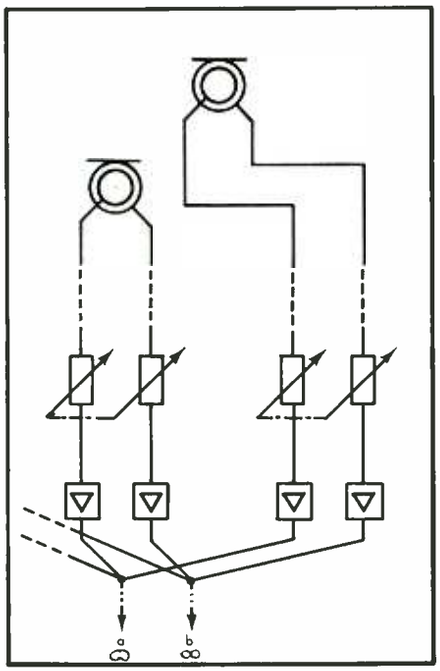


Fig. 4. Method of mixing in additional microphones.

A significant advantage of MS-stereophony lies in the fact that one channel —namely the mid-channel—carries a satisfactory single-channel transmission. The decision as to whether a two-channel transmission shall be produced monaurally or stereophonically may thus be decided at the reproducing end. This advantage is not obtained with classical stereophony; with this, two channels are always necessary for the achievement of good reproduction. Mixing of the two channels is not successful, firstly because the combination of two microphones into a "doublet" gives an undesirable highly frequency-dependent polar characteristic, and secondly the microphones will not have been placed suitably for a single-channel pick-up.

If no value is placed on "compatibility" of intensity stereophony with single-channel transmission, a pair of crossed gradient microphones with accurate cosine characteristics may be used for transmission with good results (*Fig.* 5). After double electrical addition and subtraction (according to *Fig.* 3) similarly proportioned voltages result as for MS-stereophony. The microphone output voltages permit a good transmission of directional impressions only for sectors 90 deg. wide to the front and back, and care is, therefore, necessary in placement. For sources lying outside this range of angles the directions will appear indefinite, because the loudspeakers will be driven by voltages wholly, or partially, in antiphase.

Microphones for Stereophonic Transmission

Microphones for use in stereophonic pick-up must satisfy several additional requirements. Over and above the known requirements for single-channel transmission with respect to flat frequency characteristic and low harmonic distortion, together with a wide dynamic range, classical stereophony demands equality of frequency and phase characteristic in the transmission channels; otherwise, the transmitted directional impressions will be frequency dependent. It is not easy to find matched samples from types of microphones in which the frequency response is achieved by a series of resonances spread throughout the transmission band, even if these microphones are quite satisfactory for single-channel transmission.

Condenser microphones have been found particularly suitable for the purpose. (Their accurate matching is, of course, only fully effective if, on the reproducing side, accurately matched loudspeakers are used.)

For stereophonic pick-up using classical principles, Neumann condenser microphones, specially selected for uniform frequency response, can be used. Transmission by means of the intensity stereophony principle requires microphones with strongly directional characteristics. In addition, they must have small physical dimensions so that they do not distort

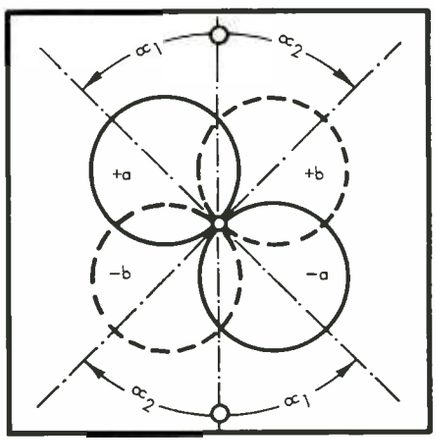


Fig. 5. Polar diagram and working angles for two cosine (velocity actuated) microphones.

the sound field when mounted in close proximity.

These stringent requirements can only be met in practice by the use of condenser microphone capsules as pick-up elements. Since it is barely possible to put two single microphones sufficiently close together without some disadvantage, the Neumann[1] stereo-microphone model SM 2, (*Fig.* 6), was developed for these applications.

This double microphone contains two similar, closely adjacent, microphone capsules. Their principal axes can be turned away from each other. The capsules are pressure-gradient operated with two diaphragms. Each system is capable of independent remote adjustment by variation of the polarizing voltage, continuously from spherical through cardioid to cosine characteristic, so that with this microphone many different arrangements may be tried. The frequency response and polar characteristics of this microphone are, of course, of prime importance in stereophony of the "classical" type, but are even more important for the M-S Intensity stereophony here described. *Figure* 7 shows the frequency response curves at each polar pattern position, and the polar characteristics of each microphone capsule at key frequencies

[1] The firm of Georg Neumann, Berlin, Germany, is the manufacturer of the U-47, M-49, and KM series of microphones sold in the United States under the "Telefunken" label.

Fig. 6. The Neuman SM-2 stereo microphone.

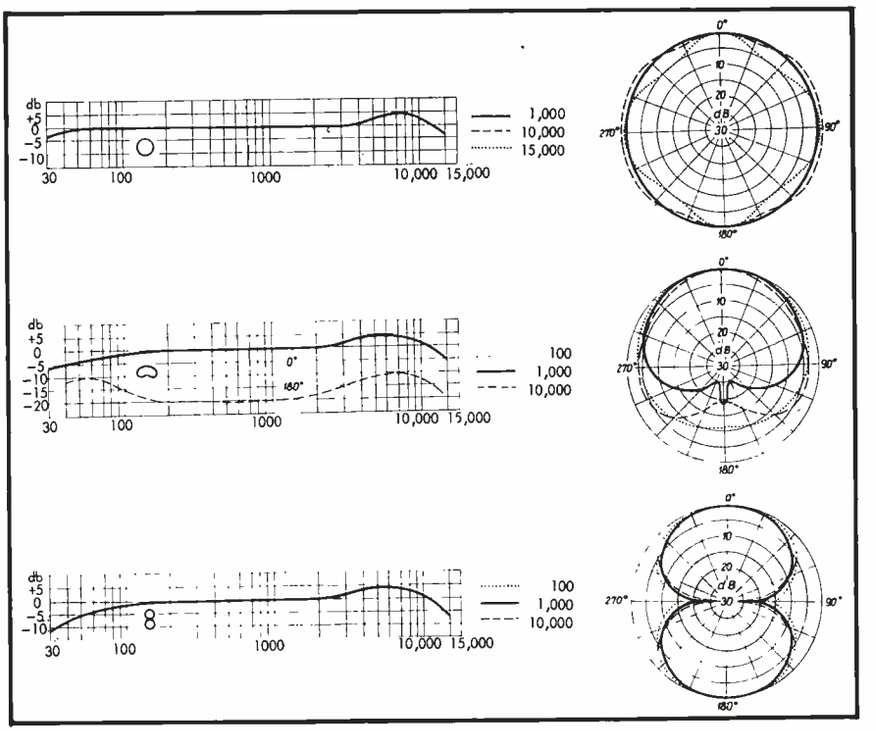


Fig. 7. Frequency response and polar characteristics of the Neuman SM-2 stereo microphone.

Application of the M-S Stereo Principle to Compatible Stereophonic Broadcasting

For some time now, stereo broadcasting through use of AM-FM or FM-FM means has been carried on. This means that radio stations broadcasting simultaneously on AM and FM have been splitting their outlets, feeding the left signal to one and the right signal to the other transmitter. The obvious fault with this form of two-channel transmission is the difference in quality between AM and FM, and, therefore, the uneven reproduction of the two stereo signals. In some localities, two FM stations have gotten together and have each carried one side of the stereo signal. This solves the quality problem but still leaves unsolved the main objection to either of these systems: the fact that a monaural listener (that means the vast majority) hears only one side *or* the other of the stereo broadcast. This presents a sound of complete unbalance, with the melody predominant at some times and the accompaniment at other times. An effort to reduce the distance between the microphones in the original pick-up will help this situation, but at the same time will reduce the stereo effect for the stereo listener.

Now let us examine the imminent start of FM Multiplex Stereo. In this method, one of the stereo signals is broadcast on one of the multiplex subcarriers of an FM station. (As many as three such subcarriers have successfully been used, primarily for point-to-point and in the background-music field for restaurants and supermarkets.) Recent tests have shown that such a subcarrier channel can be endowed with the same 50–15,000 cps response as the main FM signal. This is, of course, essential. A small adapter is required to extract this sub-carrier signal from existing FM tuners. Crosby Laboratories, Inc., of Hicksville, Long Island, have a patent designed to make such broadcasting more compatible. It does this by means of a sum-and-difference system; i.e., the two signals are electrically added and broadcast on the main FM channel, while the electrical subtraction of the two signals is broadcast on the multiplex channel. (Since there are no listeners tuned solely to the multiplex channel, the listening value of this subtractive signal is of no importance.) This is only a partial solution to the problem of compatibility; partial because, as pointed out earlier, mixing of the left and right channels of a classical left-right stereo system is undesirable from several viewpoints. Here is where the M-S Intensity Stereophony once again proves to be a solution. The "M" channel is fed to the FM Main Channel, while the "S" channel is fed to the Multiplex Channel. At the receiving end, the Main-Channel *only* listener will get the centrally placed monaural microphone output. Using the same sum-and-difference converter (*Fig.* 3) as shown previously will resolve these two signals into left and right stereo channels. The same converter, inciden-

(*Continued on page 71*)

A Paging Preamplifier

MANNIE HOROWITZ*

Designed to add versatility to existing high fidelity power amplifiers, this preamplifier is flexible enough to be used in many high-quality public-address installations.

MANY PEOPLE NOW OWN high fidelity power amplifiers or integrated combinations of power amplifiers and preamplifiers. The versatility of these components is limited to the versatility of the preamplifier.

It is frequently desirable to increase the flexibility of the unit to include a microphone input and mixer facilities, such as used in public address systems. When adding these features, a high fidelity amplifier can serve added conveniences in recording as well as for amusement at parties or charity and club affairs.

The unit to be described, shown in *Fig.* 1, was used in conjunction with the Eico HF-60 power amplifier as a paging-music system in a new factory. This system, as is, is useful in the situation where a doctor might have his office in the same building in which he resides —permitting uninterrupted music in his home, while a speaker in his office serves the dual function for background music as well as paging him to a phone. This unit, in conjunction with a power amplifier, can also be used effectively in hotels, camps, and private homes.

As described, or altered to include the suggested variations, this preamplifier can be used either directly with a power amplifier, or plugged into a low gain, flat input of an integrated amplifier system. Its flexibility and utility are innumerable.

A signal from a tuner is fed to the RADIO input while a signal from a crystal or ceramic phonograph pickup is fed to the input marked PHONO. Either or both input signals are selected or mixed by the level controls on the front panel, and fed from the output jack on the rear of this preamplifier to the input on a power amplifier. The output from the power amplifier is connected to the pair of terminals marked AMP on the rear of the preamplifier. One set of speakers is

* *945 East 26 St., Brooklyn 10, N. Y.*

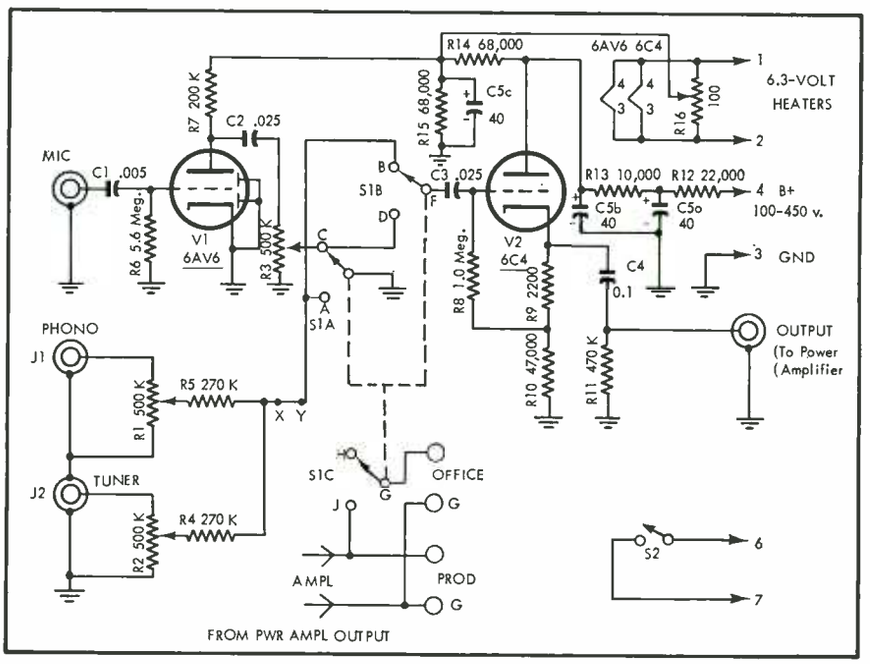


Fig. 2. Schematic of preamplifier to be used in conjunction with a power amplifier for paging. Note that function switch S_1 consists of 3 sections, and that S_2 is the master on-off switch for both power amplifier and preamp. Power is supplied at the numbered terminals, which correspond to socket used on Eico HF-30, HF-50, and HF-60. R_{16} is adjusted for minimum microphone hum.

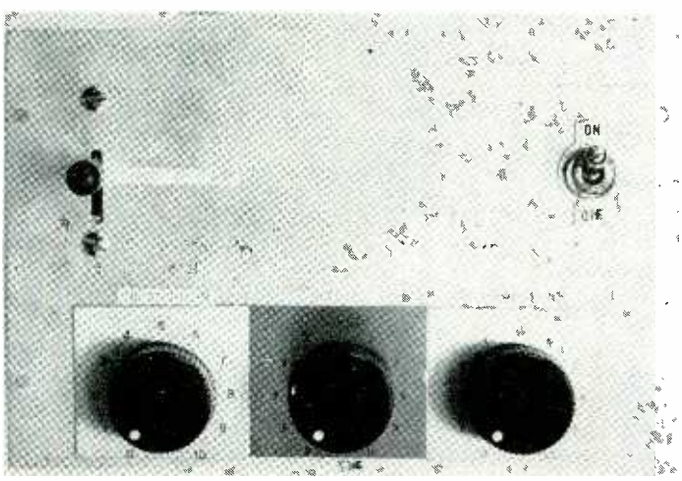


Fig. 1. Panel view of the preamplifier accessory described by the author.

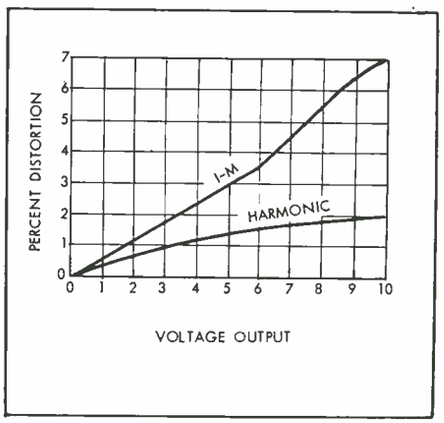


Fig. 3. IM and harmonic distortion curves from microphone stage to output. IM for phono and radio is .05 per cent, harmonic distortion 0.1 per cent at 10 volts output. (IM measurements made at 60 and 7000 cps, 4:1)

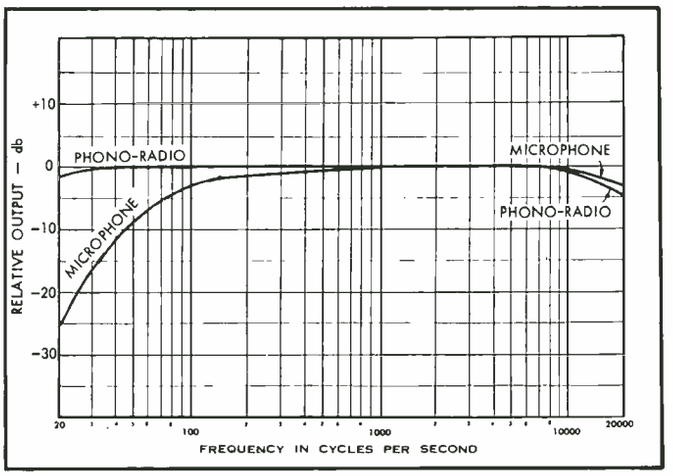


Fig. 4. Frequency response of radio-phono and microphone inputs at 1-volt output level.

connected to the terminals marked PROD on the preamplifier.

A microphone is connected to the input connecter so marked. The output level from this channel is controlled by the level control labeled MICROPHONE on the front panel. To page using the microphone, the lever switch is pressed down, automatically cutting out the radio and phonograph while connecting the microphone channel into the circuit. Pressing the lever switch permits paging through a group of speakers connected to the terminals marked OFFICE as well as the other group connected to the terminals marked PROD. The speakers connected across the terminal strip marked OFFICE, do not reproduce the signal coming from the radio and phonograph inputs.

This system will provide both music and paging for people doing production work in the factory. It will allow only the paging to be heard in the office, where continuous music is undesirable, while the paging is most necessary.

Circuitry

The circuit of the preamplifier in *Fig.* 2 is straightforward. Two inputs—phono and radio—are connected to their level controls, R_1 and R_2, where they are mixed. R_4 and R_5 are two isolating resistors so placed as to minimize interaction between channels. The junction of these resistors is connected through switch section S_{1B}, contacts B and F, to the cathode follower output tube, the 6C4.

The 6AV6 provides one stage of amplification for a crystal microphone, with the output level being controlled by R_3. This channel is shorted to ground through contacts C and E on section S_{1A} of the switch. Throwing the switch into the paging position, shorts the radio and phonograph to ground through contacts E and A of switch section S_{1A} while the microphone amplifier output is connected directly to the cathode follower through contacts F and D on section S_{1B} of the switch.

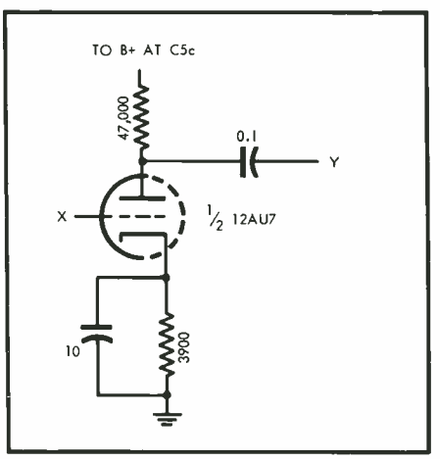


Fig. 5. Stage of amplification for low-gain power amplifiers. Other half of the 12AU7 is used in place of the 6C4 shown in Fig. 1. This circuit is interposed between points X and Y in Fig. 1, and B+ connection is made to capacitor C_{5c}.

While two sections perform this channel selection function, a third switch section, S_{1C}, connects the speakers in the office through contacts G and H when paging.

This unit drives the power amplifier. It can use this power amplifier to supply it with the necessary operating voltages. 6.3 volts a.c. is to be applied between terminals marked 1 and 2. A B+ voltage, anywhere between 100 volts at 1 ma and 450 volts at 6 ma is supplied at terminal 4. The negative side of this high voltage is returned to ground at terminal 3. 6 and 7 are connected across the on-off switch which is to complete the 117-volt a.c. circuit to the primary of the power transformer on the power amplifier. This switch is the master on-off control for both the power amplifier and the preamplifier. The terminal numbers refer to the octal plug connections when using this preamplifier with the Eico HF-50 or HF-60. When used with a power amplifier made by another manufacturer, the terminals must be connected so as to provide the corresponding voltage conditions.

Specifications

The performance of this preamplifier is excellent. The radio and phono harmonic distortion at 10 volts output is less than 0.1 per cent. The intermodulation distortion, when measured at 60 and 7000 cps with a 4:1 ratio is 0.05 per cent at 1.5 volts output. The intermodulation and harmonic distortion fig-

(*Continued on page 65*)

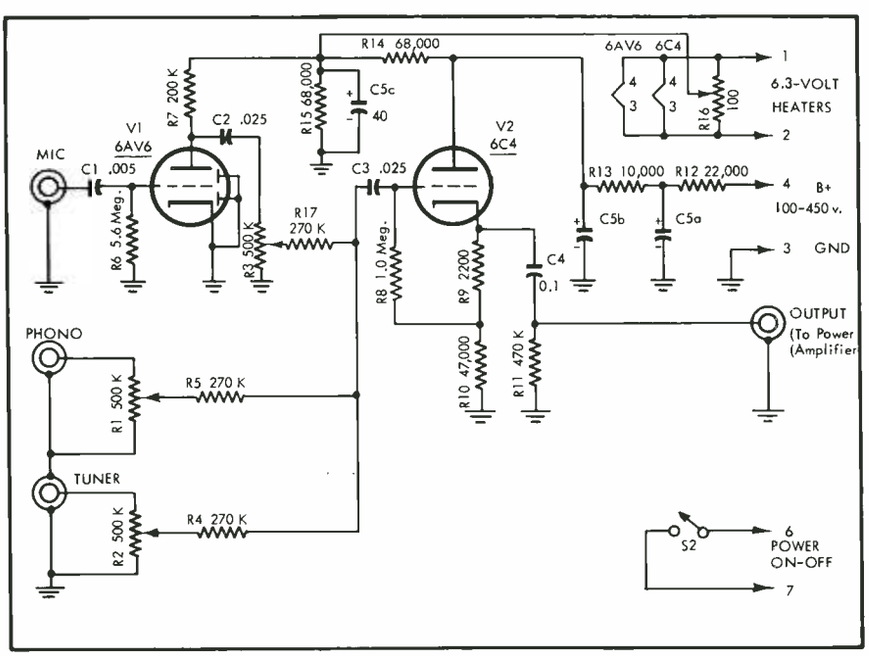


Fig. 6. Variation of Fig. 1 without switches. This uses the circuit as an ordinary mixer-preamplifier with a cathode follower output. The press-to-page switch, S_1, is omitted, and an isolation resistor of 0.27 megs has been added.

Integrated Audio Monitor for Home and Studio Use

RONALD L. IVES*

This simple and inexpensive piece of audio test apparatus could well become the nucleus of the serious experimenter's own "audio laboratory." Construction is easy because of the use of the basic elements of a standard kit.

MOST AUDIO WORKERS, whether professional, hobbyist, or both, find a recurrent need for some means of comparing the actual performance of amplifiers under a variety of conditions. Some of these tests are subjective, and may be conducted by listening to a recording of Koroido Ementado's "Lost Symphony" played through the amplifiers in turn. Others will be more objective, involving various square-wave and sine-wave generators, one or more oscilloscopes, and a host of other instruments, all costly.

For practically all of these tests, a standard speaker, of good-to-excellent quality; an audio-frequency meter; and a power-output meter of some sort are either desirable or essential. For a number of years, the writer has used an 8-in. Electro-Voice speaker, a Heathkit audio-frequency meter, and an audio wattmeter of the same manufacture with results slightly better than the manufacturers would dare claim.

An increasing number of instruments in use and some fundamental limitations of these instruments, in view of the writer's preference for low listening levels, made some changes desirable for operating convenience. After considerable experimentation, an integrated audio monitor was built, embodying on one panel a speaker, a baffle, an audio wattmeter capable of indicating down to less than 0.1 milliwatt, an audio-frequency meter dependable down to the same low power range, and the necessary power supplies and range switches. Performance of this combination has been gratifyingly satisfactory, eliciting several "make me one" requests.

General appearance of the audio panel is shown in *Fig.* 1, the panel being of aluminum, 8¾ by 19 in. The panel plus the cabinet—a gray Bud CR-1741—make a satisfactory baffle at low signal levels, but are not satisfactory for speaker inputs above about six watts. The face of the speaker is protected by a half-hard aluminum grille, procured from a kitchenware supply house.

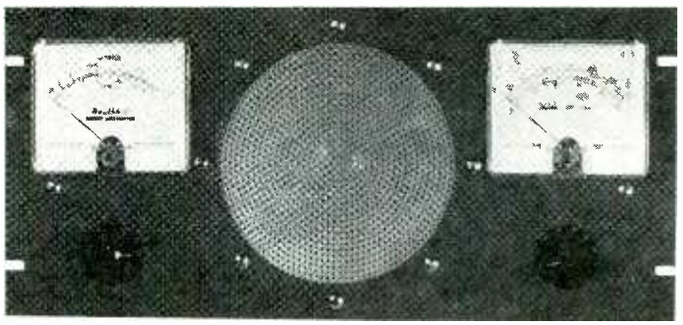


Fig. 1. Front panel view of audio monitor.

The audio wattmeter is mounted at the left, with its range switch directly below; and the audio-frequency meter is at the right, above its range switch.

The audio wattmeter circuit, based on the very satisfactory Heath design, but modified to increase the sensitivity and to protect the instrument pointer from slamming while switching, is shown in *Fig.* 2. Because this circuit is always operated in shunt with the speaker, the original dummy loads are omitted. To facilitate rapid checking of calibration, point six of the range switch is a calibration position. Ranges are shown in Table I.

TABLE I

POSITION	RANGE
1	0.5 milliwatts
2	5.0 milliwatts
3	50.0 milliwatts
4	0.5 watts
5	5.0 watts
6	calibration

A 50-watt position is intentionally omitted, as the speaker won't stand 50 watts, and neither will the local police! To eliminate grounding trouble, the calibration voltage is taken from the plate-power transformer, instead of from the a.c. line, as in the original instrument instructions.

Construction

Construction of the wattmeter, as of the frequency meter, is on two chassis, to allow space for the speaker magnet, as shown in *Fig.* 3. Switches, range resistors, and calibration dropping resistors are mounted on and in the subchassis; meter and switch plate are on the panel; other components are on the main chassis. Interchassis connections are made by means of Jones plugs. Chassis rigidity is secured by use of end brackets.

This audio wattmeter is actually a vacuum-tube voltmeter, with heavy and variable feedback, which measures the voltage across a known load resistor, but is calibrated in watts—a function of the square of the voltage divided by the resistance of the load. The switching mechanism permits the measurement of various voltage ranges without exceeding the normal capabilities of the amplifier (i.e., saturation and cutoff).

Range switching in this type of amplifier produced rather severe pointer slamming during switching, whether or not shorting switches were used. By employing a non-shorting switch on the a.c. supply circuit, and shunting a relay across the power transformer, with its contacts arranged to short the meter when the coil is de-energized, pointer slamming is reduced to a negligible value. The relay, a conventional 115-volt SPST component, was adjusted for quick action by tightening the spring and bending the upper contact down close to the armature contact when it is in closed position. Similar prevention of pointer slamming can be obtained by shunting several thousand microfarads

* *251 Lincoln Ave., Palo Alto, California.*

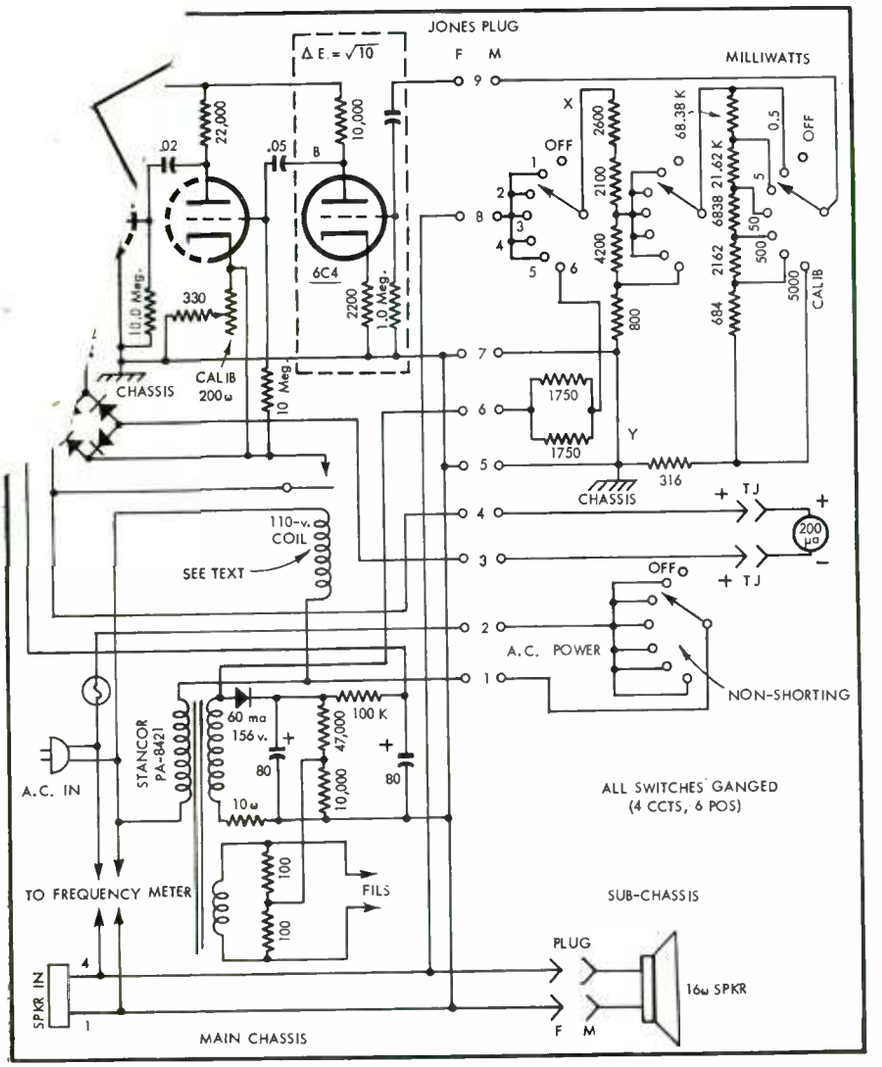


Fig. 2. Circuit of high-sensitivity audio wattmeter.

vague from the circuit diagram, *Fig.* 2, because a number of elements contained in the original wattmeter design, but not essential in this specific application, have been omitted. Originally, calibration was set by applying line voltage across a dummy load of 638 ohms, which, in parallel with the impedance-adjusting string (X—Y in *Fig.* 2) made up a total resistance of 600 ohms. When a 115-volt signal is applied across 600 ohms, the power dissipated is 22 watts. To calibrate, when 115 volts is applied across the original instrument, the CALIB control is turned so that the meter reads 22 watts (on the 50-watt range), and all ranges are then in calibration due to the use of precision resistors.

Now, when we apply 115 volts across a dummy load and the impedance-adjusting resistors (X—Y, *Fig.* 2) in parallel, we are also applying the same voltage across the impedance-adjusting string alone, and the dummy load (638 ohms) can be omitted without altering the calibration accuracy. When the power-transformer secondary voltage, with full load, is applied across the adjusting string in series with 875 ohms, the voltage at point X is exactly 115, and the requisite conditions for calibration have been met without the use of a 25-watt dummy load resistor. This voltage should be measured, and the series resistor adjusted if necessary to obtain the right value, as the voltage of the power transformer—under the light load imposed by this circuit—will run slightly over the rated 125.

With the exception of this possibly needed adjustment, all resistors other

of capacitance across the instrument movement, but this damps the response undesirably.

The physically large resistors are mounted on the top of the subchassis, and protected from both damage and accidental contact by a punched metal cover, which began life as the bowl of a potato ricer.

The 6C4 amplifier stage in *Fig.* 2, shown enclosed in dotted lines, was added to the monitor in order to get a 0.5-milliwatt range. If this low range is not desired, the points A and B in the figure can be bridged, and all boxed components omitted. This multiplies all range-position values by 10, and requires that the calibration point be shifted one position clockwise on all switches.

This amplifier is intentionally inefficient. To raise the sensitivity of the instrument by a factor of 10, the voltage need be raised only by a factor of the square root of 10, or roughly 3.16, because $W = E^2/R$.

Calibration

Calibration procedure may seem a bit

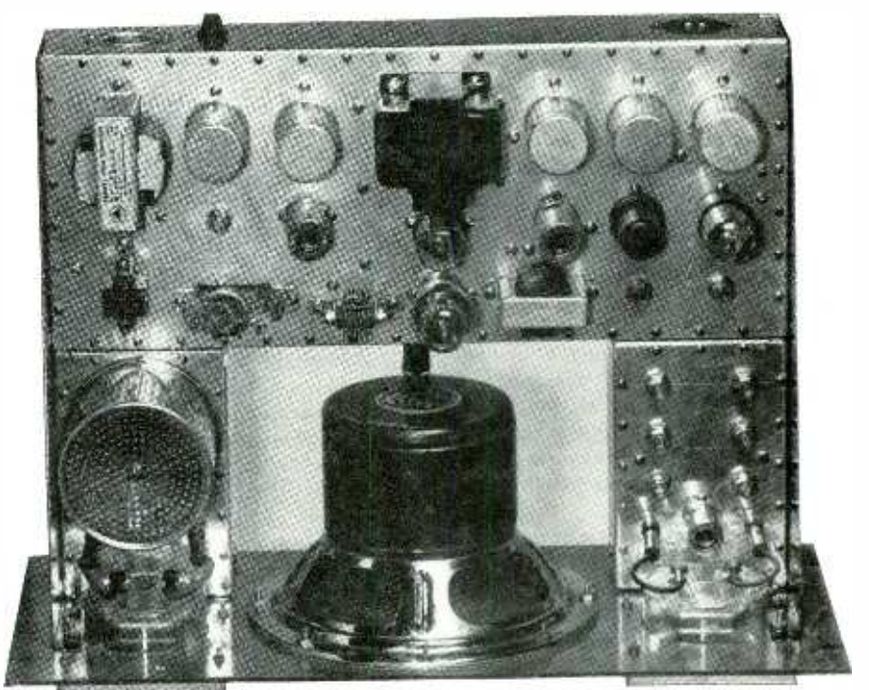


Fig. 3. Rear upper view of monitor, showing three-chassis format used to clear speaker magnet. Wattmeter subchassis is at right, frequency-meter at left, and main chassis at bottom in this view.

Testing for Transients

GEORGE FLETCHER COOPER*

In order to evaluate transient performance of an amplifier or system, some sort of "standard" transient is necessary. The problem is clearly stated by the author, and he gives a suggested solution.

FRANCIS BACON alighted from his coach to stuff a chicken with snow. He caught a chill and died. The chicken was, of course, already dead. The importance of this early experiment in refrigeration is not that it was the first step towards the deepfreeze but that it was an experiment. The classical philosophers devoted their lives to thinking about things, but after Bacon's time the natural philosophers unbent and began to look at things as well as think about them. This, indeed, was the beginning of Science and engineering as we know it today. There ought to be an epigram here, but with the Flit spray handy and the "clean" bomb round the corner I guess I'm not in a nineteenth century mood.

It seemed to me that after thinking a great deal about the special problems which transients introduce in feedback amplifiers the final test must be a practical one. What does this amplifier do to a transient? If it modifies it in any way it is not a perfect amplifier: if it modifies it very much it is not really a good amplifier. Do not, I pray, take this appeal to experiment as a sign that I have given up my faith in theory. Far from it. Theory is the essential background to all experimental work in spite of all that the so-called practical men say about it. A single test is rather like licking a cut lemon: with properly applied theory before and after the lemon is squeezed dry.

Testing for transients is obviously quite a simple matter: connect your transient sender to the input of the amplifier, adjust the transient distortion meter and read off the distortion. It's rather like saying that all you need to measure the distance to the moon is a measuring tape, a piece of string to keep you on the right line, a piece of chalk and a dark night to make chalk marks against. We haven't got a transient distortion meter—we haven't even got a standard transient. This should not deter us—if a standard transient does not exist it is necessary to invent it. The first problem is to decide what to invent.

A look back at the history of steady-state distortion is profitable at this point. Most of us, most of the time, test the steady-state linearity of an amplifier by applying a single pure sine wave. We know that no musical instrument worth listening to produces such a signal, but it provides the necessary operational simplicity. Just as in the old days you could buy a Ford in any color you liked, as long as you liked black, so you can easily get non-linearity characteristics any way you like, as long as you like the simple harmonic method. A great deal of ingenuity has been put into ways of interpreting harmonic measurements. At first we just measured the ratio of harmonic to fundamental. Then we started to use output tetrodes and everyone decided that they sounded worse, for a given amount of distortion, than triodes; this was, of course, in those happy days when we used to say that 5 per cent was the tolerable limit. Investigation showed that the tetrode produced higher harmonics, while the triodes were only producing seconds and thirds. Now we began to get complicated machines to measure each harmonic separately and clever chaps suggested clever formulas for making allowances for the order of harmonic. A sixth harmonic, we said gaily, is 3 times, or 9 times, as bad as a second.

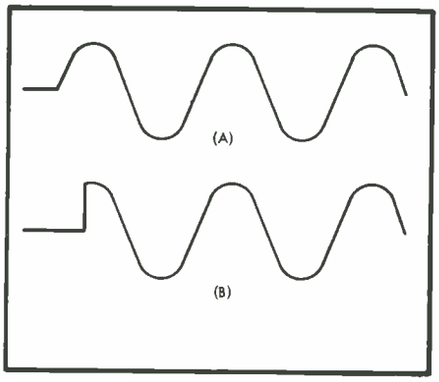


Fig. 1. If you switch a generator into the circuit, you may get (A) or (B) or something in between.

What with all these measurements and all these sums we had to work harder and harder to know less and less. Intermodulation testing, which at one time had looked almost like the ultimate in scientific precision, began to look like an easy way out. It also, now we came to think about it, looked like a sensible way out, too. Negative feedback, which had been a strictly professional technique, now made its way into the entertainment audio amplifier field and the old simple distinction between triode and tetrode distortion characteristics disappeared. Now we were happy and in practically no time at all the intermodulation testers were gathering dust in a corner of the workshop and the simple distortion bridges were back on the job: we were aiming now for such high linearity that it didn't really matter what it was.

In a way, I feel like a film actor in a Western, cantering off down the same old trail in what will probably turn out to be the same old story. There is always a hope, though, that perhaps the man with the black hat will be the hero and the man in the white hat the villain; there is always the wonder, too, that the man who wants to be a villain doesn't take shooting lessons. But we must head off down the trail, the trail to the standard transient.

Test Signal for Transients

As I said earlier, our steady-state distortion is measured with a pure sinusoid. It seems fairly logical, therefore, to use as our transient the beginning of a pure sinusoid, the start of our standard signal. The input to our amplifier will then be divided into two parts. Until a certain instant there will be no input at all, and after that instant there will be a steady sine wave input. That, you might imagine, is all we need say, and all we need do is put a switch in series with our ordinary sine wave generator. The experienced engineer will know that it really is not quite so easy: the experienced reader will guess that there must be some hidden snag, or what on earth can this article be about?

Look now at *Fig.* 1. Both the wave forms shown satisfy the description given in the last paragraph, but I think you will agree that they are not at all the same sort of transient. These two wave forms represent the extremes you can get with a simple switch depending

* *London, England.*

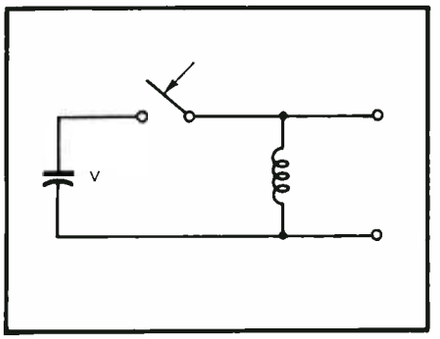


Fig. 2. This circuit will give you the signal of (B) in Fig. 1 every time.

on whether you close it at the instant of zero voltage or the instant of maximum voltage. In general, you will get something between the two, and never the same twice running. Quite clearly, there is little or no future in using a test signal which differs significantly from test to test. Somehow we must start up our sine wave in an absolutely standard manner.

It is useful here to think about an ordinary pendulum, a simple weight hanging on the end of a string. Suppose it is hanging quite freely, at rest, and we fire a very fast, very light bullet at the weight. From your schooldays you may remember something about the conservation of momentum, which enable you to work out the velocity with which the pendulum bob will suddenly start to move. Once it is moving, of course, it just swings to and fro, until air damping brings it to rest. This is the sort of behavior we have at (A) in *Fig.* 1. Suppose, on the other hand, you have an iron bob and to one side you place a solenoid and some ingenious switches. Switch on an enormous current: the bob will fly to one side, trip the switch to disconnect the current and will then be free to swing, just as at (B) in *Fig.* 1.

The reason for looking first at the pendulum is that it is easy to distinguish the two cases: in the first we begin oscillations by a sudden step in velocity, in the second by a sudden step in displacement. Now we must try to find the electrical equivalent of these, so that we can generate either waveform at will. The easiest circuit to think about is the one shown in *Fig.* 2. We charge up the capacitor by some means not shown, which is a high hat way of saying put a battery across it just before we are ready to start. When we close the switch the voltage across the coil jumps suddenly to V and the circuit starts to oscillate in the way shown at (B) in *Fig.* 1. You can find the behavior of this circuit worked out in detail in quite a lot of books but if you will accept the fact that a tank circuit oscillates sinusoidally it is rather easy to see it must be according to (B) of *Fig.* 1. In the first instant the coil will pass no current so the voltage must jump suddenly to V. O. K.? The amount of energy available is $\frac{1}{2}(CV^2)$, so the voltage can never exceed $\sqrt{V^2}$, which is just $\pm V$. Therefor the voltage jumps to V and swings to and fro between $+V$ and $-V$.

Alternative Circuit

A circuit which will give us the waveform of (A) in *Fig.* 1 is shown in *Fig.* 3. To begin with the switch is closed and a current flows steadily through the inductance. As always in studying simple circuits we assume that components are perfect, so that the coil has no resistance and there is thus no voltage across the capacitor. Then we open the switch. The current in L continues to flow because of the stored magnetic energy, but the only place it can flow to is the capacitor, which begins to charge. When all the magnetic energy, $\frac{1}{2}(LI^2)$ has been converted into electrostatic energy, $\frac{1}{2}(CV^2)$, the current stops, the capacitor starts to discharge and so a current

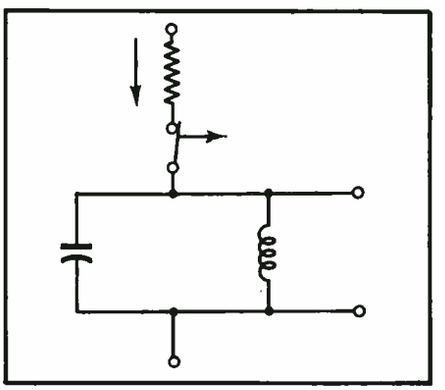


Fig. 3. This circuit will give you the signal of (A) in Fig. 1 every time.

is started in the opposite direction. And so on. We expect a sine wave out of the tuned circuit: we have seen that the voltage starts off at zero and moves steadily just as in (A) of *Fig.* 1.

These circuits as they stand are not particularly useful. I am going to concentrate on the simple circuit of *Fig.* 3, and see why we cannot use it just as it is. The first problem is charging the capacitor, not a very serious problem, because a battery and a switch are all that are needed, but an additional complication. Much more serious is the problem of the switch actually shown in *Fig.* 3. I know that we are always drawing switches in circuits but when you come to try to get a good cheap switch which has no contact bounce you find you have set yourself a real problem. Every switch I have tried makes and breaks and makes again several times during the first few milliseconds and now, in our problem, every millisecond may be one or more cycle of the input. It is not that they are bad switches, but just that nobody worries normally if there is a little bouncing during the make period. The second serious difficulty is that as soon as any practical load, such as an amplifier input, is connected to the terminals the circuit will be damped and will have a rather poor Q. Exceptional amplifiers with very high input impedances will be all right, but we do want a general purpose tester, not one which is only suitable for the special amplifiers.

In this situation we naturally turn to the cathode follower, whose every characteristic fits this particular job perfectly. High input impedance leaves the tuned circuit as free as possible to oscillate, all the feedback it is possible to get with one tube makes it as linear as we can hope for and the low output impedance makes it fairly easy to connect a load.

The introduction of a tube into a circuit without tubes is a very critical step. Like Caesar crossing the Rubicon or a reformed alcoholic taking his first Martini or those people in Boston—how much wiser to have thrown the tax collectors in the sea and drunk the tea—something has been begun which may not easily be stopped. Engineers, I've noticed, are prone to suffer from tubophilia, the love of putting tubes in everywhere they can imagine and this disorder takes many years to cure. However, once you have decided to use a tube there is no reason why you should not make it earn its living. For this reason, I have not drawn a circuit showing the combination of the tuned circuit of *Fig.* 2 and a cathode follower, which you could draw for yourself anyway. I want the tube to do a bit more work.

A Practical Transient Generator

Dissipation is always with us, in our circuits, in our nightclubs, and the practical form of *Fig.* 2 is no exception. Those neat sinusoids of *Fig.* 1 will decay more or less slowly unless we do something about it. Now that we have introduced a tube into the circuit it is quite easy to counteract the losses in the tuned circuit in a safe and easily controlled way. Let us look at the circuit shown in *Fig.* 4.

(*Continued on page 74*)

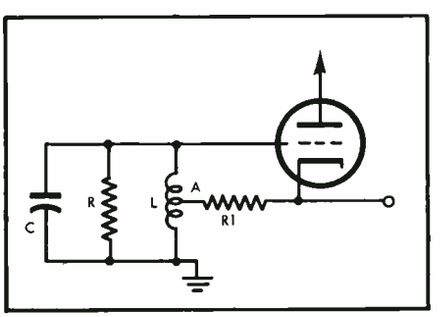


Fig. 4. We can make our cathode follower remove the effective damping of the tank circuit in this fashion.

Trends in Audio

HERMAN BURSTEIN*

The author gives an intelligent and comprehensive summation of the direction that developments in audio equipment have been taking over the past years.

SOME OF AUDIO'S OLDTIMERS will tell you that things aren't really much different than twenty years ago. Such things as stereo, high-power amplifiers of low distortion, flexible tone controls, and loudspeakers smoothly covering the full audio spectrum had already been developed by the middle or late thirties, they'll claim. Others, however, will assert that the world of sound today is far more advanced than two decades ago.

These views can be reconciled. It is true that fine audio equipment existed 20 years ago or so. But it was in the laboratory broadcast studio, or the movie theatre, and accessible just to a select few. It could be brought into the home only through special knowledge and at great cost. Today, on the contrary, high fidelity equipment is accessible to the public at modest cost.

From the audiofan's viewpoint, the most meaningful measure of audio's progress is in terms of what is available to him. So it can rightfully be said that audio has taken tremendous strides in the course of a generation.

About ten years ago, when the public was first becoming acquainted with high fidelity, the limited number of available components did not change rapidly in number or quality or features. Today there is a rapid succession of new developments. But these do not constitute a shapeless branching of the audio art. Instead, as in any other field, it is possible to discern some very clear trends, and it is the purpose of this article to point out a number that seem to be of importance.

Speaker Systems

Whereas full-range sound, particularly at the low end, was exclusively associated with big speaker systems in the early days, recent times have witnessed the invention of truly fine speaker systems approaching "bookshelf" size. While this development is of importance where the listening area is relatively small, it takes on double importance in connection with stereo, which demands two of everything. Various ingenious means are utilized in these small speaker systems to produce big bass, an excellent example being the acoustic suspension principle, which uses the air behind the woofer as the restoring force for the cone. This permits an extremely compliant cone, lowering its resonant frequency and extending response downward. Furthermore, use of air instead of a mechanical device as the chief restoring force means greater linearity and reduced distortion.

Electrostatic speakers have come to the fore, so much so that several of them are rated among the best tweeters available. Of course, like anything else, there are top-quality electrostatics at top prices and those of lesser quality at low prices. Their frequency range is gradually being extended downward, and there are some today that successfully operate well down into the mid-range.

Especially worthy of note is the increasing recognition that speaker and enclosure, whether by design or accident (as sometimes happens), must be compatible—integrated. Thus the available number of integrated speaker systems is greater than ever before. Many manufacturers who previously contented themselves with making only speakers now also provide enclosures specifically designed for their units. Others manufacture integrated systems that use speakers of standard make.

Power Amplifiers

There has been a rather amazing trend toward high-power amplifiers, with outputs in the region of 40–60 watts being common, and some even exceeding 100 watts. These are being used in place of the 10- and 15-watt amplifiers once considered quite sufficient for rooms of average size and speakers of average efficiency. What is more, many of the high-power units are available at prices not much different from what the low-power ones used to cost.

Even though the high-power amplifiers are used at but a small fraction of capacity, they are claimed to provide greater clarity and fullness of sound than their smaller brethren. Some experts, however, point out that it is true a design producing good performance at high power thereby usually encompasses excellent performance at lower levels, but that one can also design for excellent performance at low levels without having to build for high output. And they can cite a few low-power amplifiers, including some of British make, to back up their statement.

On the other hand, there is valid reason in many cases for use of high-power units. Some of the finest speaker systems made today, such as the acoustic suspension type, are of low efficiency, perhaps a tenth the efficiency of others on the market. If something like five watts is required for the latter (allowing a reserve for unusually high levels of reproduction), then about 50 watts would be needed for the low-efficiency speakers.

Variable damping, after a good deal of controversy concerning its virtues when employed with high quality speakers, appears to have finally caught on, for today it is found in a number of deluxe power amplifiers, which are not ordinarily used with cheap speakers. Although reduction of the damping factor does not improve results with many high grade speakers, on the other hand it does have this effect with some, such as the acoustic suspension type, whose manufacturers claim that a factor of 1 is optimum for best bass. It is common practice in top grade amplifiers having variable damping to provide for simultaneous control of voltage and current feedback, so that the total amount of negative feedback remains virtually constant. In some instances the damping factor is made variable over the range from zero to infinity, and a few even permit a negative damping factor.

The quest for lower distortion and cleaner sound has resulted in the growing popularity of bi-amplifier systems, that is, division of the audio spectrum between two power amplifiers. By keeping the highs in one unit and the lows in the other, intermodulation distortion is reduced in the same manner as by using separate speakers for woofers and tweeters. The strength of the trend is demonstrated by the increasing number of electronic crossover systems reaching the market. In fact, at least one three-way electronic crossover is available which, of course, signifies a tri-amplifier system.

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

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

Because the record player is so critical in a fine music system, you cannot afford to compromise with quality. Your loudspeaker may reproduce 20 to 20,000 cps; your amplifier may put out 50 watts of undistorted power—but **the music begins** at the record player. That's why today's high fidelity systems require the all new Collaro changer with the revolutionary transcription-type tone arm.

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

It's worth noting that Collaro quality is so well recognized that leading American manufacturers of fine console units incorporate Collaro into their instruments in order to achieve the best possible performance in a record player. Among these manufacturers are Magnavox, Stromberg-Carlson and Altec-Lansing.

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

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

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

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Control Units and Preamps

The search for lower distortion continues as much in control units as in power amplifiers. Thus the use of feedback is now common in this type of unit, as it has been for a long time in power amplifiers. Tone controls of the feedback type are usurping the role of the losser kind.

Despite a certain amount of dispute about their necessity when bass and treble controls are available, and a certain amount of misuse by owners, the loudness control is apparently here to stay. In the best units it takes the form of a continuously variable control, which can be set in conjunction with the gain control so that bass boost does not occur when level corresponds to the original sound, but begins to come into effect as volume is reduced.

The inevitable appearance of the transistor in high fidelity equipment has taken place initially in the control unit or in units that are preamplifiers only. There is at least one all-transistor control unit now on the market, as well as several transistorized preamplifiers designed for use with magnetic phono pickups, dynamic microphones, or tape playback heads. Some control units have transistorized front ends as a means of keeping hum and noise to a minimum.

An input for direct connection to a tape playback head has become fairly prevalent in control units. The signal from the head receives the required amplification and equalization, in a manner similar to that for a signal from a magnetic phono pickup. The general practice is to provide NARTB equalization or a close approach to it inasmuch as the majority of commercial prerecorded tapes now employ this characteristic.

Tuners

FM tuners have been growing more and more sensitive so as to bring wide range, static-free sound to listeners hitherto on the outskirts of FM reception. There has also been growing awareness that sensitivity and frequency response are not the only requisites of a good tuner, and increasing attention is being paid to distortion. Only quite recently have manfacturers' specifications had much to say about distortion in their FM tuners.

AFC (automatic frequency control) is now found in every fine FM tuner made today for the high fidelity public, being imperative where no tuning indicator is used, and, even though an indicator is present, still being highly desirable as a means of tuning easily to a station and locking to it. More and more FM tuners are appearing with meters to assist in precise tuning, which cuts down distortion and noise. Other tuners are using improved forms of tuning eye. To mitigate the consequences of off-station drift, there has been increasing use of wide-band detectors. Where detectors previously had a bandwidth of perhaps 200 kc, today it is not uncommon to find them with 500 kc and even 1- or 2-mc bandwidth.

As part of the trend toward maximizing enjoyment of FM sound, various devices have appeared to permit high fidelity reception of the FM sound on TV. These are of two kinds. One attaches to the TV set to pick up the FM signal there. The other is an independent FM tuner which can be dialed to the TV channels.

While multiplex FM reception—two sound channels on one station, thus permitting stereo reception—is not yet available to the public (though already in commercial use), it seems to be sufficiently close that many FM tuners include a multiplex outlet, intended to feed a special attachment which will detect the sound on the second channel.

FM has finally gone mobile. Whereas for many years one could obtain only AM radios for automobiles, today it is possible to obtain FM sets as well.

In the case of AM, audiofans have become increasingly conscious of the fact that many stations transmit a signal which is of high fidelity quality, or close to it. Many persons associate AM broadcasting with an inevitably limited frequency range of about 5000 cps. But this is not so. Many stations transmit flat to 10,000 cps and beyond. The chief limitation in the past was the AM *tuner*, which had a bandwidth of about 5000 cps or less. But the trend has been to AM tuners with bandwidth of 8 or 9 kc and having sharp filters to eliminate the undesirable 10-kc interstation whistle. Also, attention has been focussed on reducing distortion by means of better detector circuits. A development that promises to further improve AM reception is the use of single sideband transmission by the broadcast station, which will double the bandwidth of existing AM tuners.

Finally, it seems appropriate to mention what is more the completion of a cycle than a trend, namely the number of "receivers" on the market. A receiver may be defined as a tuner (usually FM-AM) which combines on the same chassis all the other electronics of a high fidelity system, specifically the control unit and power amplifier. Whereas in the early days of high fidelity it was considered that the only path to good sound was through the purchase of separate components, today one again finds the single package high in relative quality and public estimation.

Phono Equipment

The greatest advances in phono equipment—perhaps because there was the most lacking—have probably been in pickups. While part of the progress is attributable to new designs, as in the case of capacitive and moving magnet pickups, there has been a definite march forward in each of the older types, namely variable reluctance, moving coil, and piezoelectric. One may further discern a trend toward relatively greater use of the moving-coil principle; some of the very best, and also most expensive, pickups found today are of this type.

Turntables have improved in the sense of less rumble, particularly since better speaker systems have imposed stricter rumble limits. More attention has been given to accurate speed (for those with golden ears), and not a few turntables, as well as some changers, include variable speed or a stroboscope or both.

Even such a thing as the stylus cannot be taken for granted. For one thing, it has become axiomatic that in high fidelity systems nothing less than a diamond tip will do in order to minimize wear of the stylus and of the record, and the resulting distortion. But that is not all. Toward reducing tracing (not tracking) distortion, styli with diameters of 0.9, 0.7, and 0.5 mil have been introduced.

Toward obtaining maximum performance from discs, there has been a fair rash of devices for keeping dust out of the grooves. Since even a diamond stylus is subject to wear, there are devices which prompt the user to action before grave damage can be done to the discs by a chiseled tip. These include magnifying glasses so that the owner can inspect the stylus, and phono timers, which tell him how many hours of use he has had from the stylus.

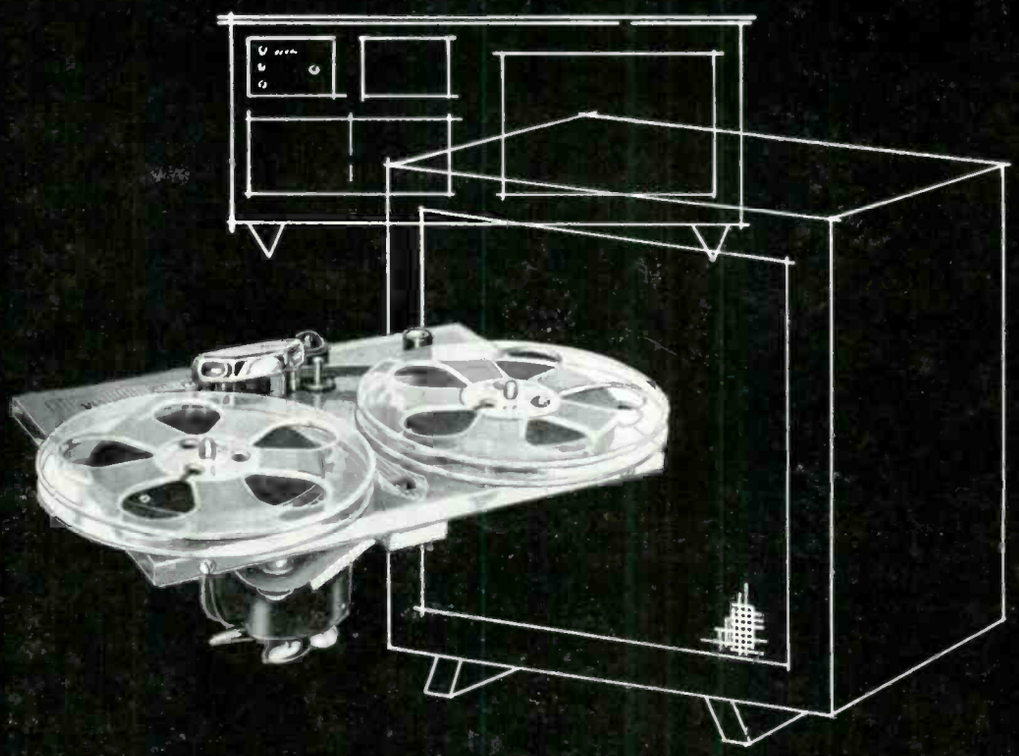
Although perhaps less readily apparent to the ear, improvements have taken place in tone arms, reflected by designs which serve to reduce arm resonance below audibility, to ensure minimum tracking error, to protect the stylus in case of sudden drops, and to enable the user to handle the arm with ease and convenience. With respect to reduction of tracking error, one should note the appearance of the radial and pantograph arms.

The phonograph now has a fourth speed, 16⅔ rpm. Though chiefly confined to reproductin of the spoken word, it may come into use in home music systems, judging from the extent to which it appears in turntables and changers that have recently come on the market. Actually, it is already in use for music, being the speed of a specially designed phonograph for the automobile, and some records for home use have appeared on the market.

Finally, one should note the recent appearance of the electronic turntable drive, which frees the user of depend-

(*Continued on page 70*)

step up to stereo with Viking tape components



The component concept

A Viking Stereo Deck can be added to your present hi-fi music system utilizing the amplifiers and speakers you now own. This is the Viking "component" concept. It means you do not need to buy amplifiers or speakers which duplicate the functions of those you already have.

Will it record?

Used with the Viking Recording Amplifier, this same stereo deck becomes a recorder and (don't miss this point) as such, actually meets or exceeds the critical NARTB* standards. *Properly used, the Viking will record and play back recorded material with broadcast quality, and at a home recorder price.*

Stereo recording

Viking provides not only in-line stereo recording, but simultaneous dual channel erase — virtually a Viking exclusive. No need for bulk erasing of tapes, or a "double-pass" erase. The new Viking FF75ES Deck provides dual erase heads. Used with synchronized Viking RP61 Recording Amplifiers, you can record original material in stereo, copy tapes, or record from stereo broadcasts with the same full-fidelity which characterizes Viking monaural recorders. (Erase bias oscillators must be synchronized to prevent heterodyne.)

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Hear the difference in recording capabilities, in signal-to-noise ratio and overall frequency response.

Your dealer will help you with integration of Viking components with your present system . . . or write direct to Viking's Customer Service Department for suggestions. Free stereo literature and catalogs available on request.

* National Association of Radio and Television Broadcasters

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Why Match Impedances?

PAUL PENFIELD, JR.*

The author comes to a different conclusion about how and when to match impedances in electronic systems, and shows why.

ALL ELECTRONICS ENGINEERS have the feeling that, somehow, "impedances should be matched." This feeling is sort of an axiomatic thing, never questioned. After all, everybody does it. But also, we realize that the rule is not universal, that there are exceptions. When we run across a few cases where it doesn't hold, we're apt to shrug them off with the feeling, "of course it doesn't apply universally, but it's still a good rule of thumb."

The fact is that it is *not* a good rule of thumb. The cases in which it is wise to match impedances are few and far between. It should no longer be regarded as a good principle.

The problem, of course, is just this: In designing an electronic system of some kind, such as generally represented in *Fig.* 1, is it good engineering practice to try to match impedances at every point in the system? Probably no one would take quite as extreme a position as to say yes, but still most of us would expect that impedances would be matched at a fair number of such points. However, in the majority of cases it is *not* wise to match impedances. This concept leads one into trouble very easily.

We then ask the important question, "when do we match impedances?" We'll answer this question at the end of the article.

AT THE OUTPUT

First, at the output of any such system. Here there *are* cases where it may be desirable to match impedances. In particular, if the load impedance can be changed without affecting the rest of the system, then a well-known result follows, this result being: *to obtain maximum power dissipation in the load its impedance should be the complex conjugate of the internal impedance of the rest of the system, looking backward from the output.*

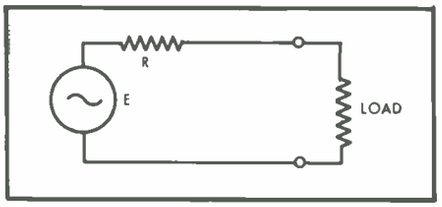

Fig. 2. Equivalent circuit of output circuit and load. We suppose that by making adjustments, E and R can be varied independently.

Furthermore, if the output load for some reason is constrained to be a pure resistance, then maximum power transfer occurs when the value of this resistance equals the absolute value of the internal impedance, regardless of phase.

The whole impedance-matching concept rests on these statements—to secure a maximum power transfer impedances should be matched, in the sense just indicated.

Just making these statements implies something about our system—in particular, it implies that we are operating it with a sine wave, at one frequency only, because of the representation of impedance as a complex quantity.

If we're concerned with a range of frequencies, we can't make an exact match, but instead have to be content with an approximate match unless, of course, the internal impedance happens to be a pure resistance.

In addition, this statement assumes that the internal impedance is well-defined, independent of the output voltage. That is, the volt-ampere characteristics of the output have to be linear. In nonlinear cases we may not be able to find any load which maximizes the power transfer for all operating conditions.

An illustration of matching impedances for maximum power transfer might be a common dry cell. Maximum power transfer to a load is made when the cell impedance and the load impedance are the same. Batteries are never run this way, of course, because they would burn out much too rapidly. But this loading does give maximum power transfer.

Another case where we might want to match impedances is at the output of a radio transmitter. Our aim is to provide maximum power flow from the antenna, and we might think this would occur when the antenna and transmitter were matched.

Here, however, the reasoning is different. The load impedance is fixed, and by adjusting or designing the transmitter we want to make the power flow a maximum. A close-up of the output circuit, *Fig.* 2, shows how, by tuning the transmitter we can vary E and R relatively independently. Maximum power flow results not when the impedances are matched, but rather when the internal resistance goes to zero.

Alternatively, if it turned out that E and R could *not* be varied independently, we would have to take a closer look. For example, if E varied proportionally to R, then to maximize power output we should make R as high as possible.

In this case there are many factors, such as the presence of the transmission line, and so on, which cloud the issue. However, it is clear that impedance matching is not the principle to follow.

Even when maximum power flow is the prime consideration, then, matching impedances is not always the thing to do. What about cases in which we are not concerned with providing maximum power transfer?

Loudspeaker "Matching"

Consider a common loudspeaker attached to an audio amplifier. Matching is generally not desirable here.

(*Continued on page 67*)

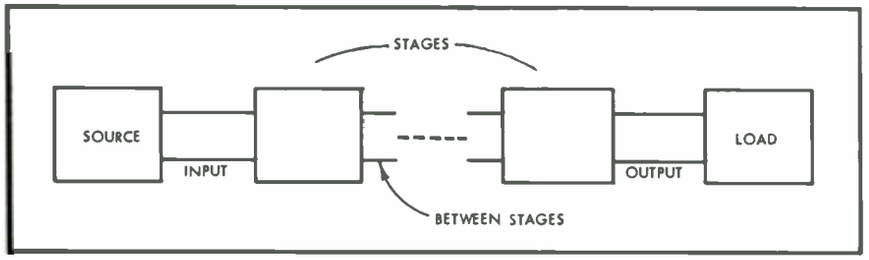

Fig. 1. General sort of electronic system, showing a source connection to the input, and a load of some kind connected to the output.

* *269 Westgate West, Cambridge 39, Mass.*

Ellington Photo by Aram Avakian

The Duke was made for High Fidelity

Ferde Grofe, who went on to write for Toscanini, used to sit all night in the old Cotton Club, moved and mystified by the music of Ellington. He finally confessed that the Duke's magic could not be set down as so many notes on a piece of paper. The phonograph records of those days in the late twenties, treasures though they are, give us little more than the shadows of what Ferde Grofe heard.

The elegance which is Ellington's now was there 30 years ago when he and his five Washingtonians sat down to make their first records before a solitary horn pick-up in a New York loft. It is still there in muffled echo for those lucky enough to have the old recordings. For the essence of jazz is the impulse of the man who plays it; and the essence of the Duke is not one instrument—but 15—because he alone among jazz composers has made the whole orchestra his instrument.

Today, for the first time, we are as rich as he, for the records we play at home over high fidelity, or the performances we listen to over FM, have all the sumptuous texture that taunted Ferde Grofe because it seemed to him then beyond recapture.

High fidelity has come of age and many excellent instruments are available today. The distinction that is Harman-Kardon's comes, perhaps, from the sensitivity and understanding its people have for the work their products do. There is more here than simple devotion to perfection in curves and percentages. That surely exists at Harman-Kardon; but a genuine feeling for the "bursting white lights" and the limitless shadings of the music is also there. Inescapably, this special sensitivity to the music—whether Ellington's or Mozart's—is expressed in the way operating controls are organized, in the emphasis placed on one function over another and in the way the product looks.

Perhaps the finest expression of this marriage of engineering skill and feeling for the art is the Harman-Kardon Festival II, Model TA-1040, shown above. Here in a graceful compact unit is a complete and powerful high fidelity electronic center. Simply connect it to an equally fine record player and speaker, and a high fidelity system of incomparable performance is yours.

The Festival combines a highly sensitive AM-FM tuner, a complete preamplifier and a 40 watt hum-free, distortion-free power amplifier. It features: magnificent Armstrong FM with Automatic Frequency Control to insure accurate tuning *automatically;* Automatic Noise Gate to eliminate noise between stations when tuning; sensitive AM with 10KC whistle filter; Dynamic Loudness Contour Control to provide precise balance for your own hearing characteristics; enormously effective treble and bass controls to adjust for the acoustics of your room; selectable record equalization; remote speaker selector switch; illuminated tuning meter and rumble filter. All this expressed in six easy to operate controls.

The cage and control panel are finished in brushed copper; the knobs and escutcheon frame in matte black. The Festival stands 4-5/16″ high, 16-1/8″ wide and 14″ deep.

The Festival price is $250.00 Slightly higher in the West.

We have little regard for the typical commercial testimonial, but happily, our admiration for Edward Kennedy Ellington is reciprocated by the Duke. Long before this advertisement was contemplated, he had chosen Harman-Kardon tuners and amplifiers for his personal and professional use. The Festival, he tells us, is his favorite for listening at home.

FREE: beautiful, new, fully illustrated catalog. Describes complete Harman-Kardon line and includes guides on how and where to buy high fidelity. Send for your copy now. Write: Harman-Kardon, Inc. Department A-14, 520 Main Street, Westbury, New York.

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INCORPORATED

The Compass-1—A New Loudspeaker Design

MILTON D. THALBERG*

Omni-directional both in sound radiation and in its uniform front and back appearance, this new speaker system is the ideal solution for stereo use—either in pairs, or as the second speaker being added to existing systems.

TO DEVELOP A NEW LOUDSPEAKER design after so many years of progress in enclosures has become somewhat of a problem, but there will always be room for improvement, probably as long as there are interested people who are never satisfied with anything but the best. And with the advent of stereo reproduction in the home, the requirements have changed so radically that many of the tried and true designs of the past have become hopelessly obsolete. When we add to this the changing fashions in home decor—not to mention the fact that high fidelity has long since graduated from the experimental stage and is now accepted in the living room.

To keep step with the augmented requirements of the loudspeaker, both in appearance and in application, a new design seemed imperative. In the first place, it is not always convenient to provide a space along the wall for a loudspeaker cabinet—many home decorators envisage a location alongside a chair where it can do double duty as a table as well as a loudspeaker. In the second place, when used as a part of a stereo system, loudspeakers must be used in pairs. This argues still further for a design which will permit more flexibility in placement.

When we move further into the technical requirements of a loudspeaker to be used in a stereo system, we find that very few of those heretofore available provide the wide dispersion angle which is so often desirable if we are to have flexible positioning of the speaker systems. While a pair of conventional cabinets may serve quite satisfactorily when used in pairs along a wall directly opposite the normal listening area, they are likely to be hopelessly inadequate in any other location in the room. For these reasons the Compass-1 was developed. And in addition to them, one other feature was added to simplify for the non-technical user a highly technical requirement for a pair of loudspeakers used in a stereo system or for unison reproduction of a monaural program through two speakers.

* *Kingdom Products, Ltd., 514 Broadway, New York 12, N. Y.*

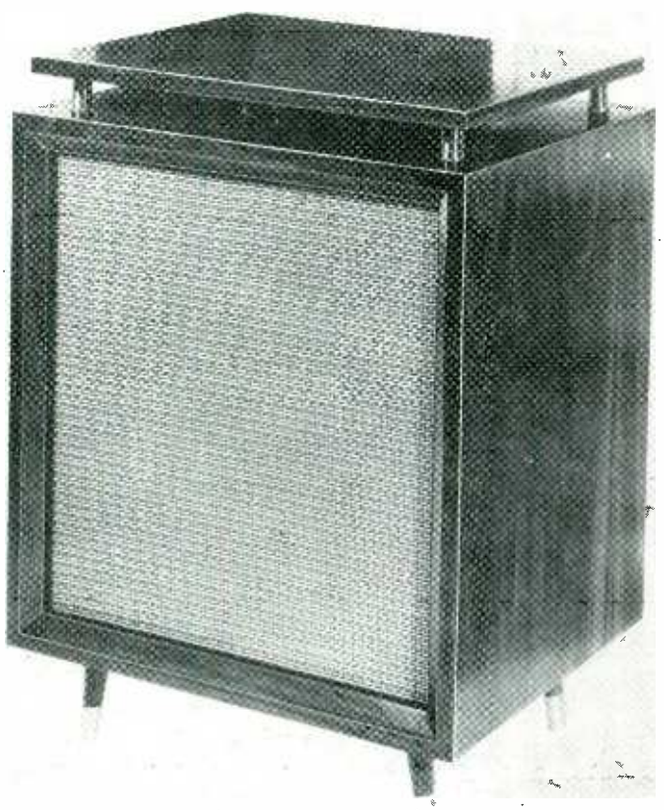

Fig. 1. The Compass-1—a new speaker design with especial adaptability to stereo systems.

Physical Design

The Compass-1 is, first of all, a high-quality two-way loudspeaker in a compact yet beautiful custom-built cabinet finished in mahogany or walnut, and mounted on four-inch legs with polished brass ferrules, as shown in *Fig.* 1. To permit complete flexibility of placement in the room, both front and back are covered with grill cloth, and connections are made at the bottom. *Figure* 2 shows the appearance of the rear. This may seem like a simple change in a loudspeaker cabinet to permit it to be used anywhere, but this is, in itself, unique in the loudspeaker field. However, this feature, along with the omni-directional dispersion of the tweeter, completely frees the home decorator from any limitation as to where the speaker may be placed. Thus two units may be located at the ends of a divan, at the two sides of a fireplace, at opposite sides of a bay window, or at opposite sides of a long room to serve as dividers. The lady of the household—who is so often the only decorator who has to be satisfied—is certain to welcome a loudspeaker which is so flexible in use.

The top of the Compass is 15 in.

Above: Enlargement of so-called "bargain" stylus. (Magnified phato)

Below: Enlargement af genuine G-E diamond stylus. (Magnified phata)

All G-E styli come to you in factory-sealed boxes, clearly marked with the General Electric manogram. To make doubly sure, look for the "GE" an the bottom af the stylus assembly.

The difference can ruin your records!

INSIST ON A GENUINE GENERAL ELECTRIC REPLACEMENT STYLUS

A G-E replacement stylus is far more than just a needle. It is a precision-built, precision-engineered assembly . . . manufactured within microscopic tolerances . . . scientifically designed to "track" properly for hundreds of hours without audible distortion.

The diamond tips are painstakingly ground to a tiny, rounded point. Damping blocks arc made from an exclusive. specially formulated compound which does not "fatigue" or deteriorate with age. Just as important. the positioning of these blocks has been precisely calculated to bring you the smoothest possible frequency response.

G-E replacement styli are designed and built by the same people who developed the famous General Electric variable reluctance cartridges. They are manufactured *only by G.E., for G-E cartridges.* Don't take a chance! Be sure of perfect performance from your General Electric cartridge. Insist on a factory-sealed box clearly marked with the G-E monogram. Sold by leading High Fidelity dealers everywhere. Mail the coupon for our free illustrated booklet.

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Please send me your free illustrated booklet an genuine G-E styli and cartridges.

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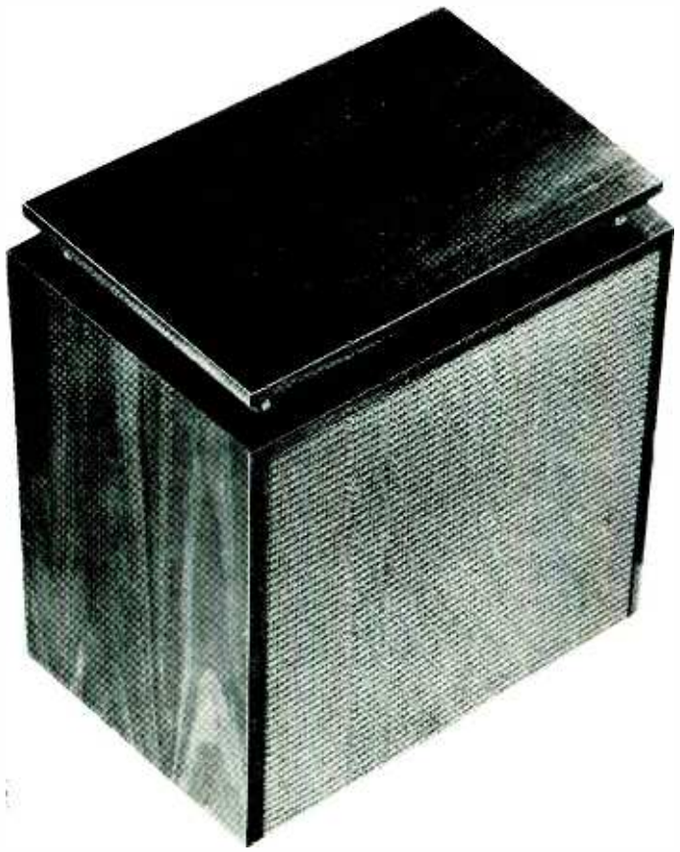

Fig. 2. The rear of the Compass-1 is covered with grille cloth so as to be uniform in appearance with the front. Thus it may be used in room-divider applications.

deep by 22 in. long, and it is 29 in. high, including the legs, which is just right for end-table use. The actual top is a ¾-inch hardwood-veneered, lumber core panel which is spaced 1¼ inches above the top of the enclosure itself with polished brass spacers, giving a modern appearance which is also functional, for it is this slot through which the high-frequency sound is radiated. Not only does the top panel completely hide the

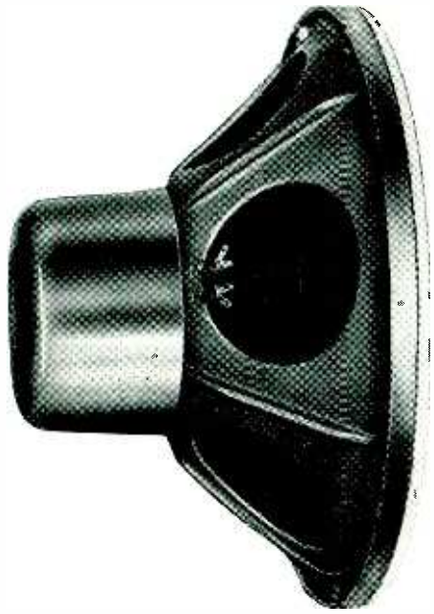

Fig. 3. The heavy-duty 12" woofer used in Compass-1 speakers.

tweeter mechanism but it also provides the acoustical path for 360-deg. sound dispersion.

The phasing switch on a loudspeaker is a completely new feature. Prior to the advent of stereo there was no need for phasing the loudspeakers, even if two were used, since the installer usually made sure of his phasing at the time of installation, and once set there was no reason to change it. However, when two separate systems are used together, even on a monaural program or unison reproduction by both speakers simultaneously, they must be phased properly to produce the ideal reproduction. This does not refer to the phasing of the woofer and tweeter in respect to each other—thus must also be done, but this adjustment is made at the time the speaker components are installed in the cabinet and need never be changed. But when two separate systems are used together, phasing becomes important.

What Phasing Means

To understand the importance of phasing, one must first understand what is meant by the term. Let us suppose that two identical speakers are mounted side by side on a baffle or in an enclosure, and connected to an amplifier. To get the most movement of air in front of them —which means, of course, to get the highest sound output—both cones must move forward and backward at the same time. If they were so connected that as one cone moved forward the other moved backward, the air would rush back and forth from one to the other without much disturbance of the mass of air in front of the speakers, and therefore without much sound output. When the cones move together, they are said to be in phase.

Now if we have two speakers separated by a small distance and we feed an identical signal to both, the source of sound *should* appear to be at a point half way between the two speakers, which it will always do when the speakers are in phase. If they are out of phase, we will seem to hear both speakers as separate sound sources, and their outputs will not blend. If two speakers are installed in a room and used on a monaural source, they can be phased by changing the leads on the input terminal strip of *one* of them—not both—and when one finds the correct position for the leads for a given location of the two speakers, they may be left with the assurance that they are in phase and will remain so.

However, experience has shown us that there are differences in the phasing of recorded tapes so that it often becomes desirable to make a listening check to determine the correct phasing of the speakers. Since this may change from tape to tape, it would be hopelessly inconvenient to attempt to reverse the leads to one of the two speakers each time to make sure that the best effect was being obtained. Therefore the Compass-1 incorporates a phasing switch in a readily accessible location. Since the switch has only two positions, the listener simply moves the switch back and forth once or twice while listening and leaves it in the position which sounds best. Even though all Compass-1 speakers have a phasing switch, it is not necessary to check both of them when used in pairs—either one will suffice. And when a single Compass-1 is used with another type of speaker, the phasing switch on the Compass-1 will do the trick. Thus even though a music lover already has one channel of high fidelity equipment, he can select the Compass-1 as the loudspeaker for the second channel when he adds stereo with the assurance that he can have properly phased reproduction at all times.

As stereo becomes more widespread, the importance of easy phasing of the two speaker systems will be better recognized. In any case, with original recording being done on three-channel tapes and the center channel being fed equally to the two outer channels when the release tapes are made—which is common practice today—correct speaker phasing is imperative to place the "phantom" center channel in the center where it belongs.

(*Continued on page 64*)

the pause that will keep your records young

an exclusive feature of the new Glaser-Steers GS-77

Your records can be a lasting joy, their original brilliance preserved for many hundreds of performances. This takes special care to guard against undue record wear. The new GS-77 handles records more gently than any other automatic record playing mechanism.

TURNTABLE PAUSE is a dramatic example of this fact. During the record-change cycle, the GS-77 turntable comes to a complete halt, and doesn't resume motion until the stylus has come to rest in the run-in groove of the next record. This completely eliminates the grinding action which occurs where records are dropped onto a moving turntable or disc.

The GS-77 TONE ARM affords further protection. Improved mass distribution and low pivot friction have so minimized arm resonance and tracking error that these flagrant causes of groove and stylus wear are now virtually eliminated. In addition, the arm has been so designed that stylus pressure between the first and top records in a stack does not vary more than 0.9 gram.

SPEEDMINDER goes still further—for by simply setting the appropriate stylus into play position, the GS-77 automatically plays at the correct record speed, and in the microgroove position, intermixes 33⅓ and 45 rpm records regardless of their sequence in the stack.

The GS-77 is the perfect high fidelity record changer. It combines traditional turntable quality with modern automatic conveniences—and it does this with incredible mechanical simplicity. No wonder

...audiophiles are switching to the new

GLASER-STEERS GS-77

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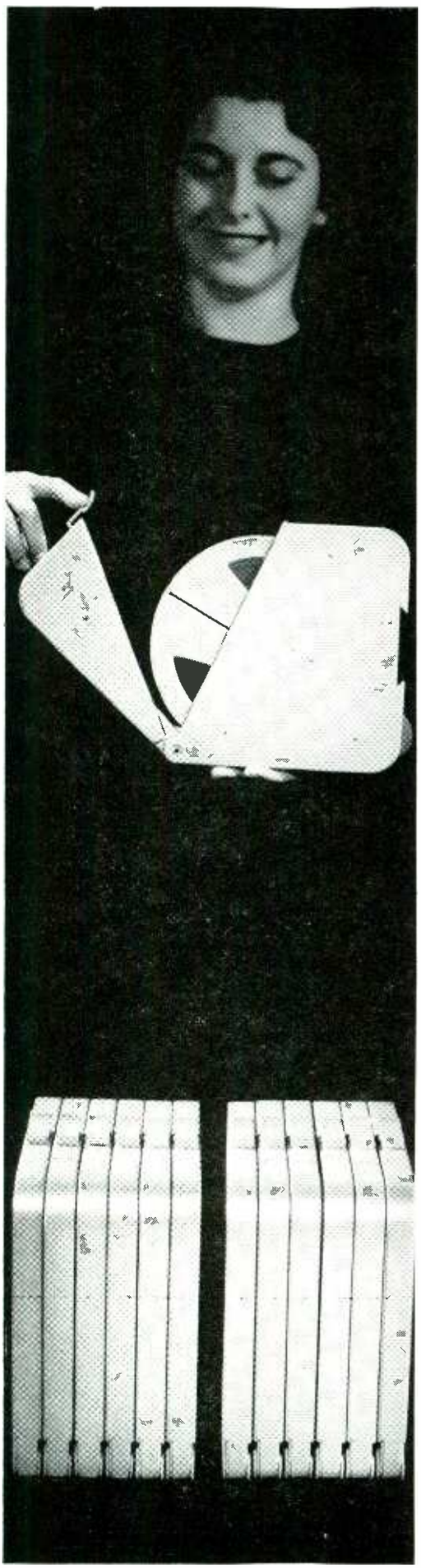

SONORAMIC

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Here is an extraordinary new product designed to protect, preserve and facilitate storage of your Sonoramic Wide Latitude Recording Tape. It's the exclusive NEW Sonoramic permanent plastic container, complete with free pressure-sensitive labels for quick, easy indexing. Sonoramic's superb quality recording tape (available in Standard Play, 1½ mil acetate, 1200 feet; Long Play, 1 mil Mylar*, 1800 feet; ½ mil Mylar, 2400 feet and Tensilized Double Play Mylar, 2400 feet) *PLUS the new container* makes this your best buy in magnetic recording tape. Ask for it at your dealer's today.

*A DuPont trade mark

FREE: *USEFUL Tape-Time Ruler and colorful brochure on Sonoramic. Write Dept. A-105, The Ferrodynamics Corporation, Lodi, New Jersey.*

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Equipment Review

Glaser-Steers GS-77 Record Changer—ESL C-60 Series Moving Coil Phonograph Cartridge

IT HAS LONG BEEN A MYSTERY as to why the record changers that have become accepted as "high fidelity" instruments have heretofore all been imported—anyone who has heard of the fabulous ability of U.S. manufacturers to build precise and high-quality devices must have wondered why this should be so. But a few hours of listening would prove beyond doubt that it was a fact.

With the introduction of the Glaser-Steers GS-77 last fall, it would appear that the foreign record changers have finally encountered some domestic competition, for the new GS-77 has sufficiently low wow, flutter, and rumble to be acceptable for high-fidelity use. The instrument is undeniably attractive in styling, and it offers some features unique to itself.

The unit, pictured in *Fig.* 1, is finished in satin black, with gold trim and a white molded rubber mat for the turntable. It is a center-drop mechanism with a balance arm being employed to hold the records level as well as to sense the dropping of the last record on the stack. The balance arm is styled similarly to the tone arm itself, and is also black with a gold trim plate.

The arm will accommodate several pickup cartridges, with two mounting brackets furnished to accommodate them. For both microgroove and standard records, the General Electric VR-II is employed, but the brackets will also accommodate the ESL Concert and the new C-60 series, Fairchild 225, Pickering 370, Grado, Miratwin MST-1, and other single-stylus models. No provision is made for the turnover cartridges which have a knob at the front, so some effort would be required to mount a Pickering Fluxvalve, Fentone, Tannoy, or Miratwin MST-2. The effort consists of filing an opening in the die-cast arm for clearance of the turnover knob. Whichever cartridge is used, however, is mounted onto one of the two brackets supplied, and the entire bracket, with cartridge mounted, is then installed in the arm with two self-tapping screws.

The minimum mounting space for the GS-77 is 14½ by 13 inches, which is not very much greater than the 12-inch records themselves. This will permit the unit to be used in relatively small cabinets. The cut-out in the motor board—for which a template is provided—requires three counterbored holes 1 1/16" in diameter and 1/16 to 3/32" deep to accommodate the three base plate springs, and two 9/16" holes for the hold-down screws. These are normally left free, but if the unit is to be transported —as in a portable case—the screws are backed out until the cross-arm on the bottom of the screws contacts the bottom of the motor board and holds the unit firmly in place.

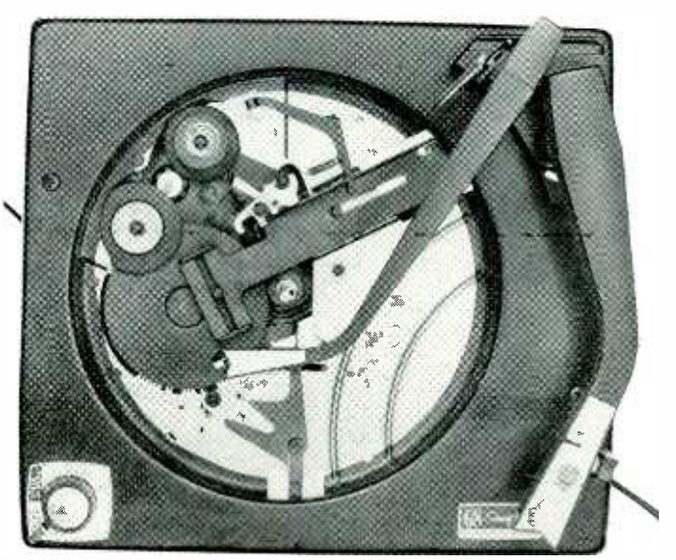
The necessary wiring is provided with the GS-77 so the unit may be put in service without the need for making any soldered connections. The power cord is 9 ft. long, and the audio connection is a 4-ft. length of shielded low-capacitance cord equipped with a phono plug.

The GS-77 has several interesting operating features, some of which have been the subject of much discussion in past years even though no existing unit was so equipped. The most noticeable of these is the stopping of the turntable during the change cycle. This permits the next record to drop onto the turntable (or onto any records already played) without any sliding between them as the dropped record is brought up to speed. This is a particular advantage when the user is inclined to be careless about how much dust accumulates on his records, but even without any dust accumulation, the sliding is entirely eliminated.

Another feature is the disengagement of the turntable idler wheel, both during the change cycle and when the unit is turned off. *Figure* 2 shows the changer with the turntable removed. At the upper left will be seen two idler wheels—the topmost one being the idler which drives the turntable, while the lower one drives the cycling mechanism. With this construction, the time of the change cycle remains constant regardless of the speed of record being played. Just to the right of the topmost idler can be seen the stop lever, which presses a felt pad against the inside of the

(*Continued on page 42*)

Fig. 1 (left) External appearance of the Glaser-Steers GS-77 record changer. Finish is satin black, with gold trim. Fig 2 (right). The same changer, with the turntable platter removed. Note use of two idler pulleys—one for turntable drive and one to drive the change mechanism. Turntable stops rotating during the change cycle.



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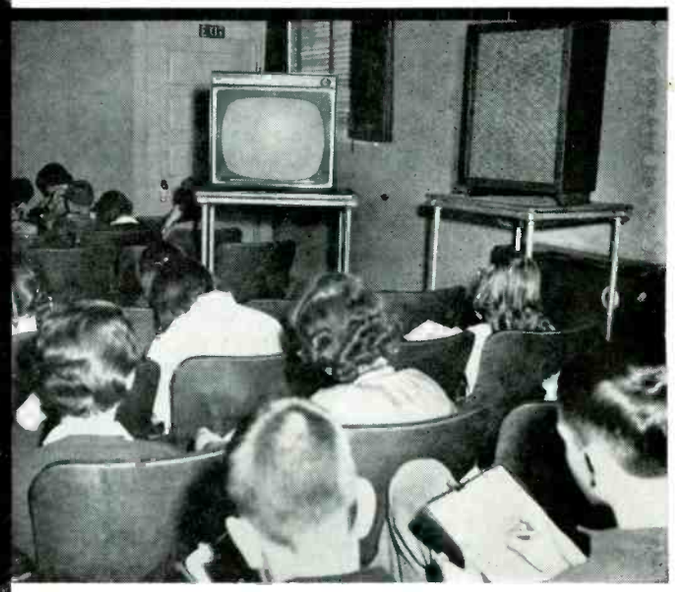
American Amplifier and Television Corp.
Washington, D.C.



FOR EDUCATION EXPERIMENT OF NATIONAL IMPORTANCE Students of Hagerstown, Md., are getting their education piped into their classrooms via closed circuit television and high fidelity sound during a five-year experiment in teaching methods that is expected to bring about wide-spread changes in U.S. education.

Engineers from the electronics industry and the Hagerstown Board of Education, under the direction of John R. Brugger, Chief Engineer, played major roles in designing the technical aspects of the project and in specifying the equipment. They report that University's high fidelity speakers and enclosures have done a superb job in the studios, control rooms and classrooms where clarity of speech and faithful reproduction of music is essential to the success of the experiment.

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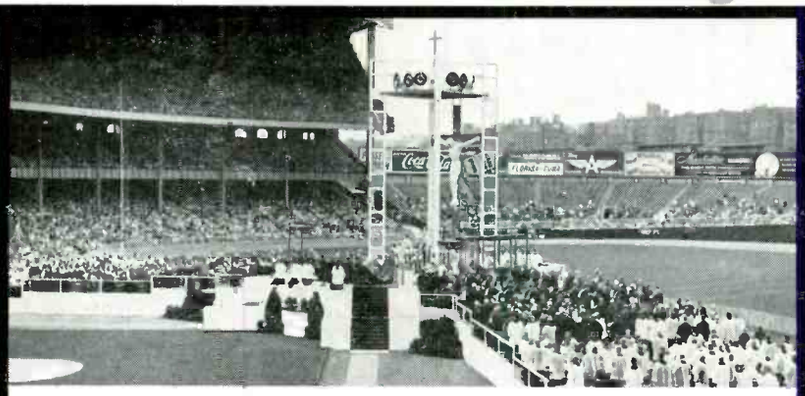

FOR UNUSUAL STADIUM FUNCTION The vast expanses of Yankee Stadium were converted to an open-air cathedral for the mass offered by Francis Cardinal Spellman, R.C. Archbishop of New York, to mark his 25th Anniversary as Bishop.

"The Yankee Stadium is well-known for its acoustic difficulties. The specific problem for this special event was to cover hundreds of thousands of square feet with true high fidelity reproduction of voice, organ and choir without reverberation and echo effects. With a single group of University speakers mounted over the altar, we were able to 'saturate' the stadium with highest quality sound that the N.Y. Times called 'cathedral-like' in its front page story. What's more, the high efficiency and distortion-free characteristics of the speakers enabled us to use remarkably low amplifier power."

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FOR PROFESSIONAL RECORDING STUDIO The Crew Cuts, well-known recording artists, are shown monitoring playback of the master tape to check over-all quality and fidelity of a new recording made at Universal Recording Corporation (the world's largest independent recording studio for all the leading artists and labels).

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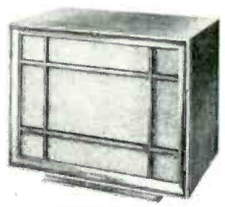

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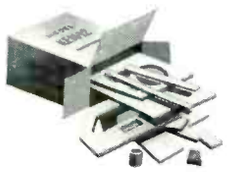

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EQUIPMENT REVIEW

(*from page 39*)

turntable to stop it quickly when the change cycle starts. The changer is a four-speed unit, and the motor pulley can be seen between the two idlers.

Another interesting feature of the GS-77 is its ability to insist upon having the correct stylus in place if the record is to turn at the required speed. Using a GE VR-II cartridge with a wire especially attached (the changer comes equipped with this wire when purchased with the GE cartridge) the turntable speed can be 78 rpm *only* when the standard stylus is in place. If the microgroove stylus is in place, the changer will run at 33⅓ or 45 rpm, depending upon the record size.

From the operating standpoint, the controls are simplified so that under normal usage the machine does all the required thinking for itself. At the lower left corner of the chassis is located a knob with a concentrically mounted lever in front of it. The knob has five positions—16⅔, 33⅓, 45, 78, and SPEEDMINDER. The four speeds are for manual operation without the automatic function. In the SPEEDMINDER position, however, the unit plays 10- and 12-in. records at 33⅓ rpm and 7-in. records at 45 rpm automatically; if during the playing you turn the stylus around to the STD position, it plays all sizes of records at 78 rpm. This serves as an excellent reminder of the position of the stylus, for practically anyone can easily recognize the difference between 33⅓ and 78 rpm.

Other than the need to move the balance arm away from the center of the turntable and over the arm rest—which one would have to do anyhow to put records on the center post—no other operation is needed to use the machine manually, and no damage can occur by moving or holding the arm during play or change cycle.

Neither wow nor flutter were noticed on usual aural test methods, and rumble was comparable with other changers—that is, not noticeable on normal levels with typical speaker systems, and barely so on those with extended bass response. On the whole, the operational features of the GS-77 offer considerable appeal to the average music lover and record user. **D-20**

ESL C-60 SERIES MOVING-COIL PHONOGRAPH CARTRIDGE

The ESL moving-coil pickups have already established an enviable reputation for quality of reproduction, high compliance, and low dynamic mass. The Concert Series—most commonly encountered of the line—had, regrettably, a rather low output signal, which was of the order of 2 mv for a stylus velocity of 10 cm/sec, and a transformer was often necessary.

The new C-60 Series is an improved pickup of the same general type, having an output of 9 mv for the same stylus velocity. Compliance is 6.8×10^6 cm/dyne or greater, according to the manufacturer, and dynamic mass at the stylus tip is

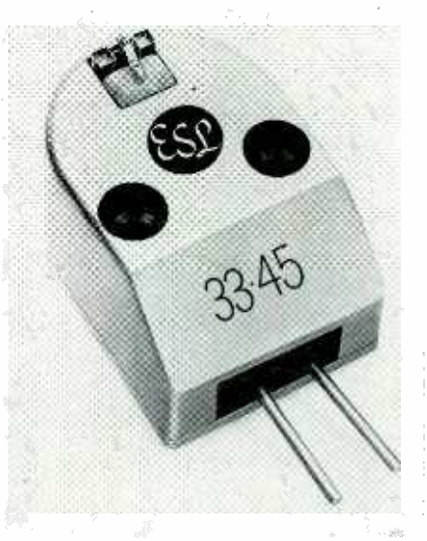


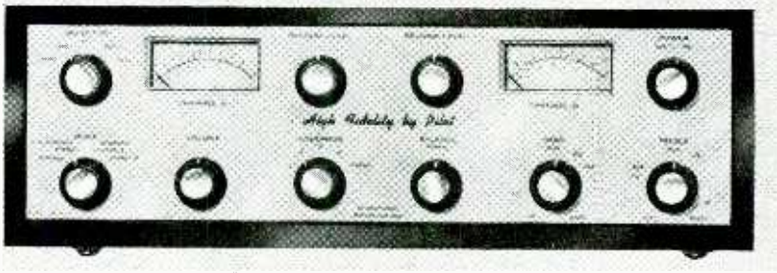
Fig. 3. ESL Series 60 moving-coil cartridge.

only 1 milligram. Using a transcription arm, the tracking will be found satisfactory over the range from 2 to 4 grams of force. The measured inductance of the pickup is 0.45 millihenry; d.c. resistance is 40 ohms. Calculating the output impedance from these values, it is seen that the inductive reactance at 1000 cps is only 2.8 ohms. Thus the impedance of the pickup is almost entirely resistive, and is thus practically constant over the entire audio spectrum, ranging from 40 to 49 ohms up to 10,000 cps. This simplifies matching and equalizing circuits, and—because of the low value of the impedance—reduces hum pick-up to the barest minimum. Combined with the increased output, this ensures that any hum at the output of the amplifier is that of the amplifier itself, and not of the pickup cartridge.

The new cartridge is sufficiently rugged to operate perfectly in record changers with their increased stylus-force requirement. which usually means a minimum of about 6 grams.

Using the Electra 33⅓-rpm frequency test record—which we believe to be more in keeping with normal operation on LP records than the 78-rpm Cook Series 10—we observed an essentially flat response (equalized below turnover) up to 10,000 cps, with a gradual rise to the upper frequency limit (20,000 cps) of about 3 db, with the exception of a 2 db bump at around 12,000 cps. In comparison with a number of other high-quality pickups checked, the performance might be considered slightly "bright" but this is easily accommodated with usual preamplifiers. In general the listening quality is considered excellent, needle talk low, and the clean response and absolute lack of hum pick-up make this cartridge a pleasure to use. **D-21**

SP-215 STEREO PREAMPLIFIER



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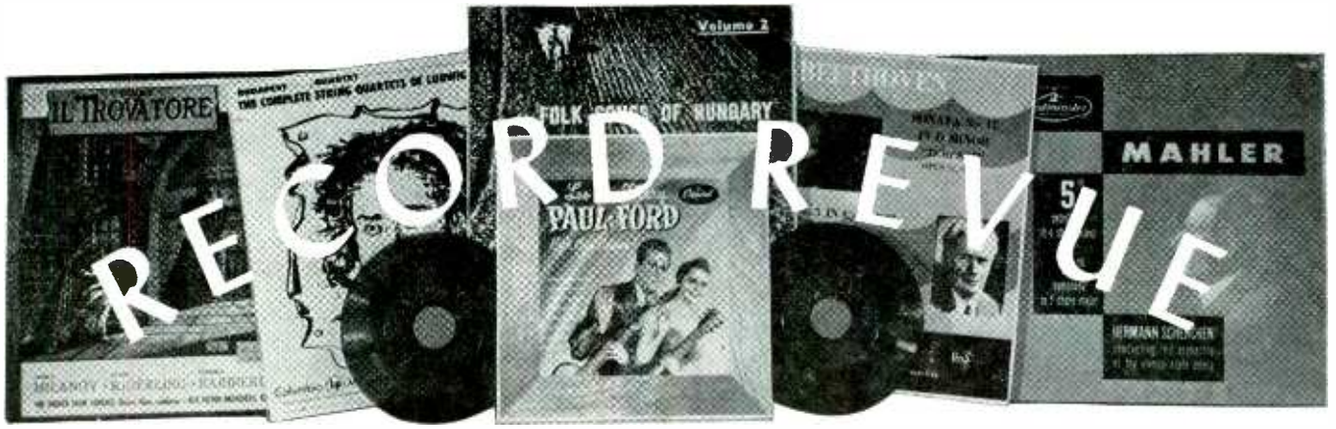

EDWARD TATNALL CANBY*

1. MOSTLY ITALIAN

Vivaldi: "L'Estro Armonico" (12 Concerti Grossi, Op. 3). Chamber Orch. of the Vienna State Opera Orch., Rossi.
Vanguard BG 572/4 (3).

The twelve concerti of Vivaldi's Opus 3 (the name is purely fanciful, an 18th century equivalent of the sales gimmick) are here played by what amounts to the strings of the Vienna Philharmonic, led by a conductor from Italy. The performances are big in the sound, recorded in a large liveness, the effect generally rather too symphonic for my own feelings about the music though for general listening this is a worthwhile advantage.

The playing is solid, crisp, dynamic, even a bit unyielding and rigid, with a "marchiness" to it in the faster movements. This might be due to the combination of a Viennese group of players, who tend to move somewhat slowly in the Austrian manner, with a conductor out of fiery Italy who wants things to get going! Just a guess, but it would account for the slight sense of strain I seem to detect here.

More and more, these days, music of this early 18th century period is moving away, in performance, from the old heavyweight "Bach-Handel" concept, towards a lighter, more transparent style—and this is due simply to our slow realization that the music of Italy in those days was already far advanced towards the "Mozart" style (that's what we call it, anyhow) on light, airy virtuosity. Vivaldi is a different man when played with that sort of lightness.

But the more massive symphonic style is still accepted by most of us, and this is a fair representation of it in its most modern form.

Vivaldi: The Four Seasons (From Op. 8). I Solisti di Zagreb, Janigro.
Vanguard BG-564

—And here, on the same label (and even with the same solo violin) is a good example of the newer type of performance, as discussed above. The Solisti, to be sure, are recorded with Vanguard's customary fine, big sound; but the symphonic effect is definitely missing; the group sounds acoustically "big", but is clearly not a large and weighty aggregation, in spite of the acoustics.

These four concerti are from another of the big Vivaldi works ("The Strife Between Harmony and Invention") but in this case they stand on their own and live up to their title in a delightful manner. Each concerto is a season, beginning with spring, and each has a running verbal description to go with it, reputedly written by Vivaldi himself.

This record is a fine illustration of the rightness of the light approach. When the "Four Seasons" were first popularized, after the war, we heard them mostly in the heavy, symphonic style, and in that form the descriptive accounts of seasonal activities—storms, balmy spring, birds twittering, harvest music and so on—just sounded silly; the effect was elephantine. But here, with the music as light as a feather and full of snap, the account of the seasons is delightful and really entertaining. It *must* have been intended this way! Excellent listening.

Vivaldi: Gloria in D; Motetto a Canto; Stabat Mater. Friederike Sailer, sop., Margarete Bence, alto; Chori & Orch. Pro Musica, Stuttgart, Couraud.
Vox PL 10.390

The Stuttgart forces have been leaders in bringing music of this same period to us in small-scaled "authentic" performances. Here, a French conductor combines with the Germans for lively, rather driving performances that are nearer to the light, new style described above than to the older, massive way of doing Vivaldi.

The Gloria was the first choral work of Vivaldi to be rediscovered, and it has become widely known in the last few years. (I wrote notes on the first recording of it.) The music superficially resembles the huge Bach B Minor Mass—or one section of it—but unlike the Bach work, this Mass was never intended to be finished in all its five sections. The Gloria, one section only, was composed simply as a luxurious example of fine writing on a big scale, using an inspiring religious theme. It would have been much too big for actual religious use.

M. Couraud does a good job in keeping this performance away from the stodgy, heavy oratorio sort of sound—and rightly. Again, this is Italian music and should be all lightness, however big the performing forces. The music moves right along here, the orchestra lightly in the foreground with the two soloists, the chorus a vigorous backdrop. Some rigidity and lack of phrasing makes the going a bit less than musically ideal.

The two companion works are for the two lady soloists, respectively; in both, the same vigorous drive keeps things moving at a somewhat hectic pace. Miss Sailer's beautiful and sincere soprano just can't move fast enough and she sounds a bit hysterical here and there, in spite of lovely singing when she gets half a chance.

The alto, Bence, fares better; perhaps because her music isn't as instrumental, she's able to keep up with the energetic conductor more easily.

Sammartini: Three Symphonies; Sonata in G for 2 Horns and Strings; Sinfonia dell'Accademia in C. Orch. Accad. dell'Orso, Jenkins.
Period SPL 731.

Sammartini was an in-between composer, writing in the time that falls between the familiar "Bach-Handel" period and the even more familiar "Mozart-Haydn" period, early and late 18th century respectively. Now that we are finding out about the in-between composers, Sammartini is making a come-back.

He was 16 years younger than Bach, Handel and Scarlatti (all born in 1685) but 55 years older than Mozart—an original and enterprising composer whose work now can be seen as a foundation for a great deal that came soon after in the times of the familiar symphonies.

All of these five works are, for our ears, of about the same sort, little semi-symphonies for strings, with help from assorted brass instruments. The music, like so much that is Italian, may on first hearing seem a bit shallow and trifling. But as your "German ears" (we're all trained in the German tradition, whether we know it or not) get away from the sound of Bach, the Italian stuff begins to show its strength. In typical Italian style, the texture is mostly sweet melody, high and graceful in the violins, with much ornamental twisting and turning. It's not exactly familiar to most of us, though already sounding like the later Mozart, but it will quickly ingratiate itself upon you in its own terms. The orchestra plays with harpsichord continuo accompaniment, as in the earlier music of Bach and Handel, and Vivaldi.

Newell Jenkins is a specialist in this period and has an impeccable sense of the style. Result: the music is wonderfully easy to listen to.

Haydn: Harpsichord Concertos in C, F. Helma Elsner; Pro Musica Orch. Stuttgart, ? conducting.
Vox PL 10.300

Vox is getting absent-minded; one conductor is listed on the front of this record jacket and another on the back. (The disc itself lists the first one, Rolf Reinhardt.)

These are really lovely concertos, very "early" Haydn, from the 1760's, thirty years or so before the familiar symphonies—but what a prolific man he was! This is again fascinating in-between style of the mid-Eighteenth century, that bridges that gap between Bach, Handel and Vivaldi and the later Mozart and Haydn. It has the outward shape of Bach, with harpsichord accompaniment, as well as solo parts, a good deal of Bach-like figuration—but a livelineess and grace of melody and ornament that are the early stage of the Mozart style.

Whatever the style (and at that point, Mozart being a small child, it stood strictly on its own merits), the composer of these works was obviously a good entertainer. The all-German Stuttgart players do a sympathetic joh. If you don't know this period in music, here's a good starter disc to begin to get used to it.

Haydn: Symphonies #33, #46. Hamburg Philharmonia, Winograd.
M-G-M E3436.

Here are two symphonies of the earlier Haydn period, somewhat later than the two harpsichord concerti above, but still long be-

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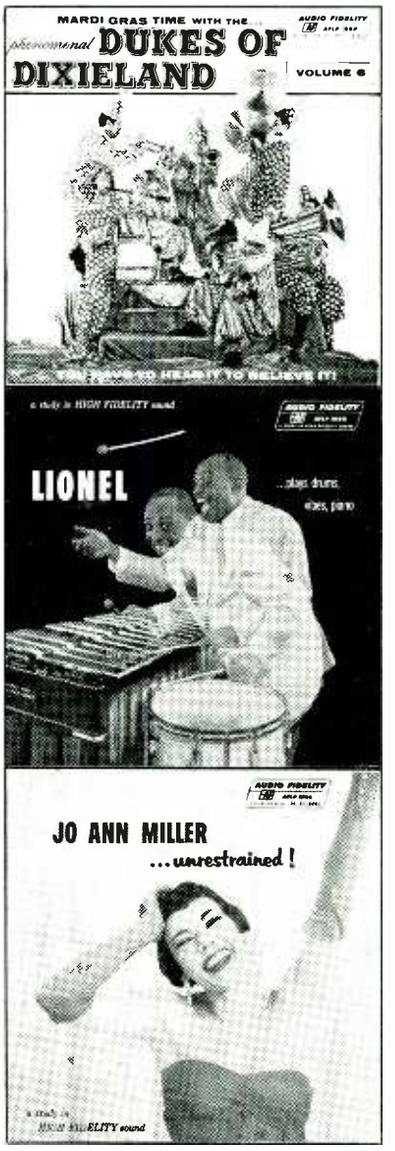

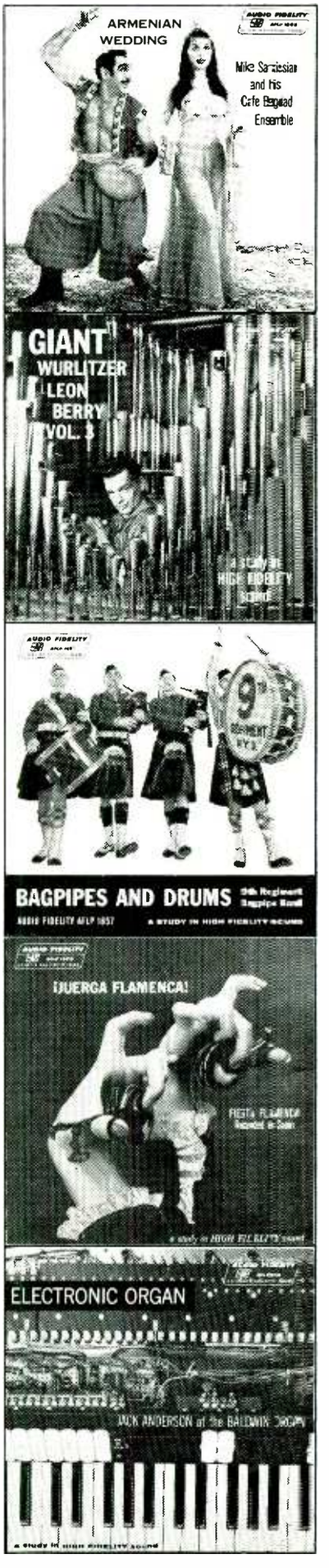

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fore the more familiar symphonies with numbers in the eighties, nineties, and so on to # 104. If you have had any experience with earlier Haydn, you'll know that though his music changed and developed over more than forty years, the early works are as much perfect models of their own style of expression as the later ones—the man was a consummate technician from the very beginning of his career.

The Symphony #46, next after the relatively well known 'Farewell" (the only one of the earlier symphonies known widely before the last war) is a wonderfully mature piece, with a generally sprightly sound, modified by sensuous and expressive themes that give it emotional depth of the best Haydn sort. The earlier symphony, from about the same time as the Harpsichord Concerti, is more outward and brilliant in the opening movement, but has its serious parts too.

Mr. Winograd is a sensitive and expressive stylist in these works. I recommend both readings as highly worthwhile. Lovely music beautifully played.

Mozart: Symphonies #32, #35 ("Haffner"), #36 ("Linz"). Pro Musica Symphony, Vienna, Perlea.

Vox PL 10.140

This is a novel and successful Mozart disc, combining the familiar "Haffner" symphony with two of its neighbors not quite as well known. This Pro Musica (not the same as those of Stuttgart, Belgium, New York, etc.) plays with Viennese sweetness but with a vigor that must come from the conductor's concept of the music—on the quick side, especially in the minuets, but never too rushed, never key-hard as in so many modern performances. I'd call this about the best of the Austrian Mozart manner.

Nicely natural recording, fairly close in a big...liveness, showing to best advantage in the smallest work, the Symphony #32. (I always did say the "chamber symphony"—small group of from a dozen to twenty players—is the very best for recording purposes.)

In Memoriam Edith Weiss Mann—Telemann: Sonatas in C Minor, E Minor; Pepusch: Sonata in F; A. Scarlatti: Sonata in F. Alfred Mann, recorder, Lois Wann, oboe, Albert Mell, vl., Edith Weiss Mann, harpsichord.

Westminster XWN 18589

Well, well—chickens do come home to roost. This one I made myself (with considerable help from a couple of willing engineer friends) back in the summer of 1950, on Maggie, my first and only Magnecorder PT-6AII. The recording is here reissued, recut to R1AA and generally modernized, and it sounds good, too, except for the last band (Scarlatti), which inexplicably cut off at 4000 cps or so—probably thanks to Maggie's tendency to lose her head alignment at inconvenient moments. (Later on, I got so I realigned her for every performance, as regular as brushing teeth.)

The music was recorded under violently adverse circumstances, in a hot New York apartment with direct current. Mme. Weiss-Mann was too ill at the time to play outside her own home. (It was her last performance.) You'll hear a faint sound from the d.c./a.c. converter in the background, almost inaudible thanks to pillows and such! But what pleased us wasn't the feat of producing a recording via d.c., but the sound that we were able to pick up.

The works are trios, for harpsichord with oboe and recorder (violin and recorder in one case) and the balance between these instruments was a real problem. The recorder is faint in the low register, piercing in its upper tones; the oboe is uniformly louder than the recorder's middle-range volume. With one Altec mike we managed to get all the instruments into a good balance, with a nice liveness—unexpected for an apartment living room.

Boccherini: Symphony in A. Karl Stamitz: Sinfonia in F. Vienna Symphony, Swoboda.

Westminster XWN 18580.

Westminster has dipped back into its earliest releases for these two reissues—if I'm right, the Vienna-Swoboda recordings preceded the well known Scherchen series that brought the first hi-fi Haydn to prominence. The sound in the Boccherini recording is noticeably less than 100 per cent modern though it's perfectly OK for the musical values; the Stamitz is much better—it could be brand new, for all I can tell.

Of the two, the Stamitz is also the most interesting. It is a symphony-concerto, with no less than seven solo instruments, reminding me strongly of several Mozart "concertant" pieces—notably the Sinfonia Concertante items in E Flat, one for violin and viola solo, the other for a group of wind solos. This one is a late-period work, near the end of the 18th century, but it is far less concentrated and less intense than Mozart's own music. Yet though the shape is lax and the musical tension low, the workmanship is expertly polished and the music sings in fine colors throughout.

The Boccherini piece is a pleasingly florid, Mozart-Haydn-like symphony though again less concentrated, more tuneful, essentially Italian.

Boccherini: Symphony in C; Cello Concerto in C. Cambini: Sinfonia Concertante #1 for Oboe and Bassoon. Solos, Orch. Accademia dell'Orso, Jenkins.

Period SPL 732

Here's more Boccherini—this symphony is considerably more interesting; possibly it's a later work since it has an almost Beethoven-like slow beginning. An odd feature is a guitar solo, making the work a semi-concerto for guitar. (The record jacket doesn't mention the guitar at all.) The Cello Concerto left me dreadfully sleepy and I can't say as I really heard all of it. Too much like the familiar B Flat one, which *always* puts me to sleep.

Cambini spent most of this time in Paris, as Boccherini spent his in Madrid. (In the 18th century, Italian musicians spread Italian styles far and wide—even to Russia.) His double concerto for oboe and bassoon is again in the "Mozart-Haydn" style, rather pastoral in its sound, fresh and lively—a charming work for an "unknown" composer.

2. HITHER AND YON

Beethoven: Fidelio. Leonie Rysanek, Irmgard Seefried, D. Fischer Dieskau, E. Haflinger, G. Frick; Chorus Bavarian State Opera, Bav. State Orch., Fricsay.

Decca DXH-147 (2).

I don't know what seasoned opera-goers will think of this Fidelio—I think it's terrific. Not because of any top-star solo work—the tenor lead, in fact, is rather a weak voice—but because it captures the spirit of Beethoven's opera and conveys its musical and dramatic sense in a production that is beautifully unified. Too many other versions are hoidge-podge mixtures of this and that.

This recording includes the spoken German dialogue as well as the music, the speech part done by a separate cast of voices in the usual manner of today. (We don't have singers who can talk stage stuff too.) No room to list their names—but they do a fine job, warm and remarkably natural, and the transitions from speech to sung music are so well done that I wondered at times whether for once maybe the whole production was recorded straight, instead of the usual separate hunks, edited together. It sounds that way, anyhow, even to the matching liveness and distance from the mike, so that there is very little of that unpleasant jolting that hits in many recordings of this sort when the speaking actor takes over from his singing counterpart and vice versa. *Very* well managed.

The orchestral part is really first-rate, from the overtures right on through; and the soloists make a team, with uncommonly fine singers involved, at that. Oddly enough, even the weakness of the tenor Florestan in his big dungeon aria (where he sees visions of freedom, while half fainting away) is convincing. After all, the man *is* wasting away and shouldn't sound like Don Giovanni about to make a conquest. Some tenors sing it just that way.

If you like Beethoven at all, this is a fine album to add to your Beethoven collection. The complete text in German and English makes it easy to follow what is happening. Oh yes—I forgot to mention the really excellent chorus, which adds excitement and perspective to the drama. Most opera choruses sound like tired extras, which they usually are.

Dvorak: Symphony #2 in D Minor. Hallé Orchestra, Barbirolli.

Mercury MG 50159

Sir John Barbirolli is an unpredictable conductor, as the New York Philharmonic found out years ago when he conducted it. Some things he turns out superbly but others—that might seem just as likely to be good—unaccountably droop by the wayside. This, quite inexplicably, is one of the latter. It just doesn't come off very well, in a million details and in general spirit. Its companion recording of the Elgar "Enigma" Variations is superb.

To be sure, this is one of the tougher Dvorak works to play, a relatively severe and complex work with a good deal of rather turgid orchestral writing that is hard to make effective. Even so . . . others have put it over.

An interesting technical side-problem arises here in connection with Mercury's "Living Presence" hi-fi microphone technique. In that rather advanced and daring style of mike pickup, Mercury tends to reveal many instruments with an ultra-sharp, close-to effect, especially the strings. Under this devastating clarity (quite unlike any concert hall effect, and rightly so) the slightest trace of uncertain playing, of bad ensemble, is relentlessly revealed and even exaggerated.

This work has lots of extremely high, squeaky string playing for the violins. I can't tell you what it sounded like in the flesh, from a concert distance, but as you listen here, there is a painful amount of scratchy, insecure playing. As I say, I suspect its effect is exaggerated by the close microphone—but the musical result is bad. Sounds as if they really hadn't rehearsed the work. A conservatively distant mike pickup with a grand blur to it probably would help. As it is, you can hear individual fiddles and, almost, individual fingers and bows hitting individual strings.

That's a price to be paid for modern recording techniques. Don't get me wrong—it's very often worth it, decidedly. Just one of the new risks in the trade.

Prokofieff: Romeo and Juliet (ballet excepts). Boston Symphony, Munch.

RCA Victor LM 2110

Aha! This is the orchestra for "Romeo" and this is the recording company, too! You see, this score has a great deal of excessively high writing for the violins, abnormally so. The squeaky themes Prokofieff assigned to the fiddles are deadly to play, though when played rightly, in tune and with good ensemble, the effect is light-hearted and charming. The Boston Symphony is famous for the precision of its strings. This is the first time I've heard the string parts played really (almost) flawlessly. The recent Concert Hall recording, with the Ballets Russes orchestra was devastatingly bad in this one respect—the strings simply squealed and shrieked. A real tough score and a nightmare, I'll bet, for the violins. (Cf. AUDIO, March, 1958.)

But there's more to it than this. In the Concert Hall version, the violins had the misfortune to be part of the close-up hi-fi effect achieved by the engineers. Result: Every tiny bit of inaccuracy in those crucial ultra-high notes was loudly exaggerated in the

(*Continued on page 59*)

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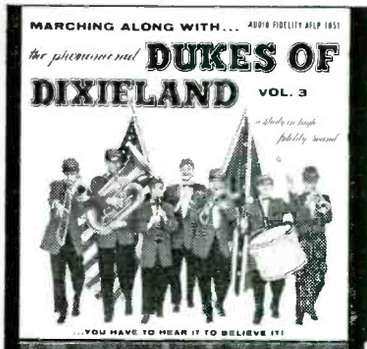

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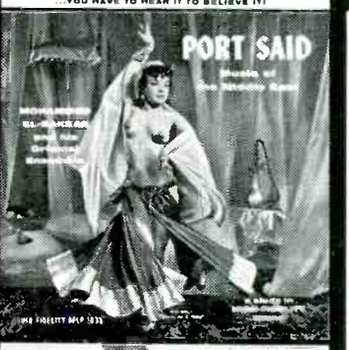

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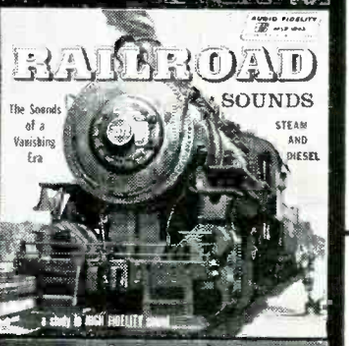

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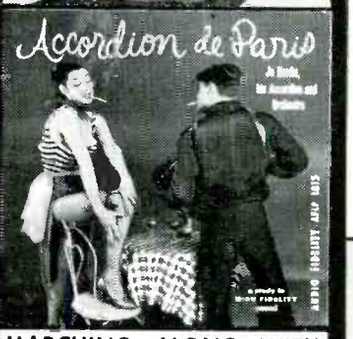

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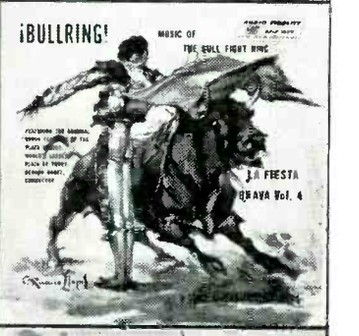

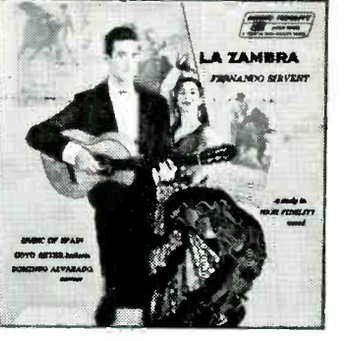

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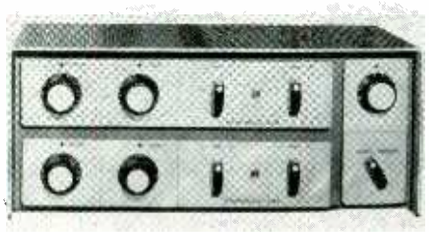
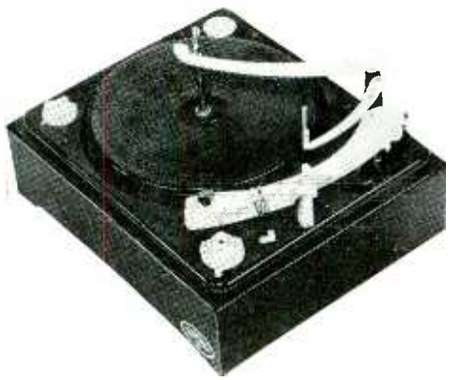
NEW PRODUCTS

• **Fairchild Stereo Preamplifier.** The new Fairchild Model 248 consists of two Model 245 self-powered preamplifiers and an additional master control panel mounted in a single handsome wraparound enclosure. The control panel contains a master gain control for setting output level of both channels and a stereo/monaural switch. The 245's can be used individually or together so that the 248 can feed single-channel systems, 2-way or bi-amplifier



systems, or true 2-channel stereo systems. Provisions are incorporated for tape, disc or tuner stereo inputs. Noise and distortion have been reduced to extremely low values. Distortion of 0.1 per cent is achieved at 1.0 volt output. Other features include self-contained power supply with d.c. used on all filaments, full shielding of all a.c. leads, and the use of low-noise EF86 tubes. Fairchild Recording Equipment Company, 10-40 45th Ave., Long Island City 1, N. Y. **D-1**

• **Improved Garrard Record Changer/Player.** The well-known Garrard Model RC121 changer has been replaced by the new Model RC121/II, a dual-purpose record player which converts instantly from an automatic intermix changer to a single-play unit, with the tone arm completely

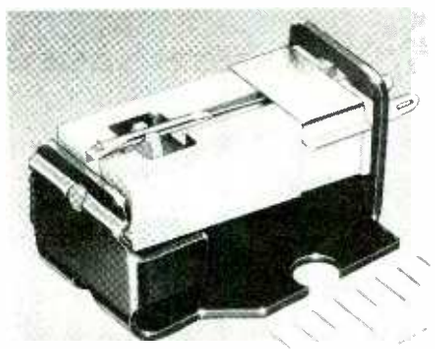


free. It is particularly adaptable for replacement or servicemen's requirements since it will fit into virtually any cabinet space designed for a record changer. The new player retains all the basic features of the previous RC121, and, in addition, incorporates various refinements. A true intermix changer, the RC121/II will change 12 and 10-in. records stacked in any order. An exclusive new spindle prevents double record drop, and affords extra protection against center-hole distortion. British Industries Corporation, 80 Shore Road, Port Washington, N. Y. **D-2**

• **Pilot Stereo Preamplifier-Audio Control.** There is hardly any radio function which cannot be controlled by the new Pilot Model SP-215. A professional-type bi-channel preamplifier, the SP-215 is equipped with inputs for stereo FM-AM broadcasts, stereo tapes, stereo discs, microphones, and other stereo signal sources. It has a separate output for recording stereo tapes, two VU meters, and controls for setting reference and peak recording

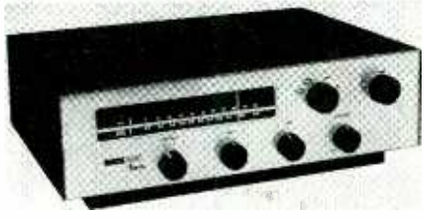
levels. Other features include bass and treble controls, volume and loudness controls, and a balance control for equalizing level of the two channels. The SP-215 can be used with any high-quality power amplifiers as the basis of a stereophonic sound system. Pilot Radio Corporation, Long Island City 1, N. Y. **D-3**

• **Electro-Voice Stereo Cartridge.** A distinct step forward on the road to mass production and acceptance of stereo discs in the home is represented by this new cartridge recently introduced by Electro-Voice, Inc., Buchanan, Mich. Priced well within the range of conventional monaural pickups with diamond stylus, the new unit is now available to phonograph manufacturers in production quantities



and is being delivered to dealers for retail sale. The E-V cartridge contains a single stylus and two ceramic elements, and is completely compatible in that it can be used to play the owner's present library of microgroove records as well as the new stereo discs. One of the biggest stereo problems facing manufacturers of turntables and changers has been that of motor rumble, which is compounded in the stereo disc because it involves vertical play of the stylus in the 45-deg. record groove. An exclusive design feature of the E-V cartridge virtually eliminates the vertical rumble originating in the turntable or changer. The cartridge measures ¾" × ½". **D-4**

• **New Harman-Kardon "Guide" Line.** Designed to pace the economy field, the new Harman-Kardon "Guide" line of tuners, amplifiers and tuner-amplifier combinations will supplement the company's present Standard, DeLuxe, and Custom lines. The Guide instruments embody advanced styling and engineering features at a price level which is expected to enlarge the market for hi-fi components. Included in the Guide line are: The Tempo, Model F-10, FM only tuner; The Allegro, Model A-10, amplifier, and The Sonata, Model FA-10, illustrated, a combination of FM-only tuner with preamplifier and

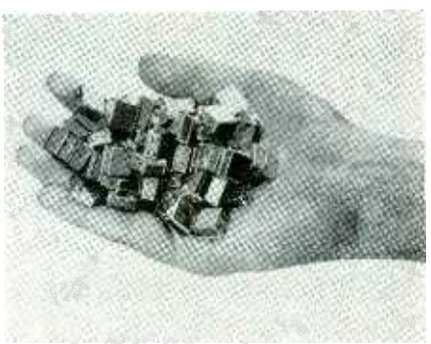


amplifier. The Tempo incorporates an Armstrong circuit with limiter and a broad-band Foster-Seeley discriminator. Harmonic distortion and intermodulation are less than 1.0 per cent at 30 per cent modulation. The Allegro embodies the important characteristics of a fine amplifier at low cost, including full-range bass and treble controls. Frequency response is 15 to 30,000 cps within ± 0.5 db at 2 watts. The Sonata offers a concentration of important hi-fi features in a handsome, compact copper and black enclosure. Features include: FM with broad-band Foster-Seeley discriminator and limiter; equalized preamplifier for magnetic cartridge and tape head; loudness contour control and separate bass and treble controls. Power output is 10 watts. Further information will be mailed upon request to Harman-Kardon, Inc., 520 Main St., Westbury, N. Y. **D-5**

• **Record Storage Hassock.** Hi-Fi-Pak is a storage hassock specifically designed for hi-fi records. It will accommodate

more than 100 discs in a vertical position. Removable dividers are four inches apart. The disappearing front permits easy access without disturbing anyone or anything which may be on the hassock at the time. Comfortably upholstered with supported plastic and available in five different colors, Hi-Fi-Pak is manufactured by Great Western Furniture Mfg. Co., 1516 Clay, Denver, Colo. **D-6**

• **Miniature Microphone.** Developed primarily for use by manufacturers of hearing aids, dictating equipment and other devices requiring miniaturization, the Shure Model MC30 microphone is so small that a hundred can fit in the palm of one



hand. It is only one-half inch square and a quarter-inch thick, and weighs less than one-sixth of an ounce. Response rating is 400 to 4200 cps; output is −76 db at 1000 cps, and impedance is 2000 ohms at 1000 cps. Manufactured by Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. **D-7**

(Continued on page 77)

CHARLES A. ROBERTSON*

Count Basie: Basie

Roulette R52003

Joe Williams: A Man Ain't Supposed To Cry

Roulette R52005

In addition to introducing a new jazz line of much promise, these two albums forecast a bright period of growth for the Count Basie band and its vocalist Joe Williams. The "Birdland" series is a pet project of Morris Levy, owner of the jazz emporium of the same name and youthful president of Roulette, and its launching involved a year's preparation, climaxed by the signing of these two artists last August.

From its formation in January of 1957, huge success in the popular field greeted the company, and the mechanics of supplying the demand for its product stretched its resources. But there was time to build a foundation for a more extensive program and it is now expanding in all directions, including the classical. One unusual factor in this rapid development is the delegation of Teddy Reig, the head of his own company, to work with the Basie aggregation. Operator of the Roost label since 1950, he supervised sessions for Savoy during the five preceding years. As an enthusiastic follower of the band, he sought out Basie at his first New York appearance and a friendship of more than twenty years' standing ensued.

When we arranged to meet to discuss the thinking behind the first releases and some of the plans for future dates, the most convenient place turned out to be Basie's own bar in Harlem on the night the Eddie Davis trio opened. Although his interest in jazz made him a collector in the early 30's, when he traded information with two others who went on to produce their own sessions —Dan Qualey of Solo Art and Alfred Lion of Blue Note—he is most happy when listening to musicians in their natural habitat. "At the time Morris Levy gave me my assignment," Reig began, "we agreed that our object would be to help Basie and Williams realize their full potential. An over-all program of considerable scope and some flexibility was outlined and will find them doing some new and exciting things in the near future. Basie is known as the leader of the most swinging band and by this time next year we want him recognized as the leader of the best dance band. Williams will be developed as a singer of popular ballads.

"Before you get the idea our only ambition is to commercialize them, I should mention a part of our scheme most attractive to me. Basie will again be heard lending his special qualities to a small group on a number of albums entitled, 'Basie Presents.' They will feature his own men and other talented soloists, plus a lot more of the Count's piano than has been heard recently. As the first stars Eddie Davis, his newest tenor-sax player, they will be a lot like the spirited performance we are listening to tonight. Williams will continue to sing the blues. Fresh material is hard to come by and both of us are busy with research for authentic and unspoiled numbers."

To avoid duplicating existing recordings, a whole new book is in prospect for the band, according to Reig who said, "Frank Foster, Neal Hefti, Jimmy Mundy and other arrangers are working on it, but the process is a slow one. The present album took three months to prepare. The difference between recording a number after a few rehearsals and doing it after Basie applies the finishing touches on the road is tremendous. It means the ease of a swinging band and the extra time is worth it. The older favorites are being revitalized by new treatments, some of them to include vocals by a trio or chorus."

Pointing out that the planning of an LP involves the successful marriage of many elements, Reig continued, "We all felt the thought behind our first effort should be in the direction of the band's unique tonal qualities, from Basie and his characteristic rhythm section to the coloring and shading of the sections. Too often these essentials are lost in the studio and we wanted the full sound, as we know it, transferred to records. Hefti wrote with that in mind, Basie considered it in setting the tempos and it dictated the methods I used in the studio.

"You will notice the Basie piano is heard more than during any session in years. This served as a focal point for the engineer, Bob Arnold, who gave me everything I wanted. As much as possible, the close-miking gives the listener the feeling he is sitting beside the Count and hearing the band with the Count's ears. There is the pulsing beat of Freddy Greene's guitar, the suppressed power of the well-separated sections and the undistorted vitality of the soloists.

"There are too few big bands now and it gives me a great thrill to handle one. I intend to take advantage of the several good ways they can be recorded. In this case, we wanted a sense of intimacy and chose Capitol's studio on West 46th Street, in preference to the larger Riverside Plaza. We intend to tape some concerts and performances on location to give the perspective of a big hall. Our next date is set for Bill Putnam's Universal Studios in Chicago, when the band plays an engagement at the Regal Theater. The arrangements by Hefti are ready and a series of college dates will get them in shape."

In giving aid to the establishment of the new series, Reig expects to be in charge of sessions by Mary Lou Williams, Cannonball Adderley, Bud Powell, and Machito. "There is enough talent in the field to go around," Reig commented when asked how it feels to work for another company, "and I like to present new men on my label. In my various capacities, I first introduced Belafonte, Charlie Parker, George Shearing and Erroll Garner. Morris Levy and I became acquainted in the days of the Royal Roost and our tastes in jazz are similar. Once something is projected, he believes in giving full freedom to his artists and producers. As a result, Hefti says he is doing his best work and Basie can plan anything he wants. Specs Powell handled his own date, but help and an exchange of ideas are available when needed. As the first album by Williams is aimed at the popular market, I asked the advice of Hugo Peretti and Luigi Creatore, co-directors in charge of artists and repertoire men at Roulette, in its preparation. His voice was treated to more of an echo than will be used in a blues session and the arrangements by Mundy are of the soothing sort."

For the most part our conversation took place in the office of the club, where we retired during an intermission, as the opening attracted a capacity crowd. Taking a brief moment from his duties as host, Count Basie came in and expressed his approval of the sound on the album with a smile of satisfaction. And before leaving, he had a complimentary pat on the back for Reig, who concluded by saying, "To me the handling of Basie and his band is the culmination of our twenty years of friendship. I welcome the responsibility, but am most happy that he will again work with a small group. Many companies consider it uneconomical to use a leader with a name as a sideman. I always admired John Hammond for his efforts to employ Benny Goodman and Basie in such units. They both have so much to offer in the way of guidance and inspiration. The album with Eddie Davis is completed and others featuring Joe Newman, Frank Foster, and Frank Wess are underway."

Roulette is managed by a Board of Directors, consisting of the seven founding partners. In charge of sales is Joe Kolsky, who carries the conviction that proper promotion and an alert distribution network can gain a greater acceptance for jazz. He is confident the groundwork laid in the past year will bear out his belief.

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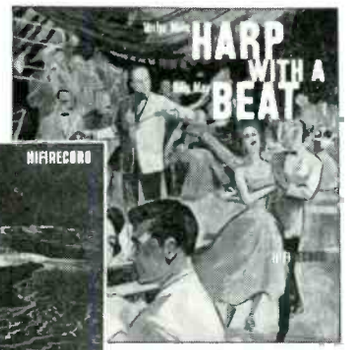

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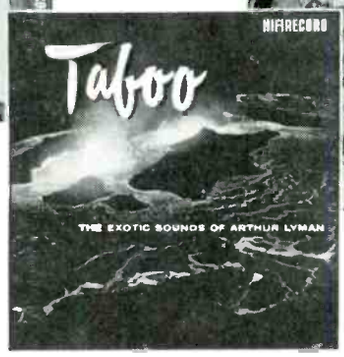

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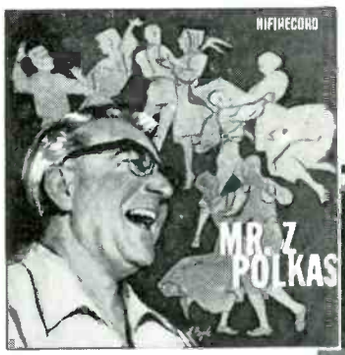

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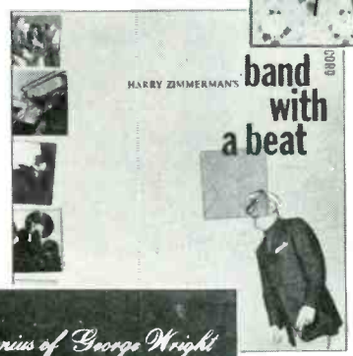

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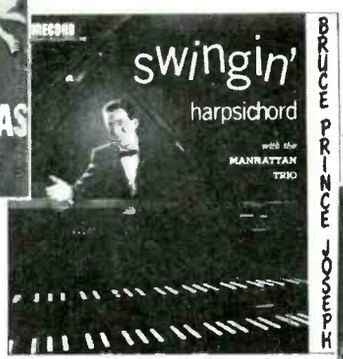

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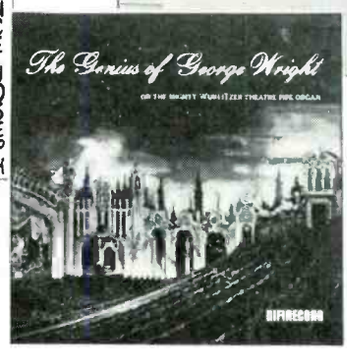

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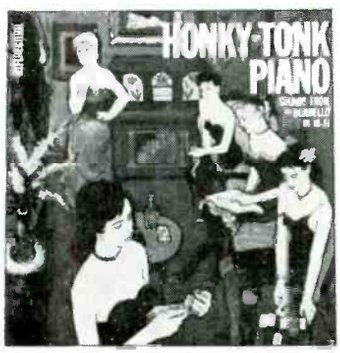

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by its regular engineering personnel and the newest member is responsible for the Basie date. After Army service in the last war, Bob Arnold attended the Royal College of Music in London, where he studied the organ and harpsichord. He earned his bachelor's degree in music at Cambridge University and joined the B.B.C. His engineering training came with an intensive series of courses during the two years he monitored the control and balance of music. In 1954 he moved to E.M.I., just as its program of stereo recording was getting underway, and became concerned with the experiments involved in perfecting the new techniques. Working with orchestras conducted by Herbert von Karajan and Sir Thomas Beecham, he made the stereo versions of items still to be released in this form.

Returning to this country slightly more than a year ago, Arnold was employed by Capitol and gained his first experience in the popular field. Among his classical efforts here is the Ballet Theater's *Swan Lake*. Due to his English accent, few persons around the studio realize he was raised in Brooklyn. As to the sound on the Basie record, also taped in stereo, he said, "Much of the credit belongs to the arrangements by Hefti. Once Reig explained what they were meant to do, I found them ideal for showing the qualities he described. Of course, the band has a depth of tone which makes padding and other gimmicks unnecessary."

It is significant of the great progress made in jazz since Basie left Kansas City that a single LP by one arranger can only begin to explore the vast resources of this band. In aiming at a composite portrait, Hefti whets the appetite for what is to follow, now that the recorded sound of the band is getting the same care he gives his arrangements. The Count's piano sparkles on *The Kid From Red Bank*, and the trumpets of Thad Jones and Joe Newman match one another on *Duet*. Eddie Davis plays a fine blues solo on *After Supper*, and Frank Wess on alto sax sails through *Fantail*. But it is the clear definition given the superb section work which makes Hefti's writing glow as never before, and marks the start of a new era for Basie and his band.

A point of controversy among the admirers of Joe Williams is whether his ability with a ballad surpasses his blues singing. On a dozen numbers, Jimmy Mundy augments the orchestra with a string section to show his more popular side. Although such jazzmen as Budd Johnson, Toots Mondello, Freddie Greene, Osie Johnson, and Joe Benjamin are present, only the pianist Jimmy Jones is mentioned on the liner. It is to be hoped Roulette will adopt the practice of listing complete personnel on its jazz series. Members of both camps are likely to find some satisfaction here, as Williams brings the warmth of his blues training to *What's New, Say It Isn't So, Talk of The Town*, and particularly the title tune.

Bobby Hackett and Jack Teagarden: Jazz Ultimate

Capitol T933

Usually cast as leaders of their own groups, Bobby Hackett and Jack Teagarden leave such trials and tribulations behind to unite in a wholly relaxed outing on eleven old favorites and a blues dedicated to the New York address of Capitol, *55th and Broadway*. It is a setting in which they both thrive best and the artful ease of every gutty interjection by Teagarden proclaims his mastery of the trombone. One of his rare muted treatments renews *I Found a New Baby*. The Hackett trumpet is fiery in the ensembles and drifts with lyric wistfulness through his choruses.

Ernie Caceres and Peanuts Hucko alternate on clarinet and double on baritone and tenor sax, respectively. In the rhythm section are the trusted standbys Buzzy Drootin on drums, Jack Lesberg on bass, and pianist Gene Schroeder. Guitarist Billy Baner is the sole accompanist to Teagarden at the start of *Baby, Won't You Please Come Home*. Reunions such as this should occur more often, especially when attended by the careful engineering of John Cue.

Big Bill Broonzy Sings Country Blues
Folkways FA2326

Big Bill's Blues

Columbia WL111

As Big Bill has not sung since an operation last July, he may well have made his last visit to a recording studio. Any possibility that the documentation of his early years, begun so well in two discs prepared by Studs Terkel, will be continued seems remote. But their release, followed closely by an LP from Columbia, may bring him at the age of sixty-five the recognition which so often comes to artists when they can no longer take advantage of it. The reissue of some of the sides he made with a small band in Chicago would be a welcome result.

In his later years he depended upon his guitar to help tell his story and it is a many-voiced companion. The second volume from Folkways is without the conversational interludes of the first, but the dozen songs are examined in the excellent notes by Charles Edward Smith. Due to a balance in favor of the guitar, his voice seems less vital on Columbia. Here the emphasis is on his complete career, and only three of the ten pieces are duplications. They are *Trouble in Mind, See See Rider*, and *Key to the Highway*, all numbers he never sings exactly alike. Part of the new "Adventures in Sound series, it carries a premium price and is impressed on quality plastic.

Dukes of Dixieland: Mardi Gras Time
Audio Fidelity AFLP1862

On this trip to New Orleans for the Mardi Gras, the Dukes of Dixieland provide a much warmer reception than the unseasonal weather afforded visitors at this year's festival. The program is divided between parade tunes and numbers descriptive of the city, including *Do You Know What It Means to Miss New Orleans*, the theme song of the Dukes. A new clarinetist with a facile upper register, Jack Maheu, joins the band on the excursion to lend fluid phrasing to *Panama* and *Loveless Love*. A second recent addition is drummer Tommy Rundell, who sets the beat on *King Zulu Parade* and *The Second Line*. He shows restraint and taste when working with Bill Porter on tuba and pianist Stanley Mendelson.

Frank Assunto's trumpet sparks *Down in Honky Tonk Town*, and *At the Mardi Gras*. He is vocalist on *Way Down Yonder in New Orleans* and the theme. *If Ever I Cease to Love* marches at a faster tempo than usual with brother Fred's trombone leading the way. And Papa Jac brings his banjo along to add to the air of carnival. A first visit to Manhattan is on the schedule for the Dukes, and will include a concert and televised jazz show the last week in April.

Eddie Vinson: Cleanhead's Back In Town
Bethlehem BCP5005

Both the spiritual and traditional blues have strong story lines with specialized meanings to absorb the student. The shorter modern blues, in an effort to entertain and gain mass acceptance, is outwardly closer to popular songs than to these early sagas. Because

it remains a musical form which permits the performer a completely personal expression, it continues to tell more than one story. In his approach to the blues, a musician reveals more clearly than any written biography his influences, environment, conditions of exploitation, and his own ability. An examination of the careers and styles of Eddie Vinson and Big Bill indicates that the difference in their blues singing stems mainly from these varying factors.

Vinson developed in the Southwest of so many Kansas City men, joined Cootie Williams, and was able at one time to head his own big band. His instrument is the alto sax and his moving solos stimulate the small supporting Basie group which lists among others Joe Newman, Henry Coker, Freddie Greene, and Gus Johnson. His singing is conditioned by his big-band experience, but he combines the shouts and hollers of the older men with tricks of clipped phrasing based on their distinctive guitar style. *Kidney Stew, Caldonia*, and *Hold It Right There* prove his mastery of the blues and the art of entertaining. *Sweet Lovin' Baby* and *I Can't Keep The Tears From Tumblin' Down* are by Chuck Darwin, supervisor of the date. Paul Ackerman pens an appreciation of the modern blues on the liner.

Lionel Hampton: Lionel
Audio Fidelity AFLP1849

Like the glories of the Basie band, the percussive force of Lionel Hampton is often distorted in the recording process. His delight in softly toying with the subtleties of swift-moving passages before suddenly bringing them to a shattering climax poses problems not always solved in the studio. Even poor sound fails to obscure his electrifying personality, but his trademark, an odd whinny of approval as he improvises, is allowed frequently to overshadow the music. More than twenty-five years have passed since a Louis Armstrong date introduced him to the public. Now all the diverse elements found in Hampton are brought into focus by virtue of a really fine recording for the first time.

By nature a percussionist extraordinary, he secures melodic release on the vibraphone and piano. His gifts are so tremendous that such versatility seems less remarkable than his confining himself to three instruments. His voice does find expression on *And the Angels Sing*, but his talents are best combined on the vibes in more than seven minutes of *Stardust*. He drums without restraint on *Tracking Problem*, a full-scaled demonstration of his astonishing technique, and *I Know That You Know*. His unique piano style enlivens a Stephen Foster medley. But the vibes absorb most of his attention as he swings such tunes as *The Man I Love, Darn That Dream, One Step from Heaven*, and the reflective *Thoughts of Thelma*. Bob Plater alternates on flute, alto and tenor sax, in combination with the sensitive guitar of Will Mackel, to spell Hampton on the solos. Others in the group from his band are pianist Ossie Deenard, drummer Wilbur Hogan, and Julius Brown on bass.

The Sounds Of Yusef
Prestige 7122

Of the odd instruments and sounds being introduced into jazz, no group is more productive than that gathered in Detroit about Yusef Lateef. In effecting a fusion with Eastern music, the leader has extended an early allegiance to the tenor sax to both the conventional flute and Indian reed flutes. When these fail to fulfill his demands, he resorts to humming his choruses in the manner of a distant Moslem chant. All the members of his quintet also double on strange instruments. Wilbur Harden on flugelhorn uses an inflated balloon for melodic and rhythmic accents. Pianist Hugh Lawson is another balloonist, besides playing a pop bottle, bells, and Turkish cymbals. Bassist Ernie Farrow employs the one-stringed Rabat, and drummer Oliver Jackson uses an Earth-board and Chinese gong.

Lateef's compositions are built around Eastern themes and are best represented by

(*Continued on page 62*)

ABOUT MUSIC

What's The Pitch?

HAROLD LAWRENCE*

On June 17, 1955, delegates of thirty-seven nations, including the Soviet Union, agreed at a meeting of the International Standards Organization that the pitch of the basic tuning note "A" should be raised from 435 to 440 oscillations per second (cps). The press coverage of the event hardly reflected its historical significance. For the tiny news item in the *New York Times* marked the official end of centuries of pitch disparities, not only between nations, but between cities, theatres, and instruments.

One of the results of the old aural confusion is that we are not always certain what the music of the past actually sounded like in terms of pitch. The musician in search of correct pitch values is a kind of tonal archaeologist who must re-create the past with a combination of clues and common sense. The human voice is of course his most reliable clue since we can assume that man's vocal cords have remained the same for several millenia. Other clues derive from the use of voices with instruments, and from the writings of musicians and composers.

The need for pitch uniformity accompanied the rise of non-vocal music in Western civilization, with its growth of instrumental ensembles and the increasing mobility of composers and players. In the 16th and early 17th centuries there were no less than three groups of pitches in England. Secular vocal music corresponded fairly closely to our modern pitch, as the extremes of the bass and soprano ranges indicated. Liturgical music was at least a full tone higher than written, and keyboard music a minor third lower because of the weaker frames of the virginal and other like instruments. Between the church organ and the virginal, there was a difference of five semitones. Composers therefore had to adjust their notation to the medium employed.

Until the 18th century more exact estimates of pitch were impossible to obtain. Due to the primitive techniques of construction and operation, organs ranged in pitch from 437 to 567 (cps)—representing a difference of a fifth, or from F♯ to C♯. Pipe-shifting was commonly practiced on organs to modify pitch, thereby throwing future historians off the scent. Pre-18th-century methods of tuning utilizing pitch-pipes were far too unreliable to establish standards. And serious attempts to define pitch, such as those of the 16th-century Heildelberg musician, Arnold Schlick, were generally ignored.

The invention in 1711 of the tuning-fork provided the most solid piece of evidence in the investigation of the musical pitch of the 18th-century. Although not as precise as the later Deagan model, the variations in the tuning fork were insignificant in comparison with the pitch-pipe. The superiority of the tuning-fork lay in the fact that its tone is exceptionally clear: only the fundamental and high harmonics are heard, and the latter can be eliminated by mounting the tuning-fork on a resonance-chamber (a table top will do), thereby reinforcing the primary tone. Through Handel's own tuning-fork we know that his pitch was lower than our own: 422.5 cps. Mozart's piano was tuned to 421.6. In general, the pitch of the 18th-century ranged from 415–430, giving rise to the setting of the so-called "Classical Pitch" at 427 cps.

During the 19th century, pitch spiralled upwards like the rising tide of a musical inflation. Some attempts were made to curb the tendencies on the Continent, but in England there seemed to be no limit to the extremes musicians and instrument makers were willing to go in order to secure greater brilliance and "improved tone." In 1846 the London Philharmonic Society adopted a pitch of 452.5; and went to 455 in 1874. For nearly a century, musicians on both sides of the Channel found themselves faced with both a language and pitch barrier. An English singer reported in 1819 that "a clarinet player who some time since arrived here from Germany, and brought with him the instrument he had used for years, found himself unable to play upon it in concerts in England." After the Wagner Festival in the Albert Hall, London, in 1877, the composer remarked bitterly that his singers were hard put to rise to the English pitch. Two years later, Adelina Patti flatly refused to sing at Covent Garden at the English "concert" pitch of 455.

To a slightly lesser degree, the Continent also rose in pitch: Paris reached 448, Berlin 451.9, and Milan 450.3 by mid-century. The race for new instrumental brightness played havoc with pitch uniformity. Concerts had to be cancelled because wind instruments could not tune up to strings. To bring orchestral instruments into a church for a performance of a work involving organ and choir was the height of musical folly since it was next to impossible to blend the pitch variations into a harmonious entity.

In 1834, a congress of physicists met in Stuttgart to propose a standard musical pitch. Their recommendation was a prophetic one: "A" was to be tuned to 440. The musical world unfortunately did not

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

act on the Stuttgart standard. In 1858, the French government formed a commission of eminent composers to establish a uniform pitch. The members were Auber, Berlioz, Halévy, Meyerbeer, Rossini, and Thomas. With the assistance of a staff of physicists, the commission tabulated the rise of pitch over a period of two centuries, and listed in detail the varying pitches then employed in the principal European musical capitals. A standard pitch was decreed at 435 cps, and a reference tuning fork was deposited at the Imperial Conservatoire of Music. The "French Pitch" was generally adopted throughout Europe, except in England where the new standard was not well understood. It was not until the turn of the century that England finally came down to a more realistic pitch, and adopted 439 as the New Philharmonic Pitch. Military bands, however, continued to play at the Old Philharmonic Pitch of 452.5, thus making it impossible for band instrumentalists to play with orchestral musicians.

While the tuning-fork was a revolutionary step in the establishment of a uniform pitch, it was still somewhat less than scientifically perfect. Temperature changes can affect it by as much as four or five cycles. The ideal tuning-note is an electrical tone-generator, which can be made to sound with a degree of accuracy better than one part in ten million—a far cry from the nasal bleat of the old pitch-pipe.

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COMING EVENTS

April 14–17—15th Annual Radio Component Show, organized by the Radio and Electronic Component Manufacturers' Federation; Grosvenor House and Park Lane House, London.

April 18–22—Third London Audio Fair; Waldorf Hotel, London.

April 21–25—83rd Convention, Society of Motion Picture and Television Engineers; Ambassador Hotel, Los Angeles.

April 22–24—1958 Electronic Components Conference, sponsored by AIEE, EIA, IRE, and WCEMA; Ambassador Hotel, Los Angeles.

June 6–8—Houston High Fidelity Show, presented by Southwest High Fidelity Distributors Association; Shamrock Hilton Hotel, Houston, Texas.

August 19–22—WESCON, Western Electronic Show and Convention, sponsored by IRE and WCEMA; Pan Pacific Auditorium, Los Angeles.

Sept. 30–Oct. 4—New York High Fidelity Show, presented by Institute of High Fidelity Manufacturers; N. Y. Trade Show Bldg., New York.

AUDIO ETC

(from page 14)

and big, non-portable ones at that. I promise you, it is a dreadful experience. That cold, clammy silence that hits you in the ears—and in the pit of the stomach—is something you can practically feel, it's so thick. Terrifying. And then when somebody thirty feet or so away on the other side of the chamber opens his mouth to say a word—you must hold onto your sanity. *He is talking inside your own head.* There is, in an anechoic chamber, absolutely no sense of space or of distance, as far as the ear is concerned. All sounds are disembodied, with direction but without position. It is impossible to assign the slightest degree of space projection to them, and so they are inside your own cranium.

I suppose that those hardy souls who work in anechoic chambers get more or less used to this horrid effect. You don't have any trouble in understanding the spoken word, after all. Not when the person speaking seems to be inside your own head. But the idea of playing *music* in such a place is something I don't really like to think about. Imagine a string quartet playing head-Beethoven, all four players hearing themselves and their colleagues indiscriminately inside their own heads!

To end seriously, I think that one of the finest ways to get mental perspective on this whole business of recorded sound and its supposed hi-fi literal realism is to work a bit with absolute recording and the anechoic chamber. A "dead" studio is musically bad enough, but it isn't nearly dead enough to teach you the true value of reverberation in sound perception. You must really remove all the reverberation before you understand. And once you have heard that sort of sound—you'll never forget it in your life.

But the fact remains that if a violinist is to achieve literal reproduction of the violin to satisfy his present vociferous demands, he must play for the mike in an anechoic chamber.

It's that or nothing—unless he's ready to climb up a flagpole in the middle of a ten-mile desert and play to a suspended microphone up there. That'd do it, too.

2. ELECTRONIC DRIVE

You'll remember that quite awhile back I reported on several items sight unseen—things that just seemed to me good ideas in principle. One of them was the Fairchild Electronic Drive turntable, then just announced.

Well, Fairchild actually lent me one, *after* I'd written that article, which in a way was asking for it, since I'd really said all the good things I possibly could about the idea, before I so much as saw the practical embodiment of the principle! Who ever heard of practice being better than theory?

And so I won't spend much time praising the Fairchild, and will point out only some details that are understandably not quite as super-duper in practice as a wild imagination might have made them. While I'm at it, I'll point out, too, that this gadget

does do what it was supposed to do and shouldn't be run down by superior minds who want to have everything and a bit more in one package.

The basic premise of this table, don't forget, was a drive that operates via adjustable-frequency a.c. instead of fixed-frequency 60-cps line, the drive current provided by an amplifier; the virtues of the idea are double—first, that speed can be changed electronically instead of mechanically, minus gears and retractable pulleys; and secondly, that the speed can be controlled independently of the line frequency, again without extra gears and pulleys. An offshoot that's of even greater importance, as I pointed out, is that *line fluctuations* in frequency are at last controllable and need not cause changes in pitch in the music. This last is of tremendous interest to all who must depend on unstable world-wide electric power lines, outside of the good old U. S. and (dare I say it) occasionally in the U. S. too.

Given these ends, the practical development of a table was a tough problem, I can easily imagine. The resulting product, rightly, was not intended for the low-priced market and is not simple. The table is one of the biggest and heaviest I've yet run into and I do *not* intend to mount it in a suitcase for my next European trip! To drive a quality table at no less than four standard speeds (with adjustment provided) from an electronic signal generator is a mean problem, since a very wide range of frequencies must be covered —wide as far as the problem is concerned—with enough current on hand in each case to start the table going and keep it going against all possible drag, all without gearshift or other mechanical aids. About like designing an auto motor that would work with a single drive connection and an equal torque at 2 miles per hour and at seventy. And there's that little matter of frequency stability. If the table decides to run slower or faster as things get hot, or as voltage sags or peaks, or as frequency changes in the power supply—ouch.

Therefore I feel charitable towards the Electronic Drive and I am frankly astonished that it works so well. I had heard some rumors of unstable speeds; I haven't noticed any yet. (I can pull a plug and convert mine to straight 60-cycle drive in a moment; so far, no pitch deviation has been noted at the 33 speed which is available in "direct," or connection to the outside 60-cycle power.) The thing plays at 16, 33, 45 and 78 and it'll start up and keep going at all these speeds, with good torque—enough to keep the table going even if you hold back the record with your finger. The mechanical end is excellent as a matter of course and I didn't expect to find any wow or flutter, haven't heard any. Two belts do the driving, somewhat as in the Components tables (one belt).

I don't have any practical way to put this baby through a real European test—i.e., voltage zooming up and down, frequencies ambling back and forth with enthusiasm. I know what can happen to American phono and tape equipment under such conditions. I know, too, of the station-wagons full of equipment that nor-

mally are put in the field over there when professional records are to be made—and a lot of it built deliberately to insure a steady pitch in the recordings.

I know of the howls of expatriate Americans who have imported standard hi-fi equipment into various countries, with unpleasant results of pitch. I know, even, of the nuisance that still exists in acquiring special 50-cps equipment for the "standard" European frequency that exists in many areas.

Yes, frequencies do stay put in many places—don't get me wrong. Standards are going up, I assume. But if you want to be *sure*, and if you have the cash, can carry the weight, and have the space, then Fairchild's Electronic Drive will make you feel better, on all these counts. Like the Traveler's Insurance ads, it gives you American Family Independence—from doubtful power sources.

And so—with Fairchild's indulgence, I'll mention a few minor disadvantages that come necessarily along with the basic advantage of this table. First, it has to warm up before it starts. Take quite a while. Can be annoying—though your amplifier takes the same amount of time and if you have the two on a common power supply they start to work simultaneously. Still—this can get on your nerves. Turn the machine on and nothing happens. Wait, wait, wait, and finally the table begins to turn slowly, then faster and up to speed. Rather eerie, the first time—like my experience in Switzerland when an unoccupied cable car suddenly took off into space without a sound just as I had reached out one foot to step into it. (In five seconds I would have been dangling 200 feet in the air.)

Second, the turntable is big, clumsy, weighs a ton. Not important once it is installed, but it definitely won't do as a portable player.

Third, thanks to a whopping big power amplifier, it tends to get pretty warm, and I'd guess it draws a fairly big current, for the thrust it eventually delivers. Necessary aspects, give the basic premise. The thing hasn't overheated yet, though I have it in a fairly tight box without extra ventilation. I suggest that good ventilation is absolutely necessary, even so.

Fourth, the change-speed isn't as sure-fire and as simple as the usual table; it takes a moment or two to make up its mind when you shift the control, and there are a few very odd in-between speeds that occur between the standard settings. (Contrary to what you might expect, the speed control is not continuously variable; it has four fixed points, with "off" positions spaced between.)

Fifth, variable speed is available individually for each position, but you must get down inside; on the regular model you must take off an outside cover. (I understand that you can now have one with the adjustments permanently exposed, if you want.) All this is obviously due to the need for switching of circuits between the different speeds, though I haven't tried to find what the switching does. Not important, and quite acceptable if you go along, again, with the basic premise of the whole design.

That's enough to give you an idea, in

case you think this is a miniature fly-weight adjustable table! I think it should be stressed that the entire design aims at top-quality performance under the given premise—and, as far as I can tell, achieves it nobly. The table is soundless, smooth as silk, the playing speeds steady, the rumble and hum just plain not audible. I wouldn't go so far as to recommend this model indiscriminately for all uses in its range of quality and price; it is a relatively specialized machine and should be understood as such. Once again, given the basic premise, and given your need for the basic advantages, the solution of the problem has been carried out on a high plane.

If you want a "plain" Fairchild table you can have it now both in one speed (the same as above, minus the electronic drive, which can be added later) or in a new two-speed model, with conventional switching between speeds. I suppose this last might be considered as a wee, small retreat from the principle of electronic speed determination originally propounded, but I think it is fair to Fairchild to think more positively, that the mechanical two-speed model is simply a supplementary widening of the available possibilities in this line of goods. After all, some of us don't need Electronic Drive, but wouldn't mind having a Fairchild-made quality table. Æ

RECORD REVUE

(*from page 46*)

reproduction, from what seemed like a few inches away. Phew!

RCA Victor is cagey. Is it a mere co-incidence that in this recording the violins seem abnormally *distant*? I dunno—but it certainly helps to make those squeaky passages blend into smoothness. (Cf. the Mercury recording of Dvorak, preceding.)

The Munch Prokofieff is crisp, clean, light as a feather and, for my ear, very chilly. It has the electricity that ought to be there, but it is lacking in the Prokofieff warmth. Most of this comes out in very fast tempi that make things sparkle but don't give the touchingly sweet or coy or humorous ideas half a chance to get through. My opinion, anyhow. This is like a "Peter and the Wolf" done double-time. Somehow, the thing is mechanical, all precision and with little inner expression. Maybe the Boston players just don't like the score very much.

Tchaikowsky: Manfred (Symphonic Poem). State Symphony Orch. of the U.S.S.R., Rakhlin.

Westminster XWN 18536

Sputniks? You can forget about the former Russian inferiority in recording; most of the new tapes coming over are quite equal to ours in sound quality and even in "hi-fi" technique—though there is a curious and undefinable difference in the over-all sound. I suspect this last has to do with relatively dead recording studios or halls, which is, after all, strictly a matter of taste. This one is pretty dead, has a somewhat "S-II" sound, in a mild way, especially when the brass lets go full-power; it sounds small and without any very definite spatial location. Otherwise, the sound is superb.

If you like tone poems of the "Romeo and Juliet" sort, this'll give you a quadruple dose. It's a vast piece in no less than four long movements—one of the few of the breed actually to be subdivided. It has the usual Tchaikowsky themes and they recur in the usual impressive manner, but the piece is just plain too long for my not so tolerant tone-poem ear. Suit yourself! The general

technique and sound is definitely reminiscent of "Romeo and Juliet" and (what am I talking about?) there are some really lovely and haunting melodies, some marvelously gloomy and dismal scenes . . . I guess I *do* like it, as a matter of fact. Too long, that's all.

Mahler: Symphony #4. Saxon State Orch., Dresden, Ludwig. Anny Schlemm, sop.

Decca DL 9944

This is the lovely symphony with the soprano solo in the last movement, one of the easiest Mahlers to take. If you happen to know the very intense and Romantic Bruno Walter approach, this version may at first seem rather offhand, even casual; after two playings I decided that this difference is a legitimate one of interpretation. I like the Bruno Walter approach better—Mahler *was* intense. But the music is far from spoiled here, in this very musical, if somewhat mild reading. Anny Schlemm suits the interpretation well in her singing and the sound is modestly fine hi-fi.

Schumann: Cello Concerto. Schubert-Cassado: Cello Concerto ("Arpeggione" Sonata). Gaspar Cassado, cello; Bamberg Symphony, Perlea.

Vox PL 10.210

I guess the cello is my *bête noir*; my hackles seem to rise each time one of the more flamboyant of the cello virtuosi tackles his bow. Cello records—cello pieces—seem to come in droves; once started, a cello recital never relents . . . which is the background here for my feelings concerning this record.

Cassado is an old-line flamboyant cellist, and a fine one. But to go along with him you must see music from a cellist's eye, with a vengeance. The Schumann Cello Concerto, to be sure, is one of the more idiomatic pieces in the cello repertory—that is, its music just naturally suits the florid, tenor-like cello style of virtuoso playing. But it is not one of the finest Schumann's works and I found it here, as might be expected, more cello than Schumann. OK, if you like the cello. (I've heard the piece, though, in versions that bring out more of the composer's own speech and personality.)

As for Schubert-Cassado—this is a grandiloquent symphonic concerto transcription by Cassado himself (done many years ago) of Schubert's much-abused sonata for a somewhat cello-like invention, the arpeggione, and piano. The original has become a cello repertory piece, though Schubert fans tend to find it, (like the Schumann Concerto) not one of the composer's most successful items. In this transcription Schubert is overwhelmed with anachronism—the "concerto," as here conceived, is utterly un-Schubertian, sounds as though it came out of the high Romantic period of virtuoso nonsense, maybe 50 or 60 years after Schubert's death! I was hardly surprised to find that M. Cassado had to write some extra Schubert himself, to round things out properly. I must say that he did an expert job. You'd never know any of it was Schubert, even the part Schubert wrote.

Well . . . as I say, I don't like cello music; I just like music.

Reginald Kell, Clarinet, Brooks Smith, Piano. (Saint-Saëns, Templeton, Szalowski, Vaughan-Williams).

Decca DL 9941.

The Clarinet is a fine instrument for recording, no doubt about it, and Reginald Kell is the most soulful and sensitive of classical clarinetists; his instrument "sings," emotes, palpitates, colors itself, in a wonderful range of musical expression.

This nice-sounding disc features a big, tuneful sonata by old Saint-Saëns, composed in his last year at age 86 and as youthful as you please (it was 1921), plus a humorous trifle by Alec Templeton. The reverse supplements some pleasantly romantic Vaughan-William pseudo-folksong (you'll swear you've heard them before . . .) with a sonatina by a mild modern, Szalowski.

Kenneth Patchen Reads His Poetry with the Chamber Jazz Sextet.

Cadence CLP-3004

This is the second opus on records from the new West Coast movement that has all the poets reading their stuff as night club entertainers, with jazz accompaniment. Seems to be a great success there.

The idea is interesting and has lots of possibilities—more will come of it than does here. Trouble with this recording is that you can't understand three quarters of what Mr. Patchen has to say, though the jazz is beautifully projected. The Patchen voice is gravelly and he ain't no announcer type; he's the kind that even when he speaks low in his throat makes the VU meter jump frantically. He practically gargles here, like an amateur recordist muttering into a crystal mike at a half-inch distance.

I was sent the book in which these poems occur in print, but I found I couldn't locate the darned things fast enough to keep up with Mr. P. He goes right along and, since the titles aren't announced nor even listed on the jacket, you have to stop the record every time, to find what is coming next.

Patchen is very colloquial and not at all an elegant poet—none of the newer gents is quite that. I soon discovered that the Patchen spoken poems are censored in a good many places, as compared with the printed versions. Wisely so, since there still is a difference between what can be printed without offense and what can be said out loud (in a night club) with similar propriety.

I look forward to more of this sort of experiment—but somebody'd better do a better job on the recording, or teach the poets to speak with minimum intelligibility. (The guy is good, by the way; I don't mean to run him down aesthetically.) Æ

NEW LITERATURE

• **H. H. Scott,** 111 Powdermill Road, Maynard, Mass., features the new Scott Model 330-C AM-FM stereo tuner in Catalog A-3 which is now being distributed. Introduced as the "tuner of the future," the 330-C may be used as an AM tuner, as an FM tuner, or both sections may be used together for AM-FM stereo reception. Catalog A-3 will be mailed free upon written request. **D-14**

• **General Electric, Specialty Electronic Components Department,** West Genesee St., Auburn, N. Y., has just issued Brochure EP-257, illustrating and describing the entire line of G-E hi-fi components for the home. Prices are shown for all items as are a number of suggestions for home applications. Requests for free copies should be addressed to: G-E Hi-Fi, Box 101, Liverpool, N. Y., or circle code **D-15**

• **ORRadio Industries, Inc.,** Shamrock Circle, Opelika, Ala., makers of Irish brand magnetic recording tape, has performed a useful service for home tape recordists with the publication of an instructive pamphlet titled "Tape It Off the Air." The pamphlet gives detailed information on how to rig a tape recorder to make good recordings from AM and FM radio receivers or from TV sets. The recordist is told how to set the volume level and how to use the volume indicator. Also he is given instructions on how to hook up his tape recorder with the radio or TV. Diagrams are used to illustrate the text. Requests for free copies should be addressed to F. R. O'Sheen at the address shown above. **D-16**

• **University Loudspeakers, Inc.,** 80 S. Kensico Ave., White Plains, N. Y., has issued a new brochure describing the University Progressive Speaker Expansion plan. With the aid of charts, the audio hobbyist is shown how to choose his basic speaker or speaker system, then he is guided through a progression of steps which will enable him to add components until he has his "dream" speaker system —with no need to discard original components. The brochure presents complete descriptions, illustrations and prices of University speakers, networks and enclosures, including the do-it-yourself enclosure kits which are adapted to PSE. Your copy will be mailed upon written request. Write for it. **D-17**

• **Fisher Radio Corporation,** 21-21 44th Drive, Long Island City 1, N. Y., has recently issued an attractive new radio-phonograph catalog which contains complete information about Fisher high-fidelity consoles. All models are handsomely illustrated and descriptive material includes technical specifications as well as cabinet finishes and outstanding features of each model. This catalog should be in the hands of everyone thinking about buying a fine ready-assembled high-fidelity music system. Your copy will be mailed upon written request. **D-18**

• **Livingston Audio Products Corporation,** Box 202, Caldwell, N. J., features more than 90 stereo titles in the fields of classical, semi-classical, jazz, popular, and folk music, as well as 150 diversified monaural titles in its new 1958 Stereophonic Tape catalog which has just been released. Highlighting the 28-page catalog are a complete listing of all artists and selections on each stereo tape, and a special listing by catalog number of all stereo and monaural tapes. Individual sections are also devoted to tape accessories and sampler and test tapes. Copy will be mailed upon written request. **D-19**

JAZZ AND ALL THAT

(*from page 53*)

the harmonic and metric variations of *Love And Humor*, and the plaintive *Meditation*. By switching to tenor sax on *Buckingham*, he relates it more closely to American jazz. Harden contributes *Playful Flute*, prefaced by Lateef with the sound of a scraper. After this, an unusual treatment of *Take The A Train*, almost seems conventional. Few musicians pass through Detroit without hearing the unit in person, but a clean-cut recording by Rudy Van Gelder brings it closer to home.

The Music Man
Capitol WA0990

Jimmy Giuffre: The Music Man
Atlantic 1276

To relate the fate of an itinerant salesman of band uniforms and instruments at the hands of a local librarian in the Iowa of 1912, Meredith Willson has created a book rich in native wit and a score of ebullience and gaiety. An air of exuberance fills the LP by the original cast, as Robert Preston successfully conveys the dual personality of rascal and stout good fellow. Barbara Cook is appealingly winsome in her ballads, and The Buffalo Bills are a quartet as wholesome and refreshing as after-shave lotion. Part of the romantic memories of everyone who marched beside one, as did this writer, the music man will parade before generations to come, thanks to Willson.

The first of the jazz transformations to salute this Broadway hit musical relies on understatement to add to the charm of the ballads *My White Knight*, *Till There Was You*, and *Goodnight My Someone*. But the scoring by Jimmy Giuffre, who alternates on clarinet, tenor, and baritone sax to take all the horn solos except on one number, is hardly robust enough for such show stoppers as *Wells Fargo Wagon*, and *Gary, Indiana*. The instrumentation of three saxes, three trumpets, bass, and drums fails to meet the requirements of *Seventy-Six Trombones*.

The Mastersounds: The King And I
World Pacific PJM405

For their second album, The Mastersounds turn to Rodgers and Hammerstein's score of the musical "The King and I." With Buddy Montgomery on vibes, pianist Richie Crabtree, drummer Benny Barth, and Monk Montgomery on the Fender electric bass, their instrumentation might have been planned for the *Dance Of The Siamese Children*. Without stretching it to the point of tedium, they manage to convey a delicate feeling of the Orient, Buddy Montgomery deserves the credit for arranging the tasteful blend of melody and rhythm. In concocting an epilogue of nearly ten minutes, he sums up the beauties of the show. With vibrant sound resembling the Modern Jazz Quartet, it is a delight for any living room.

Cliff Jordan, Vol. 1
Blue Note 1565

Since this session was held, Cliff Jordan joined the quintet of Horace Silver, who warrants much of the credit for his exposure on records. His importance is bound to grow in such surroundings and more will be heard of this young tenor-saxist from Chicago. *Beyond The Blue Horizon* finds him at his best in a full-blooded statement of warmth and depth, and he contributes *Not Guilty*. The muted trumpet of Lee Morgan outlines his blues *Ju-ba*. Trombonist Curtis Fuller introduces his original *Blue Shoes*, and John Jenkins on alto sax is responsible for the happy mood of *St. John*. The solos of pianist Ray Bryant are pleasantly probing, and drummer Art Taylor and bassist Paul Chambers complete the rhythm section.

Curtis Fuller: Bone & Bari
Blue Note 1572

Two of the latest arrivals from Detroit unite in the unusual combination of trombonist Curtis Fuller and Tate Houston on baritone sax. The paired horns achieve a deep-toned blend, lightened by the rollicking German-band effect on *Nita's Waltz*, one of the four originals by Fuller. His title tune swings nicely, and he includes two blues at medium and fast tempos. Fuller solos on *Heart and Soul*, and Houston, a member of the Maynard Ferguson band in recent months, displays his talents on *Again*. It is his first appearance on records outside a big band and his warm and moving conception indicates that he enjoys the freedom from section work. Pianist Sonny Clark, Paul Chambers, and Art Taylor form the able rhythm section.

Blues For Tomorrow
Riverside RLP12-243

Hi-Fi Drums
Capitol T926

The similarity between these albums is in their assembly, though Art Blakey's solo on the blues might be interchangeable. Both consist of items made at different times by various groups and gathered together because they express a central theme. In its informal anthology of modern blues, Riverside uses unreleased material gleaned from sessions which resulted in LP's in recent months. Included are a quartet featuring Sonny Rollins, the Mundell Lowe quintet with Billy Taylor, the Bobby Jasper quartet with George Wallington, and four Californians under Herbie Mann on bass clarinet. The sextet selected to support Thelonious Monk expounds at greatest length, with solos by John Coltrane, Coleman Hawkins, and the irrepressible Blakey. Always a release valve for musicians, the blues finds them turning in some of their best work, particularly Lowe and trumpeter Jack Sheldon.

In compiling a showcase for drummers, Capitol revives some items from departed 10-inch LP's. Buddy Rich and Chuck Flores work out with the Woody Herman Herd, Louis Bellson fronts his own group, and another exponent of paired bass drums, Dave Black, drives the Duke Ellington band. Newest and most brightly recorded is *Tri-Fi Drums*, an eight-minute excursion for Stan Levey, Alvin Stroller, and Irv Cottler, written by Bill Holman for the Billy May band, which also presents Stroller on *Brushed Off*. Seven drummers should be enough to entice the percussion fan.

Charles Mingus: East Coasting
Bethlehem BCP6019

The Charles Mingus Jazz Workshop offers a challenge to the jazz musician and its leader has experienced no trouble in finding top men for his studio dates. During the past year he had the good fortune to form a small cohesive group and work over his writing with it in public performance before recording. It was a constructive period in which his ideas were tightened or expanded, and the results are conveyed here with the vigor and emotion that comes from complete understanding. Most productive is his association with Fred Knepper, a young trombonist who, as Mingus notes, "is all eras on that instrument." In the course of exploring his horn with the curiosity and inventiveness of the New Orleans men, plus the added knowledge of the more advanced modernists, he recognizes no limitations—a point of view also somewhat of a watchword for Mingus in his bass playing and composing.

Only *Memories of You*, a showcase for the muted trumpet of Clarence Shaw, is not by Mingus, and his five originals comprise retrospective examinations of his two homes in *East Coasting*, and *West Coast Ghost*. *Celia* is named for his wife, and *Conversation* is marked by the quick conception of pianist Bill Evans. Under the Mingus wing, drummer Dannie Richmond, as he indicates on *51st St. Blues*, and Shafi Hadi on alto and tenor sax are developing the competence gained in

rhythm and blues into the creative impulse required in jazz.

Dave Pell: I Had The Craziest Dream
Capitol T925
Richie Kamuca: Jazz Erotica
Hifirecord R604
Pete Rugolo: Out On A Limb
EmArcy 36115

Lumping modern musicians of the West Coast together in a school is a matter of convenience, partly justified by their consistent expertness and an approach which some feel carries them often over the borderline of jazz. That they seek to communicate in a variety of ways is evidenced here. The Dave Pell octet is unique in its respect for dancers. Because many of its arrangements are published, it is also one of the most copied of contemporary groups. With a range from *On the Good Ship Lollipop* to Marty Paich's *Nap's Dream*, it shows the advantages of pleasing the dancer, the listener, and the musician.

The octet headed by Richie Kamuca on tenor sax has a suavity that would put the most polished society orchestra to shame. Playing studied arrangements by baritone saxist Bill Holman, it reveals the charm this school can have for the listener. The urgent drumming of Stan Levey gives propulsion to the proceedings.

A most comprehensive survey of the scene is found in the compositions of Pete Rugolo. Only four members of the rhythm section, headed by drummer Shelley Manne, were present at all three sessions. Writing with particular soloist in mind, Rugolo scatters throughout the ten works a lengthy roster of top men, including Bud Shank, Bob Cooper, Jimmy Giuffre, Dave Pell, Larry Bunker, Barney Kessel, Maynard Ferguson, and Russ Freeman. Manne makes a brilliant concerto of *Ballade for Drums*, and Ellington is saluted on *For Early Duke*.

Fernando Sirventi: La Zambra
Audio Fidelity AFLP1848

Featured for four seasons at La Zambra, a New York club noted for the excellence of its classical and flamenco guitarists, Fernando Sirventi drew the nightly plaudits of the audience by appearing in both capacities. His choice of repertory on this disc combines the dual aspects of his art in his own arrangements. For the flamencos, he has the company of the dancer Goyo Reyes and the singer Domingo Alvarado to add to the atmosphere of emotional and rhythmic spontaneity. He made his first professional appearance in his native Madrid and, after touring the continent, came to this country in 1951. As a soloist, he essays a light, airy coloration in preference to the more somber hues of some of his compatriots. Included is Tarrega's *Recuerdos De La Alhambra*, and *Asturias* by Albeniz. The sound of the heel clicks is not overly resonant and good separation keeps the castanets from conflicting with the superb tone of Sirventi's Marcelo Barbero guitar.

The Sounds Of Holland
Capitol T10133

The Dutch are a busy people and there is enough movement here to satisfy even those sound fanciers who have ears only for stereo. Using portable recorders, technicians of the Bovema Corporation at Heemstede worked for nearly a year to assemble kaleidoscopic portrait of the Netherlands. It has everything but the sound of a knife slicing open an Edam cheese. There are visits to the canals, the North Sea, Schiphol Airport, a railway station, a night club, children at play and school, street noises, and clogging wooden shoes on a cobbled sidewalk. There are the Palace chimes and finally the New Church carillon at Delft. Brief, informative narration by Hans Conreid gives sense and direction to the tour of a nation that seems always on the move. The noble tones of the mammoth barrel organ, previously alloted an entire album in this series, fill the interludes during changes of scene.

Robert McFerrin: Deep River
Riverside RLP12-812

As the second Negro to sing with the Metropolitan Opera Company in its seventy-year history, Robert McFerrin followed Marian Anderson. In lending his virile baritone voice to fourteen spirituals, he continues to measure up to her standards in his depth of conviction and native warmth. Now a regular member of the company, he brings the calm strength of a trained artist to the more familiar arrangements of Hall Johnson and the less frequently heard *His Name So Sweet, I Got to Lie Down, Witness,* and *Fix Me, Jesus.* Included are William Grant Still's *Here's One,* and William Lawrence's *Let Us Break Bread Together.* His recital is rich in a tradition fully understood by Norman Johnson, his able piano accompanist.

The Dagenham Girl Pipers
Capitol T10125

Reversing the usual order, the visit of the Dagenham Girl Pipers to this country preceded this release by several years. Organized in 1930 from among the eleven-year-old members of an Essex Sunday School class, it was the first time an all-female contingent manned the pipes in the United Kingdom. Recorded in the London studios of E.M.I. last year, their present-day descendants recall the tour with two rousing medleys which include *Swanee River* and *Yankee Doodle.* They follow the medley form in marches, reels, strathspeys, and songs typical of pipe bands. May it herald another stop by the Dagenham lassies on their jaunts around the world. Æ

COMPASS-1 LOUDSPEAKER

(*from page 36*)

Speaker Components

Much of the high quality of reproduction of the Compass-1 is due to the high quality of the speaker components themselves. The woofer, *Fig.* 3 is a heavy-duty 12-inch cone speaker built on a non-resonant cast aluminum frame, and using a magnet assembly with a weight of 61.5 ounces. By itself, this unit has a frequency-range capability extending from 20 to 14,000 cycles per second. The acoustic enclosure is completely airtight, with suitable internal padding.

The tweeter unit, *Fig.* 4, is a marvel of loudspeaker engineering. It consists of a small-diaphragm pressure-type driver unit loaded by a 360-deg. exponential horn. The horn itself is essentially two convex discs which practically touch at the center where the diaphragm is located, and the sound radiation is through the annular opening at the rim of the two discs—this opening being ⅞ inches high and 9 inches in diameter. The tweeter output is flat within ±5 db throughout its range, which extends to 18,000 cps, with usable output to over 20,000 cps. Frequencies below 2500 cps are eliminated from the tweeter input by the crossover device so as to increase the total power-handling capacity of the Compass-1 so that it will accommodate the output of a 50-watt amplifier on normal program material.

Fig. 4. The omni-directional radiation pattern of the Compass-1 results from the use of this type of tweeter.

Because of the omni-directional radiation pattern of the Compass-1, the advantages of finished front and back may be used to their fullest in matching any room requirements. The over-all high quality of reproduction does credit to any hi-fi system, and the phasing feature is of the greatest importance when the speakers are used in pairs in stereo systems, or even when a single Compass-1 is added to an existing system using some other type of loudspeaker. Æ

AUDIOCLINIC

(*from page 4*)

amplifier, McIntosh 30-watt amplifier, and the new Healthkit 70-watt amplifier. Which would you consider to be the best amplifier, and which is the best preamplifier? Raymond Waggoner, Ann Arbor, Mich.

A. Components are designed to meet a variety of needs and conditions. Some of these are: 1. power requirements, 2. number of phonograph equalization positions, 3. number of inputs, 4. number of outputs, 5. need for separate input level controls, 6. mixing facilities, 7. price, 8. physical size, and 9. appearance. Because of these factors it is not possible to define as best any equipment for your particular needs. Looking and listening based on your specific needs can give the only true answer to your problem. Æ

PAGING PREAMPLIFIER

(*from page 23*)

ures for the microphone stage are shown in the curves, *Fig.* 3.

The sensitivity is satisfactory, requiring 1 volt input to the phono or radio jacks for 0.5 volts output, while the microphone input requires 0.013 volts for the same output.

The radio-phonograph hum and noise level is 72 db below 0.5 volts while the microphone hum level is 57 db below this level.

The frequency-response curves are shown in *Fig.* 4. The radio-phonograph response is ideal. The drop at the low end for the microphone response is significant due to microphone and speaker variations and inadequacies in that range of frequencies.

Possible Circuit Variations

Using this unit with the Eico HF-50 or HF-60 Hi Fidelity power amplifiers, the radio and phono stages have sufficient output and provide excellent fidelity. With a lower gain power amplifier, it may be necessary to add one stage of amplification. This can be readily accomplished with a few minor revisions in the unit.

The 6C4 cathode follower tube is replaced with a dual triode 12AU7. One section is retained as a cathode follower, using the same circuitry as with the 6C4. The connection between X and Y in *Fig.* 1 is broken, and the remaining triode of the 12AU7 is inserted. A complete schematic of this is shown in *Fig.* 5.

Another possible variation permits the use of this preamplifier, with or without the added stage of amplification in *Fig.* 4, as an ordinary mixer P.A. unit, entirely eliminating switch S_1. A schematic of this appears in *Fig.* 6. However, the versatility possible when switching inputs and speaker groups is lost.

Components

All components used in the preamplifier (*Fig.* 2) are standard jobber-stock items. The three-pole double-throw lever switch is of the spring return variety. Disregarding the fourth pole on the Centralab switch, lever switch #1457 can be used.

The six-conductor cable to connect this unit to the power supply on the power amplifier can be of the ordinary intercom type. Belden #8448 cable is perfect here.

The chassis shown in the photographs was built from sheet steel. A standard chassis complete with cabinet can be bought from the parts jobber. ICA metal cabinet #3823 is ideal.

Construction

Tube sockets, electrolytic capacitor, and hum bucking potentiometer R_{16} are all mounted on the top of the chassis, as shown in *Fig.* 7. The input and output plugs, and speaker terminal boards are mounted on the rear. The 0.5-meg. level controls, the press-to-page switch and the on-off switch are then mounted on the front panel, as seen in *Fig.* 8.

The filaments are the first to be wired,

Fig. 7. Rear view of completed preamp chassis.

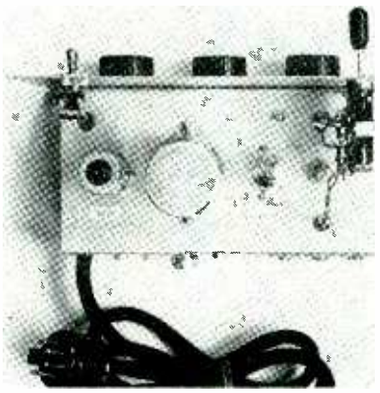

Fig. 8. Top view of the chassis showing position of the paging and power switches, S_1, and S_2.

making the leads as short as practicable. Dress these leads away from the inputs. The six-conductor cable is inserted in the hole provided for it at the rear of the chassis. The two leads to the switch and the two leads to the filaments are then connected, observing the aforementioned precautions.

The input and output connectors, next to be wired, are connected to the level controls and 6AV6 tube with short, direct leads, as shown in *Fig.* 9. After wiring the B+ and ground leads, from the six-conductor cable, the components are connected in accordance with the circuitry in *Fig.* 1 and soldered in place, making the leads as short and direct as possible.

The leads from the microphone control arm, the junction of the two 0.27-meg. resistors R_4 and R_5, and ground, are then wired to the switch sections S_{1A} and S_{1B} as shown on the schematic. Next, connect the speaker terminals as shown in *Fig.* 1, extending two leads to the switch, S_{1C}. These leads should be dressed away from all tubes as well as the other switch connections, to avoid feedback.

The appropriate power plug for the particular power amplifier is wired to the remaining end of the six-conductor cable to provide the necessary voltages at the preamplifier.

With tubes and knobs in place, the unit is ready for operation. The phono, radio, and microphone are connected to the appropriate input jacks, while a shielded cable connects the output jack to the input on the power amplifier. The output from the power amplifier is connected across the terminals marked AMP. The speakers used for both music and paging are connected to the terminals marked PROD while those used for paging only are connected to the terminals marked OFFICE. All interconnections are completed when the power plug is connected into the power amplifier.

Due to the excellent characteristic of this unit, the limiting factor on the fidelity of the resulting PA system is the associated power amplifier, speaker and input equipment.

PARTS LIST

C_1	.005 µf disc ceramic
C_2, C_3	.025 µf disc ceramic
C_4	0.1 µf molded paper, 400 volts
C_5	20-40-40/450 electrolytic capacitor, can
R_1, R_2, R_3	0.5-megohm potentiometer, audio taper
R_4, R_5	0.27 megs, 10%, ½ watt
R_6	5.6 megs, 10%, ½ watt
R_7	0.2 megs, 10%, ½ watt
R_8	1.0 meg, 10%, ½ watt
R_9	2200 ohms, 10%, ½ watt
R_{10}	47,000 ohms, 10%, ½ watt
R_{11}	0.47 megs, 10%, ½ watt
R_{12}	22,000 ohms, 10%, 1 watt
R_{13}	10,000 ohms, 10%, ½ watt
R_{14}, R_{15}	68,000 ohms, 10%, ½ watt
R^{16}	100-ohm wire-wound potentiometer, 1 watt
S_1	3-pole double throw lever switch, spring return (Centralab 1457 or equivalent)
S_2	SPST toggle switch
V_1	6AV6
V_2	6C4/EC-90
	Six-conductor cable
	Single-conductor shielded cable
	Two 7-pin miniature tube sockets
	Knobs, plugs, connectors, dial plates, etc.

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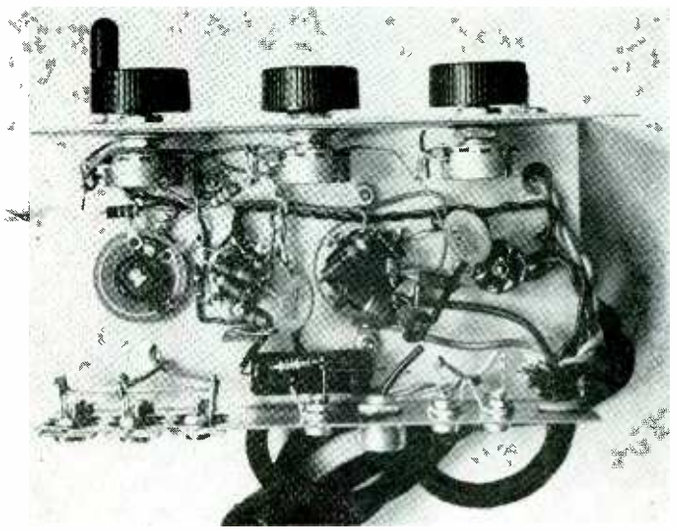

Fig. 9. Underside view of chassis to show simplicity of wiring.

IMPEDANCES

(*from page 32*)

This statement may sound odd when we consider how careful audio people are to use only eight-ohm speakers where it says "eight ohms." True, it *is* desirable to give careful attention to the speaker impedance, but it should not be chosen to *match* the amplifier output impedance.

When it says "eight ohms" it means connect an eight-ohm speaker for best results in terms of lowest distortion and other factors. This does not provide the maximum power output, because the actual speaker impedance, which is a function of frequency, is far different from the amplifier output impedance, which likewise is a function of frequency. The amplifier output impedance will likely be very different from eight ohms.

In fact, some high-fidelity amplifiers are equipped with a damping control, whose main function is simply to vary the internal impedance, even to make it slightly negative. Clearly here impedance matching is not followed.

Another interesting case is where many speakers are connected to one amplifier. Often here an amplifier with a very low internal resistance is used. This keeps a constant output voltage on the line to the speakers, regardless of the number connected. Additional speakers can be added or taken off this 70.7-volt line as easily as light bulbs can be connected to a power line. Obviously the whole idea here is to avoid matching impedances altogether.

The VU Meter

For the output part of our system perhaps one more example will suffice. It is well-known that the mechanical properties of meters (voltmeters, ammeters, and the like) are affected by the electrical resistance they "see." In particular, the common VU, or volume-unit meter has proper ballistics when it "sees" a resistance of 3900 ohms. Therefore when we connect a VU meter in a circuit we must be sure that it sees this resistance.

But the VU meter also has an internal resistance, and it happens this also is 3900 ohms. Is this then a case of matching impedances?

Well, not exactly. If the two resistances—the internal resistance and that required for proper ballistics—were different we would certainly ignore the internal resistance, since we're not primarily interested in maximum power transfer. The two were made equal, it happens, so that a T-pad could be inserted between the meter and the circuit whose voltage is read, to adjust the

sensitivity of the meter. Transfer of power is of secondary importance here.

Although impedances are matched in this case, it would not be wise to do so with other types of meters. This is one more case out of many in which transfer of power is relatively unimportant, and impedances are not deliberately matched.

At the output of an electronic system, then, impedance should be matched only when maximum power transfer is required *and* when the load impedance is the one to be varied. Impedance levels should be carefully chosen, to be sure, but not by using the principle of matching.

BETWEEN STAGES

Now the question of matching impedances arises again at points in the middle of the circuit, for example between amplifying stages. Is matching a good idea or not, and how can it be done?

To answer the second question first, impedances can be matched here by means of a transformer, by a network such as a T-pad, by negative feedback applied to either or both sides, or by actually changing the stages in such a way as to secure a better match.

A common example may be that of coupling two transistor stages. (Recall that the three configurations of transistor stages—grounded-base, grounded-emitter, and grounded-collector—have different input and output impedances.)

We know that maximum power transfer occurs under matched conditions—does it then follow that for maximum power gain from an amplifier individual stages should be matched?

Well, this depends on the method used. If transformers are used, fine. Matching does result in maximum power gain. Otherwise, generally not.

If a match is achieved by means of a dissipative network, such as a T-pad, then in general the gain is lowered by matching. Negative feedback applied to one or both sides of the point in question can help us match impedances, but the gain will not increase. If a very serious mismatch occurred in the first place, then sometimes it is possible to get all the benefits of a moderate amount of negative feedback with very little loss in gain, but don't expect any increase!

And finally, with transistors, a match can often be achieved by choosing which configuration to use—thus, a grounded-base circuit could be followed by a grounded-collector stage for a good impedance match. However, this is not the way to achieve maximum gain. In spite of impedance mismatches, maximum gain results from always using grounded emitter stages. This is because, with only trivial exceptions, both the current gain and the voltage gain of a grounded-emitter stage are the highest. For highest power gain, transducer gain, available gain, insertion gain, and so forth, always use the grounded-emitter configuration throughout.

The absurdity of trying to get high gain by matching impedances between stages was recently brought to light by a circuit for a high-gain amplifier designed along these principles.[1] By alternating grounded-emitter and grounded-collector stages six transistors were used where otherwise four or five would have done the job.

And, still on the matter of matching between stages, if something besides maximum gain is important, such as low distortion or low hum level, we have no particular reason at all for matching impedances. For example, by adjusting the source impedance of a power transistor stage properly we can control the percentage of distortion. If our aim is low distortion, then we would be foolish to insist on an impedance match.

Between stages, then, the principle of impedance matching is useful only when transformers are available *and* when gain is of primary importance. Cases of this nature are in a small minority.

[1] J. Braunbeck, "High-gain transistor audio amplifier." *Radio-Electronics*, June, 1956, p. 30.

AT THE INPUT

Now at the input of our system we find that impedances are almost never matched. The reason is that considerations other than maximum transfer of power are invariably more important.

For most input transducers it is advisable to pick the terminating resistance with some care. However the principles involved are *not* those of securing a good match. A few cases may point up what is involved.

A crystal microphone connected to a vacuum-tube grid should not be matched if the noise level is important. Making the grid resistor as high as possible is the way to keep both the signal-to-noise ratio and the output of the first stage high.

Low-impedance microphones are usually coupled to a grid with a transformer, sometimes called a matching transformer. However, the mike is not matched, partly for the same reason noted for the crystal mike, and partly because of trouble with stray capacitances. In these cases, then, matching is not done as a rule.

And phonograph cartridges, especially the magnetic type, should definitely not be matched. Here frequency response is most important, rather than transfer of power from the pickup. Terminating resistances often affect the frequency response greatly, and it is imperative that the cartridge not operate matched.

Self-generating photocells are also interesting. If the problem is to obtain a faithful reproduction of the incident light, without distortion, then the cell should be terminated by a resistance far different from its internal resistance. Here distortion is more important than power transfer, and so we do not want to match impedances.

Active transducers which change their resistance because of externally-applied conditions are also interesting to consider. Carbon microphones, strain gauges, and photo-resistors are like this. The device is biased at some d.c. voltage or current, and the signal is caused by the change in resistance.

If the change in resistance is not too great, we have an almost linear system and so we can match approximately if we want to. But will this provide maximum power transfer?

No. For maximum power transfer, unlike the other transducers, these types must be terminated in a resistance different from their internal resistance. If the transducer and the load are placed in series across a constant voltage, the load resistance should be one-half the transducer resistance, whereas if the two are placed in parallel with a constant current feeding them, the load resistance should be just twice the transducer resistance.

If transformers are used to secure the matching, then "matching" *in this new sense* will provide the maximum power transfer to the first stage, and hence maximum power output. But if no transformers are used, then maximum power output is generally achieved by not matching, in either of these senses.

Upon loading, however, the linearity of these active transducers suffers. If low distortion is required, trying to match impedances may be quite unwise.

For input devices, then, only once in a long while is it desirable to match impedances—only when a transformer can be used, *and* when highest gain is desired. Even so "matching" must be done so that the load and source impedances are definitely *not equal*.

Conclusion

In summary, then, we come to the conclusion that only in certain special cases is it right to match impedances. Only when we are dealing with a linear system, at a single frequency and when we are concerned with maximum power output or maximum gain, and usually only when transformers are available to do the matching.

Our analysis is restricted to moderately low frequencies, where our con-

*audiofacts

Stereo Disc versus Stereo Tape

The excitement over the introduction of the stereo disc has generated a little heat but not very much light. Recently, however, C. J. LeBel, a widely-known audio expert and a vice-president of Audio Devices, Inc., helped to clarify the situation with some calm and rather specific statements. Since Audio Devices makes both master recording discs and magnetic recording tape, LeBel is in an excellent position to comment. Here are a few excerpts from his article:

"The cost of a stereo disc has been forecast as being no higher than a monaural disc: this is only partly true. For one thing, better quality control of processing will be needed to overcome ticks and pops in the stereo disc.

"The pickup must consist of extremely light equipment requiring better engineering than is presently needed for the same quality reproduction. Better engineering must also keep down the hum that arises from the required sacrifice of output voltage. Another problem is to overcome both lateral and vertical rumble.

"Some people claim that the stereo disc can be played by an ordinary non-stereo pickup. This is wishful thinking, for the average monaural pickup will cut the stereo groove to bits in a short time.

"The problems of stereo disc reproduction are rather formidable. There is a strong probability that high quality reproduction equipment for stereo disc will cost at least as much as for stereo tape and possibly more. It seems to us that there will be peaceful coexistence, as there is now in the monaural field. The mass stereo market will probably be in disc, whereas the high fidelity field will probably prefer tape."

If you are interested in keeping up with the latest developments in both tape and disc recording, write for a free subscription to the *Audio Record*, the publication from which these excerpts are taken. Send your request to Audio Devices, Inc., Dept. AA, 444 Madison Avenue, New York 22, N. Y.

*one of a series

cepts of lumped-circuit parameters still hold. There are cases of impedance matching at VHF and above that are very important because of the nature of transmission lines and their behavior toward mismatch, but we have not gone into them here.

For non-linear systems such as multivibrators or switching circuits the concepts of impedance matching break down completely. Even in such matters as coupling magnetic amplifiers together and to loads, it is not useful to consider impedance levels at all.

For extended frequency ranges it is often *not possible* to get a good match except at certain frequencies.

When we are concerned with effects like distortion, frequency response, hum, circuit stability, noise, temperature effects, aging, and so on, rather than power output, impedance matching is of very little use.

And when transformers or other lossless matching devices are not available, it generally pays, even for maximum power output, not to match impedances.

Many times we may think we are matching impedances, but on closer examination we see that really we aren't. Hooking up loudspeakers is a case in point—we saw that loudspeaker impedance is chosen to minimize distortion and instability, rather than to provide maximum power transfer.

So we are now able to answer the question we raised at the beginning, "when do we match impedances?" The answer—"almost never!"

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Æ

TRENDS IN AUDIO

(*from page 30*)

ence upon a 60-cps frequency for accuracy of speed and enables him to take the phonograph to any part of the world where practically any form of electric power is available.

Tape

Tape recorders have been with us for a substantial number of years, but it is only lately that machines rendering performance consistent with high fidelity standards have been available at what may be considered moderate prices. If one is interested only in tape playback, the cost is reduced because today he can simply buy a transport mechanism (which includes the playback head) and plug the output of the head directly into a modern control unit, which supplies the necessary amplification and equalization.

Nearly all prerecorded tapes now conform to NARTB equalization, and most high-quality machines employ such equalization. The trend is for the entire industry to conform. The 7.5-ips speed has been accepted as most suitable for home use, combining economy of tape and space with adequate frequency response. The development of thinner tapes has increased the amount of material that can be recorded on the 7-in. reel, which is virtually standard now for home use.

It was long felt that tape would some day offer distinctly better reproduction than discs and thus edge the latter out of that portion of the market interested in top quality. But this has not proven the case, in part because tape has not fulfilled all its potential and in part because the commercially recorded disc has consistently improved. On the other hand, tape had the lead as the exclusive recording medium for stereo sound, so that today one is identified with the other, but it is now apparent that the disc will soon challenge tape's monopoly.

Stereo

Still in its infancy for home use, stereo has already been acclaimed as the single biggest development in audio. Stereo recorded tapes are outselling monaural by as much as 100 to 1. In fact, some tape recording companies have dropped monaural altogether.

Whereas for a good while the only stereo tape playback machines available were in the high-price class, there are now a number of moderate-price stereo machines, and the indications are that every tape recorder manufacturer will soon have a stereo unit. Several companies have put out kits for converting their models to stereo use, and there is at least one universal adapter on the market.

The number and variety of components designed specifically for stereo is increasing monthly. Today one finds dual tape amplifiers, dual control units

(including tape amplifier and tone controls, etc.), dual complete amplifiers (control units and power amplifiers), and dual control units with one power amplifier (which assumes that the owner will use his hitherto monaural power amplifier for the second channel). Even stereo speakers are available in the sense of two complete speaker systems within one housing. There are also complete stereo systems available, either in one piece of furniture or several.

Along with the trend to stereo there has been increasing interest in what may be called, without stigma, pseudo-stereo devices. An important attribute of natural sound is a sense of spaciousness, which stereo helps recreate. Several new devices seek to create the same illusion when using a monaural signal. This is done by feeding the monaural signal into two speaker systems, with a time or phase delay between them. One device on the market uses an acoustic time delay device, while another employs an electronic phase shift, which varies with frequency.

Kits

Instrument kits have been available to technicians and the like for a relatively long time, but kits for building various high fidelity components may be viewed as a comparatively recent development. Perhaps there was doubt on the kit manufacturers' part as to whether the general public, without an ounce of electronic knowledge, could be entrusted with a soldering iron and an assortment of parts. However, given good design, thoughtful layout, and well-prepared directions, the lay audiofan has proven qualified to construct almost anything from a kit. So today one can buy most audio components in a kit form—power amplifiers, control units, tuners, integrated speaker systems, and even a phono arm.

New Tubes

Improvements in tubes have in many ways been responsible for the improvements in various elements of an audio system. For example, new output tubes such as the EL34, 6550, and KT88 make it economically possible to construct power amplifiers with outputs of 50 watts or more at very low distortion. These tubes have modest drive requirements, which simplifies the proceding circuitry and thereby results in still better performance. Similarly, the EL84 makes it possible in economical fashion to achieve high-quality power amplifiers rated at 15 to 20 watts. Tubes such as the ECC83, EF86, Z729, 12AD7, and 5879, commonly used in the first stage of the control unit, make it possible to reduce hum and noise while maintaining high gain and low distortion. Æ

"M-S" STEREOPHONY

(*from page 21*)

tally, is needed for the Crosby sum-and-difference system.

The M-S Stereo Principle Applied to Stereo Tapes

It is interesting to note that after the "M" and "S" channels have been converted into Left and Right channels, the insertion of another identical converter (*Fig.* 3) will reproduce the original "M" and "S" signals. This is in sharp contrast to recordings made in the Left-Right or classical system. A stereo-tape, whose left and right tracks were derived from a recording made with the Neumann SM-2 Intensity-Stereo Microphone, may be played back with a full-track playback head, which, in essence, acts as a converter and adds the two signals and restores the "M" channel; the *true mid-channel* of the cardioid element.

The M-S Stereo Principle Applied to Stereo Discs

Again here the Intensity Stereophony shows definite advantages. Indeed, these advantages are such that the M-S principle can be applied without the necessity of the previously described converter. We can actually use the geometry of the groove as a converter. The stereo-disc principle which has recently been adopted is based on playback with a cartridge sensitive to signals placed in the groove at an angle of 45 deg. to the vertical. There is no compulsion placed on the record manufacturer for using a 45-45 cutterhead to achieve this groove. The 45-deg. modulation can be assumed to be a vector resulting from lateral and vertical signal. Let us use a cutter capable of recording a vertical and lateral signal on a disc, and modulate the lateral channel with "M" output of the SM-2 Microphone, and the vertical channel with the "S" output. A 45-45 stereo cartridge will effectively act as our converter (*Fig.* 3) in playback, providing the sum of M and S on one side of the groove and the difference on the other. At the same time, this groove played back with a monaural lateral playback cartridge will reproduce the "M" or *true mid-channel* alone. (It must be pointed out that the damage to the vertical groove component by cartridges with low vertical compliance will be exactly the same as in stereo discs cut from left-right stereo tapes using a 45-45 degree cutting head.)

Conclusions

Much research has been done in the field of stereophonics from the standpoint of reproduction through earphones, loudspeakers, two-channel, three-channel, or multichannel systems. Judgment in the use of different recording techniques has been on the basis of many and varied criteria. These have included attempts to startle the listener; tries at spreading the orchestra out to many times its actual concert width; arbitrary assignment of instrumental sections and vocalists to left and right channels, without regard to representation of realism; and many more. We believe that with the advent of stereo-disc and stereo multiplex FM, a tremendous interest in sound reproduction will be generated; an interest many times that of recent years. And after we have settled down to real *enjoyment* of our newly-discovered dimension, rather than the open-mouthed, startled look one sees nowadays on the faces of people when first confronted with *stereo*, then I believe we will go back and re-examine some of the basic truths of stereo recording with perhaps a view toward a return to realism and a true third dimension. The writers firmly believe that the Intensity-Stereophony principle represents reproduction of a true third dimension. Æ

INTEGRATED AUDIO MONITOR

(*from page 25*)

than those in the input dividing circuits can be stock 10-per cent items. Resistors in the input dividers should be of one per cent accuracy or better, as are those supplied in the Heath Audio Wattmeter Kit.

This type of audio wattmeter, on the basis of extended tests, is far superior to the older and cruder diode type,[1] and at least equal, for this specific application, to the dual-triode wattmeter described by Seely.[2]

[1] R. L. Ives, Diode wattmeter construction, *Radio-Electronics*, Vol. 26, No. 2, Feb. 1955, pp. 38–39.

[2] Samuel Seely, *Electron Tube Circuits*. New York: McGraw-Hill, 1950, p. 486.

Frequency Meter

The audio-frequency meter, whose components are grouped on the left side of *Fig.* 3, is also built on two chassis, with the critical elements and controls on the small subchassis, and the less critical components, including power supply, on the main chassis. The circuit is a modification of the well-known amplifier-limiter-rectifier cycle counter which is used in the Heathkit Audio Frequency Meter and a number of other similar instruments. Although many Heath parts are used in this assembly, the circuit differs from the Heath circuit by the addition of an amplifier, so as to lower the minimum voltage to which it will respond dependably; the inclusion of a calibration check position on the range switch, to permit instantaneous operation checks if desired; and by elimination of all frequency ranges above 30,000 cps. (I can't hear that high, and the speaker will not respond well at such high frequencies). The circuit is shown in *Fig.* 4.

Operation of this frequency meter consists of amplifying the initial infed signal, equalizing the pulses, and then counting them. Amplification is done in the first three tubes. The input 12AU7 is an almost-linear amplifier, the first

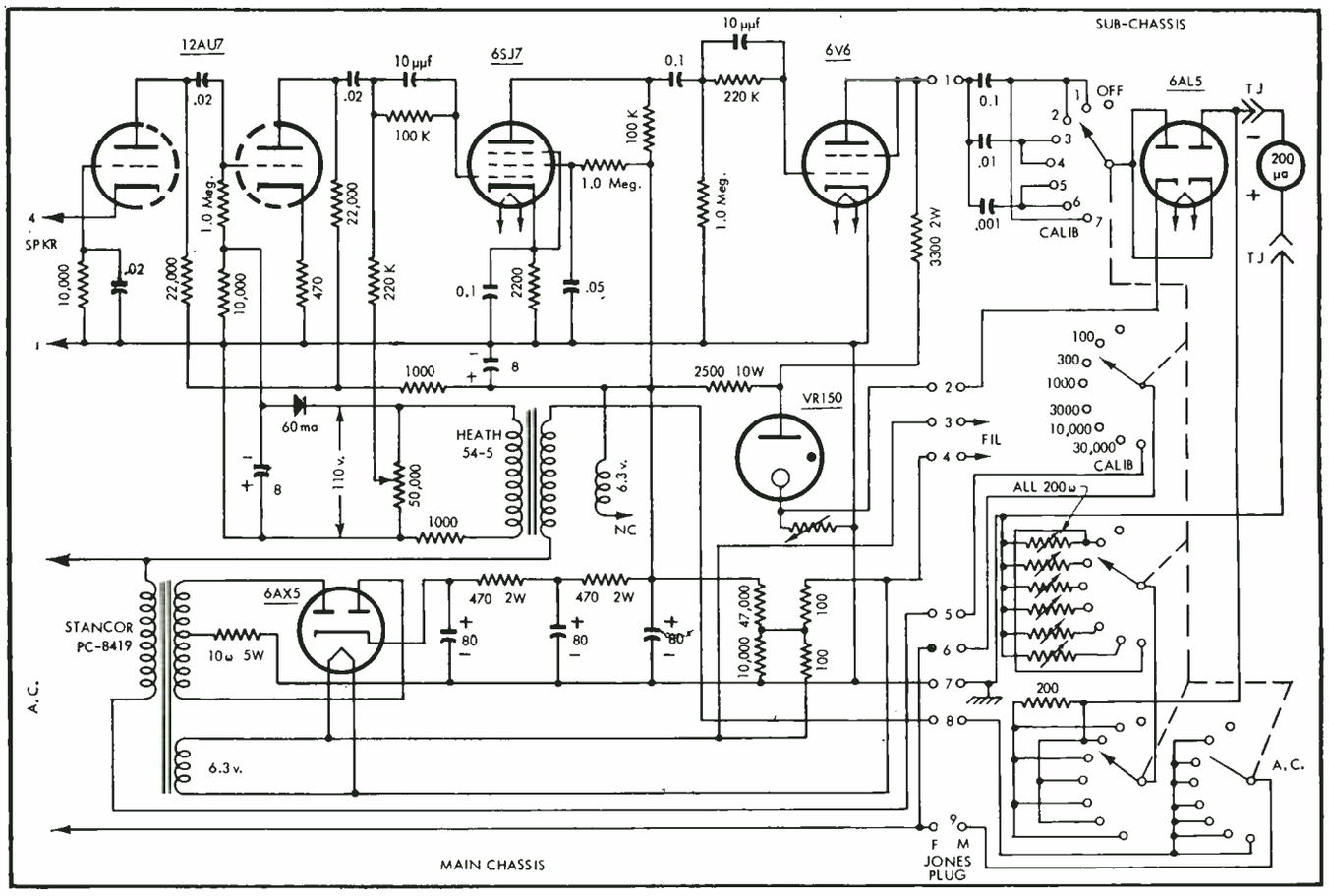

Fig. 4. Schematic of audio-frequency meter.

half being cathode driven, the second half conventional. On very strong signals, a small negative bias is produced on the first grid, due to grid rectification. The 6SJ7 functions as a standard amplifier on weak signals, and as a limiter on strong signals, due to the high grid-circuit resistance and the somewhat "starved" plate and screen supplies. The last tube in the amplifier, a triode-connected 6V6, operated at a reduced and regulated plate voltage, acts almost solely as a limiter. As a result, output of the amplifier portion of the frequency meter consists of square waves, of uniform amplitude, regardless of the input amplitude.

These square waves are differentiated across the capacitor in the output, then rectified in the 6AL5, and the rectified current is passed through the meter. In consequence, the meter indication is a true measure of input frequency.

Contact potential in the dual diode circuit is bucked out by the drop across the resistor in the return of the voltage-regulator tube so that the meter reading is a true measure of frequency, instead of frequency plus contact potential. This correction is made with the input shorted, and the 1000-ohm resistor is adjusted so the meter indicates zero.

Calibration of the lowest range is accomplished by switching to the calibration position. Here, the second half of the 12AU7 is biased off, and an a.c. signal (60 cps) is injected into the grid of the 6SJ7. The voltage of this signal is set at about 20 (not critical), and the resistor for the lowest range (0–100 cps) is set at 60. Other ranges can be calibrated by use of an audio oscillator, by a "counting up" procedure, or by comparison with a precision frequency meter.

Power Supply

Power supply here is a conventional full-wave rectifier system, with a two-stage R-C filter. Filaments are run at a moderate positive bias with respect to ground to eliminate diode hum injection. This is necessary only at very low signal levels, and need be applied to the first triode only. It is regarded as standard to connect a large capacitor from filament center tap to ground, but oscilloscope tests showed that it made no difference in this circuit.

All of the components in this frequency meter are stock items, and no improvement in performance is likely to result from the use of "gold plated" components. Filter capacitors are very much larger than is initially necessary, so that gradual loss of capacitance with ageing will not lead to a sudden instrument failure. Life of these capacitors (Mallory FP149) at voltages not exceeding 350 is in excess of five years in normal station operation. Tube life is considerably more than 7000 hours in this type of service, so that the use of "special red" and "premium" tubes would be painting the lily.

Panel and above-chassis construction, illustrated in *Figs.* 1 and 3, is simple and straightforward. Tube shields are used as hold-downs on miniature tubes, but are not electrically necessary. Meter connections are made with tip jacks as a matter of servicing convenience. Under-chassis construction, shown in *Fig.* 5, is likewise quite simple. Components are anchored in place with more care than is usually employed, to prevent

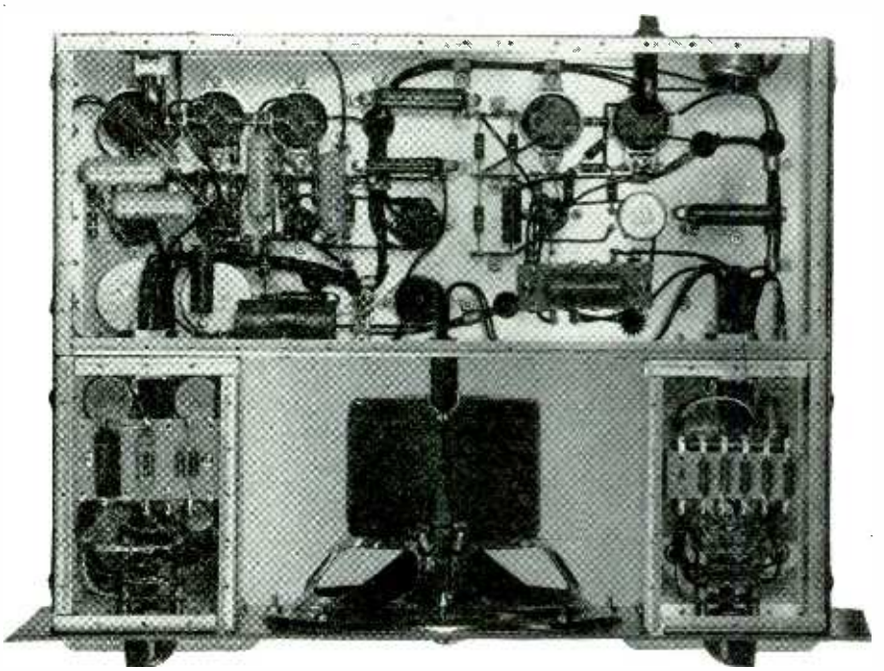

Fig. 5. Underchassis view of monitor, showing mounting of components and wiring methods. Wattmeter components are at right, frequency-meter components at left.

rattle at power outputs up to fifteen watts. Electrolytic filter capacitors are mounted in plug-in type sockets (Cinch 2-C-7) to facilitate replacement. In consequence, probably in accord with Finagle's Third Law of Electronics (components easy to replace never fail), none of them have needed replacing!

Because of numerous unhappy experiences with "improved" plastic insulation, all wiring is with waxed cotton-braid insulated stranded wire (Belden 8844), which has been consistently satisfactory over a period of years. Wire is anchored in place at strategic points by use of cable clamps, to prevent both vibration and shifting. Connections to plugs are insulated with two short lengths of telescoped sleeving, a technique borrowed from the Signal Corps.

Sheet metal screws in the chassis assembly were omitted, and all plate-holding screws are 4–40 binding heads, tapped into the chassis rails. Liberal use of tie terminals assures that the smaller components will not loosen with age. Bottom plates are used with all three chassis, for both electrical and mechanical shielding.

Performance of this audio monitor panel is about all that can be desired for an assemblage of "standard" speaker, wattmeter, and frequency meter. By its use, evaluation of new amplifiers and other audio components is made more objective, and the checking procedure is greatly simplified by inclusion of the three test components in one unit. The built in calibration checks on both instruments were found to be a most convenient adjunct, well worth their small additional cost in materials and labor.

Total cost of this monitor, assuming that all parts are bought new at current net prices, is in the neighborhood of $100.00. Time needed for completion is about six evenings for a worker of average speed who has an electric drill available. Maintenance cost (first year) is zero, but thereafter should consist only of infrequent tube replacements. Calibration drift on both meters, after six months of use, was less than one per cent. After one year of operation, the frequency meter was off one cycle on the 0–100-cps range; and the wattmeter needed a barely discernible retouching to bring it "right on" again. Æ

TESTING FOR TRANSIENTS

(*from page 27*)

In the circuit shown in *Fig.* 4 the cathode of the cathode follower is returned, not to ground but to the center point of the coil. I have left out the switch which appears in *Fig.* 2, and added a resistor R which represents the losses in the tuned circuit. Now L will act as a transformer and will give a value of impedance from A to ground of $R/4$. If we have for some reason undisclosed an alternating voltage of V between cathode and ground we shall get $[\frac{1}{4}R/(R_1+R/4)]V$ between A and ground and as a result of the transformer effect $2[\frac{1}{4}R/4(R_1+R/4)]V$ between grid and ground.

Suppose that we choose $R_1=R/4$. The grid-to-ground voltage is then $[\frac{1}{2}R/(R/4+R/4)]V=V$.

With an ideal cathode follower using a tube or infinite amplication factor and finite impedance, the grid voltage produces an equal cathode voltage, and as we have just shown, the cathode voltage then produces an equal grid voltage. The circuit therefore will just oscillate. You can work out for yourself, you can believe me when I tell you, or you can go and build it up and see that with a practical tube a rather smaller value of R_1 will be needed if the circuit is just to oscillate.

An Improvement

Once you introduce a triode you might as well use two triodes, because they come neatly packed in pairs in a single bottle. The second triode is most conveniently used to start and stop the oscillations and the circuit takes the form shown in *Fig.* 5. The way this circuit works must now be examined. To begin with the grid of V_2 is held at ground potential so that V_2 is conducting. Provided that R_2 is not too large, the combination of R_2 and the tube is sufficient to dump down the tuned circuit and prevent it oscillating steadily. When R_1 has been adjusted correctly this will certainly be true. The tube current, of course, flows to ground through L, which should have as low a resistance as convenient: there will then be practically no (d.c.) voltage across C.

Suddenly the grid of V_2 is driven hard negative. V_2 no longer conducts and the circuit has become that shown

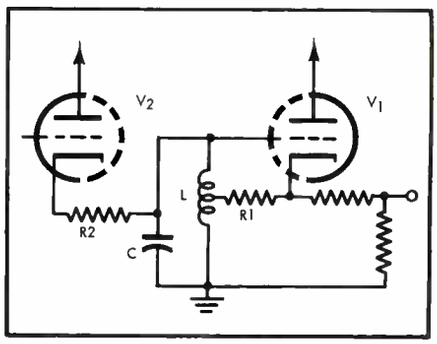

Fig. 5. The spare triode V_2 in the 12AT7 bulb is used for keying.

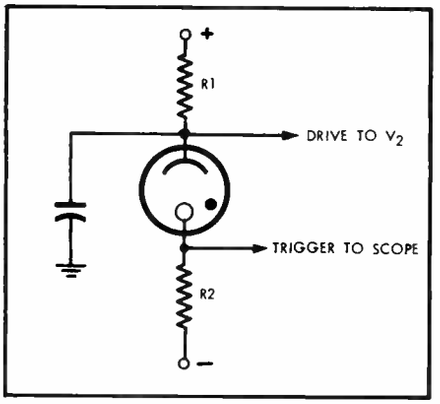

Fig. 6. A gas-tube driver circuit for very slow repetition rates.

in *Fig.* 4 except for one detail: L is carrying current. This is the situation discussed in connection with *Fig.* 3, and all that V_1 should do is cancel out the effect of the loss in the tuned circuit. The circuit shown in *Fig.* 5 will therefore produce the waveform shown at (A) in *Fig.* 1, provided that it is correctly adjusted. This adjustment comes in two parts and must be done with an oscilloscope. The first stage is to disconnect R_2, so that we just have the simple oscillator circuit of *Fig.* 4. With the variable R_1 at maximum, connect the oscilloscope to the cathode of V_1 and reduce R_1 until the circuit starts to oscillate. Adjust C until you have about the right frequency: all this is the old "how to make an oscillator" story which I do not need to write out in detail. Now adjust R_1 again so that the oscillations are stable in amplitude, keeping R_1 as high as possible. Make a note of the actual amplitude on the oscilloscope.

The next step is to adjust R_2. First of all, increase R_1 until the circuit just does not oscillate. Connect R_2 by some means—I shall go into detail later on—to drive V_2 on and off. Now adjust R_2 so that the first few cycles of each wavetrain are the same size as the steady oscillations you had previously. And then, if you like, trim R_1 again to avoid any trace of either decay or growth.

This procedure should give a very clear beginning to a sine wave of constant amplitude. What more could you ask for?

Quickly, some values. If we say that 1600 cps is a convenient sine-wave frequency we have $2\pi \times 1600 = 10{,}000$. An inductance L of *100 mh* is quite practical at this frequency, so that $\omega L = 1000$ ohms. $C = 0.1$ μf. A coil like this could reasonably have a Q of 100 on a ferrite core, so that R would be 100,000 ohms and thus R_1 would be around 25,000 ohms. A good level of oscillation would be about 10 volts, making the current through L equal to *10 ma*, a value well within the capacity of a 12AT7. Clearly R_2 must be fairly small, and can probably be omitted, leaving only R_1 to adjust.

The output is taken normally from the cathode of V_1 through a fairly high resistance voltage divider. Typical values might be 47,000 and 1000 ohms, giving about 200 mv of transient, enough for most amplifiers.

Keying

Now, what about the grid of V_2, which we have left floating. Anyone who is going to build a device like this transient tester will, I guess, already possess a square-wave generator, and with a CR coupling to the grid you certainly could drive the system with square waves. This gives a very comfortable view on the oscilloscope, provided you run the square-wave generator at 30 cps or higher. The only disadvantage of this is that it does not give the amplifier time to recover between the bursts of tone, though this should not be important if the amplifier is good at low frequencies. A gas-tube flash circuit, like the one sketched in *Fig.* 6, requires a negative supply of about −150 volts as well as the usual positive supply, but it has the advantage that it will run quite nicely at 1 cps. The resistor R_2, which should be less than 100 ohms, provides a signal which can be used to trigger the oscilloscope.

At this stage in our experience of transient distortion it seems best to rely on the oscilloscope as an indicator, watching with keen, and rapidly tiring eye, to see just how the amplifier output differs from the input. I have tried the experiment of passing the output through a distortion bridge to balance out the fundamental, although that was when designing a transistor amplifier with, deliberately, a badly regulated power supply. But we are just beginning to think about transient distortion, and we should not try to run before we can walk. **Æ**

LETTERS

(*from page 6*)

pacity for critical value judgment.

J. Mill,
1810 Wesley Ave.,
Evanston, Illinois

(*We don't believe Mr. Canby objected to record clubs* per se, *but only those which offered solely choices from the output of a single record company.* Ed.)

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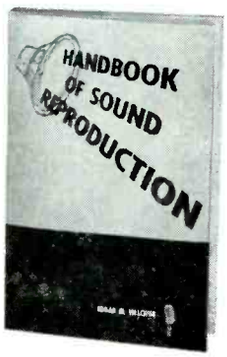

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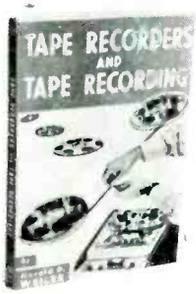

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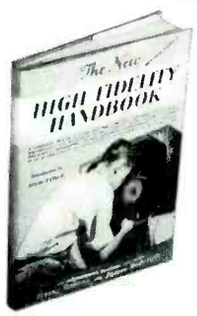

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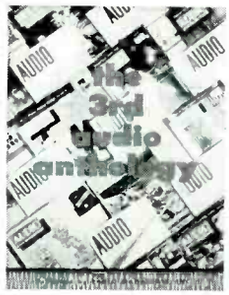

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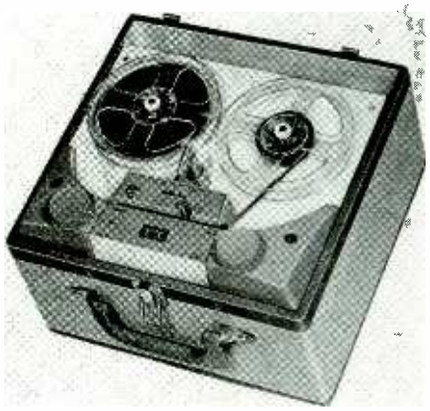
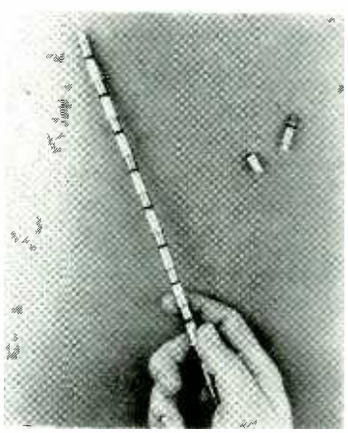
(*from page 48*)

• **Telectro Lightweight Tape Recorder.** Although it weighs less than 15 pounds, the Telectro Model 1960 is a fully-equipped two-speed tape recorder, including built-in power amplifier and playback speaker. Push-button speed-change control affords a choice of 7.5 or 3.75 ips. Features of the



1960 include dual-track recording, fast forward and rewind, delayed action interlock control to prevent accidental erase, and record level indicator. Extremely low priced, the recorder is compact, measuring but 7¾ × 11 × 11⅝ in., and is housed in a handsome two-tone luggage-type carrying case. It is supplied complete with microphone, a 1200-ft. reel of tape and take-up reel. Telectrosonic Corporation, 35-16 37th St., Long Island City, N. Y. **D-8**

• **"Expandable" Rectifier.** A versatile new silicon rectifier which can be used singly, or assembled instantly into series chains for higher voltage applications, is now in full production by the Rectifier Division of Audio Devices, Inc., 620 E. Dyer Road, Santa Ana, Calif. Called the A750 "ex-



pandable rectifier," the new device can be combined with inexpensive thread bushings to form simple assemblies for kilowatts of rectifier power. To produce a high-voltage rectifier in a matter of minutes, a number of units are connected end-to-end with the bushings to form a series chain. Ten units, for example, will have a peak inverse rating of 4000 volts.

and higher ratings are available simply by using the required number of units. **D-9**

• **Bell Stereo Tape System.** A complete stereo system, including full facilities for stereo recording and playback, is the latest addition to the Bell line of high-fidelity equipment. Consisting of two matched speaker-amplifier systems and a tape transport unit, the T-207S assembly offers a remarkable degree of flexibility. In addition to conventional half-track monaural recordings, one can record stereo with either stacked or staggered head arrangement. Recording characteristics conform to NARTB standards. Frequency

response for both record and playback is said by the manufacturer to be 20 to 10,000 cps ± 2 db. Tape speeds are 7.5 and 3.75 ips. Provision is made for recording the playback from Channel 1 on to Channel 2 while simultaneously, with the use of an external mixer, adding a microphone recording on Channel 2. The transport unit incorporates three 4-pole motors and makes use of electro-dynamic braking. Five heads, together with appropriate switching, afford the wide range of recording methods. Bell Sound Systems, Division of Thompson Products, Inc., 555 Marion Road, Columbus, Ohio. **D-10**

MORE CLASSIFIED

FOR SALE: AMPEX Stereo System including 612 Stereo tape player, two 620 Speaker-Amplifiers. Portable cases. Like new, $500. J. M. Edelman, M.D., 700 Commerce Building, Baton Rouge 1, Louisiana.

PROFESSIONAL TAPE STROBE—Indispensable to all recording studios and radio stations. Compact and precision machined. Indicates incorrect tape speeds and slippage immediately and accurately. A necessity in the elimination of pitch error. Complete in sturdy instrument case. $22.50 postpaid. Scott Instrument Labs, Dept. 100-1, 17 East 48th St., New York 17, N. Y.

WANTED: Western Electric Model 728-B Loudspeakers and Model 713-C High Frequency Drivers. These must be in excellent condition. Indicate lowest price and condition in first letter. E. L. Mleczko, 710 West Adams Park Drive, Covina, California.

FOR SALE: Jim Lansing C34001 Two-Way Speaker System. Blonde. $185. J. M. Edelman, M.D., 700 Commerce Building, Baton Rouge 1, Louisiana.

VERY HEAVY 18-cu. ft. infinite baffle. Braced 2-in. panels. $135 FOB. Hooks, 1511 Jackson, Durham, N. C.

METAL CONE loudspeaker, G.E.C. England. $30; presence unit $20; both new in maker's carton. B. A. Pegg, 808 Meadowbrook Road, Glen Burnie, Maryland.

CASH for used Ampex 400A or 401A. Peter J. Heffrich, R.D. #1, Wescoesville, Pa. State approximate hours and condition.

CLASSIFIED

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THE AUDIO EXCHANGE has the largest selection of new and fully guaranteed used equipment. Catalog of used equipment on request. Audio Exchange, Dept. AE, 159-19 Hillside Ave., Jamaica 32, N. Y. AXtel 7-7577; 367 Mamaroneck Ave., White Plains, N. Y., WH 8-3380; 836 Flatbush Ave., Brooklyn, N. Y. BUckminster 2-5300.

HIGH FIDELITY SPEAKERS REPAIRED
Amprite Speker Service,
70 Vesey St., New York 7, N. Y. BA 7-2580

LOOKING FOR CLEAN RESPONSE TO 20 CYCLES? Listen to the radically new Racon "Hi-C" 15" foam-suspension speaker. Racon Electric Company, Inc., 1261 Broadway, New York 1, N. Y.

FOR SALE. AMPEX 350, 350-2, 600, 601, 601-2, and A-Series, available from stock at Grove Enterprises, Roslyn, Pa. TUrner 7-4277.

WANTED: Used Ampex Equipment. Box CD-1, AUDIO, P. O. Box 629, Mineola, N. Y.

ENJOY PLEASANT SURPRISES? Then write us before you purchase any hi-fi. You'll be glad you did. Unusual savings. Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

WRITE for confidential money saving prices on your Hi-Fidelity amplifiers, tuners, speakers, tape recorders. Individual quotations only; no catalogs. Classified Hi-Fi Exchange, A R, 2375 East 65 St., Brooklyn 34, N. Y.

FOR SALE: Ampex 350-2, rack mounted. Good condition, $1500.00. David B. Jones, P. O. Box 189, Caldwell, N. J.

GENUINE KLIPSCHORN, finest furniture model—mahogany—like new, $595. Same, but mahogany finish on gum, $495. Utility model, $395. Magnecord M90 portable with remote control, $995. Binaural Magnecord PT6-BN-BA2112—like new—$495. Harry Keep, 3704 Travis, Houston 6, Texas.

BACK ISSUES of AUDIO, '52, '53, '54, '55, Audiocraft, High Fidelity, Journal of Audio Engineering Society. T. M. Olsen, 745 East 242nd St., Bronx 70, N. Y.

PRESTO DISC: 6N turntable, 1D cutter, 112, 136, 188, 224 lpi, 3-speed, $450. 92B amplifier, $300; Two 75A turntables, 1C cutters, 112, 224 lpi, 3-speed, $175 each. 87A amplifier, LP equalization, $100; TAPE: RC-10/14 tape mechanism, $300; 900-1 tape mechanism, 10" adapters, $200; 900A2 3-channel record amplifier, $275; A920 record-playback amplifier, $275; SA-9 transfer switch, $15; E-V mike, model 666, $100; Two E-V model 731, 250 ohms, $15 each; Two 12" Atlas floor stands, $15; Rek-O-Kut turntable, model T-12, 33-78, $25; Pentron tape mechanism PMC, $50. All first class. Ely Recording Studios, 1833 N. 2nd St., Harrisburg, Pa.

FOR SALE: AMPEX 350, Portable, half track, 3¾–7½ ips. Like new, $975. J. M. Edelman, M.D., 700 Commerce Building, Baton Rouge 1, La.

BRAND NEW, 60-watt Dynakit, beautifully wired, $68, preamp $32, both $95. Guaranteed 100 days. Glenn Miller, 7355 North Winchester, Chicago, Ill.

BOZAK Dual Speaker System mounted in large, extra heavy corner cabinet. Terrific buy at $150. W. Fingerle, Jr., Mimosa Drive, Cos Cob, Connecticut. Tel: NOrmandy 1-8176.

PROFESSIONAL DIRECTORY

Industry Notes ...

RIAA Tape Standards. Frequency response standards for 7½-ips magnetic tape recordings have been approved by the Record Industry Association of America, Inc., according to William S. Bachman, chairman of the engineering committee. Manufacturers who wish to measure tapes or tape recorders to comply with the standards have to measure them against test tapes which have been deposited with the RIAA. Mr. Bachman stated that the association will not object to manufacturers of commercial tape identifying their products as complying with RIAA standards so long as it displays the same frequency response characteristics as the standard tapes held by the association.

HI-FI TV MUSIC SERIES. A series of Sunday afternoon TV programs, to be presented under the auspices of the high-fidelity industry, is tentatively scheduled for 15 major cities, according to Henry Goldsmith, president of Rigo Enterprises, Inc., producers of high-fidelity music shows. The initial series, to be telecast in New York, Chicago, Los Angeles, San Francisco, Pittsburgh, Washington, St. Louis, Buffalo, Minneapolis-St. Paul, Milwaukee, Kansas City, Baltimore, Cincinnati, Seattle, and Denver, is scheduled for 13 weeks. Titled "The High Fidelity Industry Presents," the programs are narrated in part by Milton J. Cross and will feature filmed and recorded renditions of operas and classic works.

PACIFIC COAST LEADS IN HI-FI STORES. The number of hi-fi specialty stores in the United States has risen to 2143, according to a study by the National Credit Office. Included in the total are retailers and jobbers who handle hi-fi components and parts in addition to completed units. It does not include department stores, discount houses, or retailers who carry finished unit but do not stock components. The study reveals that there are more hi-fi specialists in Illinois, Pennsylvania, and Texas than in New York and that California has three times as many as any of them. The Pacific Coast, in fact, has the greatest number of hi-fi specialists in the country, 474, followed by the Illinois-Indiana-Michigan-Ohio-Wisconsin area with 400.

BIG STEREO SALES JUMP SEEN. Sales increase this year of 20 per cent in stereo recording-reproducing equipment and 50 per cent in recorded stereo tape is forecast by Edward Altshuler, business analyst for the Magnetic Recording Industry Association. Mr. Altshuler stated that, in 1957, stereo units accounted for 50 per cent of national equipment sales, and that recorded stereo tapes represented 75 per cent of all recorded tape sold at retail. A recent study conducted by Munroe Merrick, market research analyst for Ampex Audio, Inc., estimates sales of 600,000 recorders this year, with unit volume climbing to 725,000 in 1959. Using these base figures, Mr. Altshuler predicts sales of stereo units will reach 480,000 this year and 580,000 in 1959.

ADVERTISING INDEX

MAGNECORD

TAPE RECORDERS

QUALITY that ENDURES

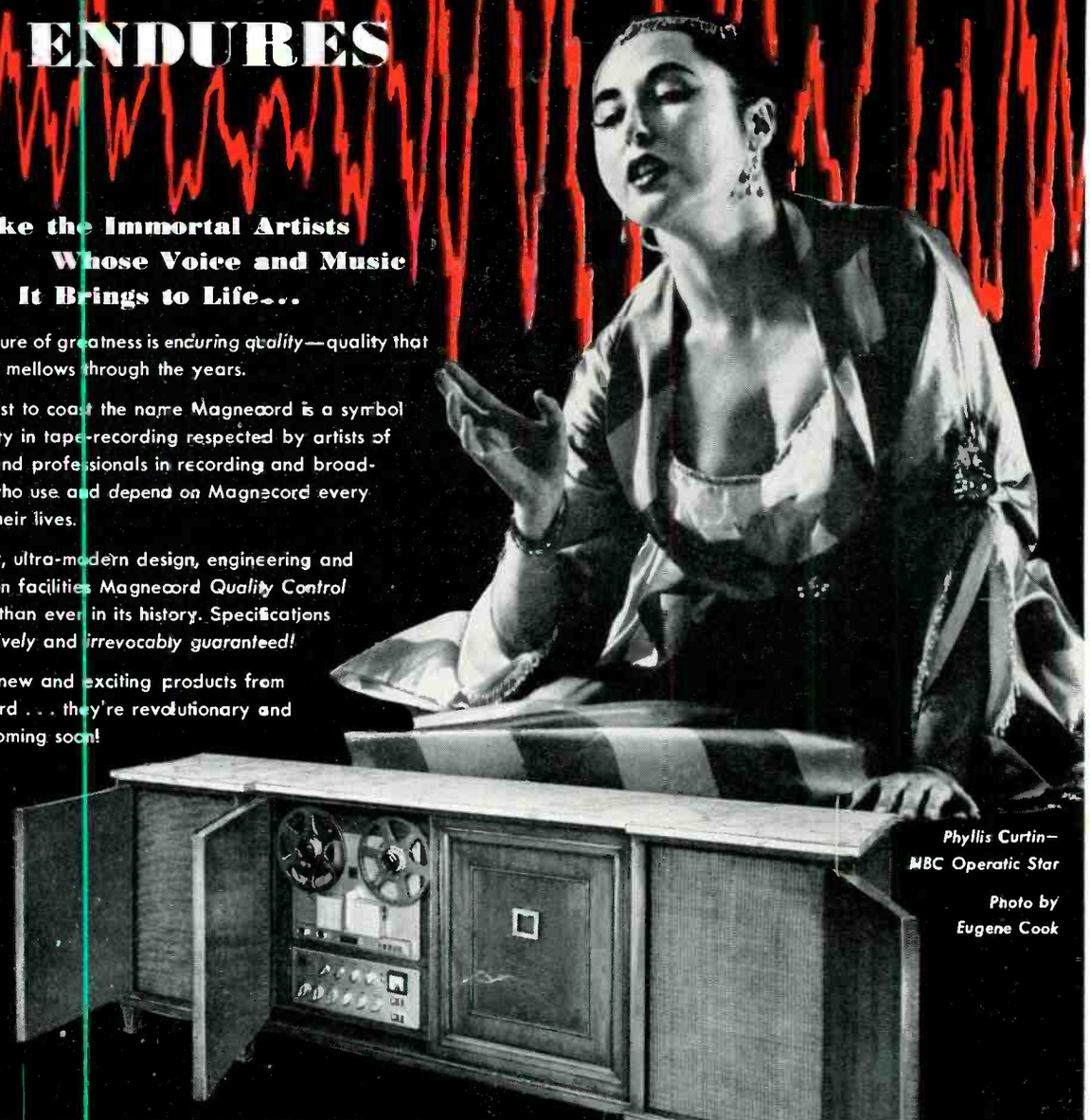
Like the Immortal Artists Whose Voice and Music It Brings to Life...

The measure of greatness is enduring quality—quality that lives and mellows through the years.

From coast to coast the name Magnecord is a symbol for quality in tape-recording respected by artists of renown and professionals in recording and broadcasting who use and depend on Magnecord every day of their lives.

In its new, ultra-modern design, engineering and production facilities Magnecord *Quality Control* is better than ever in its history. Specifications are *positively* and *irrevocably guaranteed!*

Look for new and exciting products from Magnecord . . . they're revolutionary and they're coming soon!



Phyllis Curtin—NBC Operatic Star

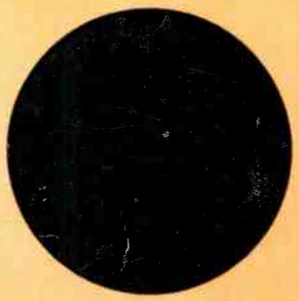
Photo by Eugene Cook

SOUND OF THE FUTURE

A few valuable franchises are still available.

Ask your distributor or write **MAGNECORD, Division of Midwestern Instruments, Inc. — P.O. Box 7136, Tulsa, Oklahoma**

To grace your home...a new high ...in high-fidelity high styling

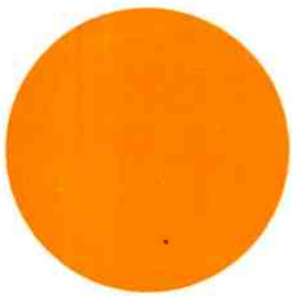


From your magnificent Carlton, you get exquisitely accurate sounds. Nothing extraneous. Nothing exaggerated. Rich middle tones. Precise highs. Bass...with body...no boominess. Living sound...music as music should really sound . . . does sound in a concert hall.

Exacting research by Electro-Voice audio engineers have produced the Carlton's unique Phase Loading.* Add the Carlton's contemporary enclosure design, meticulously crafted from fine hand-rubbed hardwoods by Electro-Voice's master furniture makers, and you have one of the finest speaker systems you can own.

Hear the Carlton before you buy . . . you'll want to build your entire music system around its superb capabilities. You'll like the magnificent matching Sheraton Equipment Console which is generously custom-designed to hold your amplifier, tuner, turntable or record changer, tape deck PLUS record and tape library.

Hear Electro-Voice "Living Sound" demonstrated at your nearest High Fidelity dealer... or write for literature on all Electro-Voice High-Fidelity Equipment.



CARLTON, IVA—Mahogany, Net $265.00; Limed Oak or Walnut, Net $270.00.

CARLTON IV (Deluxe speaker components)—Mahogany, Net $359.00; Limed Oak or Walnut, Net $364.00.

SHERATON EQUIPMENT CONSOLE—matches Carlton enclosure. Dimensions: 33½" high, 37½" wide, 19½" deep. Compartment A: 10¼" high x 18" wide x 17¼" deep. Record player mounting board adjustable. Clearances 3½" and 6" above board. Compartment B: 10¼" high x 18" wide x 17¼" deep. 1½" clearance above mounting board. Mahogany, Net $173.00; Limed Oak or Walnut, Net $181.00.

*__The CARLTON__ 15" 4-way system utilizes new Electro-Voice Phase Loading. The "K" type driver is actually at the rear of the cabinet, close to the floor and facing the wall. This positioning adds almost a full octave to your bass range. Crossover at 300 cps to coaxial mid-range driver; the VHF driver takes over at 3500 cps to 21,000 cps in the Carlton IV; 18,000 cps in the Carlton IVA. Individual "brilliance" and "presence" level controls in both models. Size: 33½" high, 26¼" wide, 19½" deep.

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