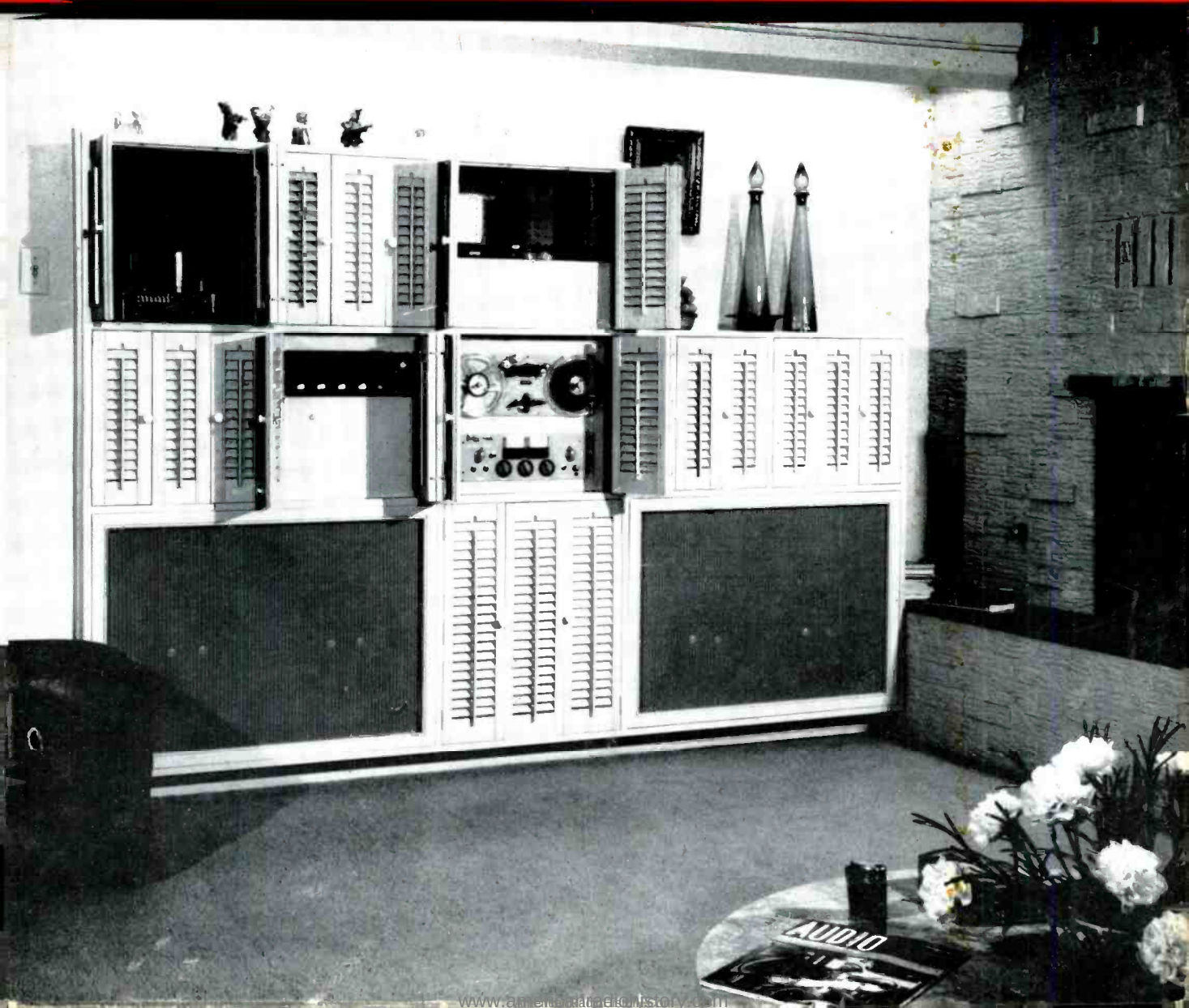
# AUDIO

MAY, 1959
50¢

*...the original magazine about high fidelity!*



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## 20 Watts STEREOPHONIC...
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**RADIO CORPORATION OF AMERICA**
**Electron Tube Division** **Harrison, N. J.**

MAY, 1959 VOL. 43, No. 5

Successor to RADIO, Est. 1917.

# AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION





CONTENTS



COVER PHOTO—Music wall built by E. L. Phillips, Jr. for his home in Odessa, Texas. In the upper compartments are two McIntosh MC-60 power amplifiers and a Fairchild 411-H turntable with Grado arm and stereo cartridge *and* a Calrad viscous damped arm with an ESL Concert monophonic cartridge. The center row contains a Garrard RC-88 changer with E-V stereo cartridge, a McIntosh C-20 stereo preamp (serial No. 6), Magnecordette stereo tape recorder and amplifier, Grundig TK-820 tape recorder (for background music), and drawers for tape storage, tools, spare cables, microphones, etc. Two Bozak 305 speaker systems at the bottom flank a record storage compartment. Cabinet cost, only about $450.

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# AUDIOCLINIC??

JOSEPH GIOVANELLI*

### Deemphasis and Time Constant

Q. *I have a Browning RJ48 tuner which which has given exemplary service since 1954. Its FM response has a rising characteristic to 10,000 cps, which makes it slightly on the bright side, which is not too objectionable; but I have lately added a tape recorder and the high-frequency boost in the tuner together with the high-frequency boost in the recording equalization causes a most unpleasing sound on playback. The de-emphasis network at the discriminator of the tuner consists of a series 75,000-ohm resistor, followed by a 620 μμf capacitor to ground, with the signal taken off the capacitor.*
*1. How can I change this network to give me flat response?*
*2. What is the method used to calculate the time constant? John A. Roberts, Quebec, Canada.*

A. The values in the de-emphasis network of your Browning RJ48 tuner should be a 75,000-ohm resistor and a 1000 μμf capacitor. However, the a.c. resistance of the discriminator is approximately 10,000 ohms and is in series with the de-emphasis network. Therefore, the actual value of the external resistor to be used is 65,000 ohms since this value plus the 10,000 ohms inherent in the discriminator itself is equal to 75,000 ohms, the correct value needed for the time constant of the de-emphasis network, 75 microseconds.

The time constant in microseconds of a resistor and capacitor in series may be figured by assuming the capacitor to be in micro-microfarads and the resistor to be expressed in terms of megohms. By multiplying resistance by capacitance, you will then have the time constant of the network in microseconds.

### Interconnecting a.c. Equipment with AC-DC Receivers

Q. *My problem concerns strong hum after connecting an FM tuner into an AC-DC receiver which has the input specifically marked: "for FM tuner, TV sound, phono." This sounds as though it was meant for connecting a.c. devices. The receiver has push-pull output and a phase inverter, and the usual series-connected filaments. It also has a shunt resistor-capacitor connected from B minus to chassis ground. Its tuner input has a 0.01-μf capacitor connecting the signal lead and its shield and a 0.01-μf capacitor connecting shield and B minus. The input shield does not connect to chassis. Everything seems in order according to the manufacturer's schematic. Can you kindly give me an idea of what is happening to cause hum? Can it be eliminated or reduced? I would like to use the receiver as a handy, quick check for tuners and other equipment. S. W., New York, N. Y.*

A. AC-DC receivers are normally troublesome when connected as amplifiers. This results partly from the direct connection to the power line and partly because of poor grounding in such circuits. Poor grounding is made necessary in order to isolate these circuits from the line. This isolation, in turn, is made necessary to minimize the shock hazard and to conform to U. L. requirements. The first of these outlined conditions may be remedied by placing an isolation transformer between the set and the power line. One side of the primary of this transformer should be bypassed to B minus with a 0.05-μf capacitor, of 400 volt d.c. rating.

If this procedure proves unsatisfactory, we must improve the grounding. This is in addition to using the isolation transformer. (Use of this isolation transformer eliminates the shock hazard which might otherwise result after the readjustment of the ground lead.)

1. Connect B minus directly to the chassis.
2. Connect the return for the tuner input to the point at which the first audio amplifier stage is grounded.

### The Pickering Stereo Cartridge

Q. *My original monophonic setup worked very well. After I switched to stereo, I experienced difficulties with my Pickering stereo cartridge. When I connected this cartridge to the input terminal (specifically marked "Pickering") of my preamplifier, I obtained almost no gain.*

*I noticed, also, that the cartridge when tracking at 2–4 grams, has considerable distortion, especially at the high end.*

*How may I correct these conditions? Harry Hausman, Weirton, W. Va.*

A. The new Pickering stereo cartridge has relatively low output as opposed to the older monophonic cartridges for which the Pickering terminal on your preamplifier was designed. The cartridge, therefore, should be plugged into the high-gain input, normally used for GE inputs and the like.

The original Pickering stereo cartridge cannot track at 2–4 grams, because this is not sufficient force to push the stylus shank parallel to the face of the disc and, therefore, in line with the polepieces. A 6–8 gram tracking force should provide the best results. There is a new T-bar stylus assembly, however, which will track at the lower force, and it is interchangeable with your present one.

### 1. Aging of Power Tubes
### 2. Pots in Filament Circuits

1. *I should like very much to learn how the power output and distortion characteristics of such tubes as KT88's, EL34's, and so forth, vary with age. I am unable to find anything on the subject in the literature available to me.*

2. *I should also like to know why, in hum-balancing circuits across filament windings, 100-ohm potentiometers are used instead of 1000-ohm or higher valued units. A. J. Steen, Los Angeles, Calif.*

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

# THE Garrard PAGE

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

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**It's "CLEAN"**
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**It's CORRECT**
*Precision-engineered to track all cartridges at lightest proper weight, the Garrard Changer tone arm insures minimum friction and record wear.*

**It's GENTLE**
*Garrard's exclusive, foolproof pusher platform actually handles records more carefully than by your own hand—far more carefully than by any other changer or turntable.*

**It's CONVENIENT**
*Garrard affords all the features of a manual turntable, with the tremendous added advantage of automatic play when wanted! Pre-wired for stereo—and installed in minutes.*

**It's ECONOMICAL**
*Despite its many advantages, a Garrard Changer costs less than a turntable with separate arm. Backed by Garrard's 36-year record of perfect, trouble-free performance.*

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**Stereo and monaural**... most people ready to buy high fidelity components seek advice from friends who own them. Generally you will find that these knowledgeable owners have a Garrard changer. And if you ask experienced dealers, they will invariably tell you that for any high fidelity system, stereo or monaural, the world's finest record changer is the...

Garrard



A. 1. There can be no data given as to what happens to power tubes as they age. This is because the change in characteristics varies with the manner in which the tubes are operated and the manner in which the aging occurred. In other words, the tube will have a far longer life when voltages are conservatively applied than when voltages at or near the tube's maximum ratings are applied. Much also depends on the operating cycle—whether the amplifier is operated continuously or sporadically for short periods.

2. Low impedance potentiometers are used in hum-balancing circuits because they will draw sufficient current from the filament winding to make their effects felt. The potentiometer serves to ground the filament supply to the exact electrical center of the circuit. This will cause the hum voltage to be symmetrical, thereby keeping hum to a minimum. If the resistance of the potentiometer is high, the resistance between this electrical center and ground will also be high. A high resistance is a poor ground.

### Input Voltage and Signal-to-Noise Ratio

Q. *A certain preamplifier, with a tape-head input of 0.5 mv, has a signal-to-noise level of 50 db. What would be the noise level for an input signal of 1 mv? For 2 mv? H. S., New York, N. Y.*

A. If the signal-to-noise ratio of a preamplifier at 0.5 mv is 50 db, it will increase to 56 db with a 1 mv signal applied, and will increase to 62 db with an applied signal of 2 mv. Of course, it is assumed that the input impedance is equal in all three instances.

It might at first be supposed that by doubling the input signal voltage the improvement in signal-to-noise ratio would also double—thereby providing an improvement of only 3 db. Doubling the voltage across a constant impedance, however, causes the power to increase as the square of the voltage—in this case 4 times. The basic formulas for calculating the amount of gain or loss in db are based upon power rather than upon voltage. Since the power has increased 4 times, the signal-to-noise ratio will increase by 6 db as already mentioned.

### Amplifiers at High Power Levels

Q. *I would like to test the sound quality of my amplifier when it is operating at levels up to 20 watts, its nominal capacity. I presently have a 20 watt capacity, 16-ohm speaker, and would like to listen to it at normal levels while the amplifier is working hard. What kind of arrangement can be used under these circumstances to drain most of the power from the amplifier? A VTVM, wattmeter, and audio generator are available. Irwin B. Margiloff, Syracuse, N. Y.*

A. All you need to do to lower the power fed to your speaker is to connect a 16-ohm L pad to the system. Instructions for so doing are usually furnished with the pad.

Be sure the L pad has a power-handling capacity great enough to handle the maximum power you will feed into the system.

Æ

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*about hi-fi tubes for hi-fi stereo circuitry*

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**6CA7/EL34**—Exceptionally linear, high-power output pentode with low-voltage drive requirements. Up to 100 watts in push-pull.

**EL84/6BQ5**—Unique AF power pentode combining high gain and linearity with 9-pin miniature construction. Up to 17 watts in push-pull.

**EL86/6CW5**—Low voltage, high current version of the type EL84/6BQ5. Up to 20 watts in push-pull.

**ECL82/6BM8**—Triode-pentode. Up to 8 watts in push-pull.

**UCL82/50BM8**—Series string (100 ma. 50v) version of ECL82/6BM8.

**PCL82/16A8**—Series string (300 ma. 16v) version of ECL82/6BM8.

## VOLTAGE AMPLIFIER TYPES

**EF86/6267**—High-gain pentode with exceptionally low hum, noise and microphonics.* Particularly suitable for pre-amplifier and input stages. Similar to the Z739 and the 5879.

**ECC81/12AT7**—Medium-gain dual triode with low hum, noise and microphonics. Replaces the 12AT7 without circuit changes.

**ECC82/12AU7**—Low-gain dual triode with low hum, noise and microphonics. Replaces the 12AU7 without circuit changes.

**ECC83/12AX7**—High-gain dual triode with low hum, noise and microphonics. Replaces the 12AX7 without circuit changes.

**ECF80/6BL8**—High-gain triode-pentode with low hum, noise and microphonics.

## RF AMPLIFIER TYPES

**6DJ8/ECC88**—Frame grid, sharp cut-off twin triode. Particularly suitable for cascode circuits, RF & IF amplifiers, mixer & phase inverter stages. Features high transconductance and low noise.

***6ES8**—Similar to 6DJ8/ECC88. Has remote cut-off characteristics.

***6ER5**—Frame grid shielded triode with remote cut-off characteristics. Suitable for RF amplifiers in TV & FM tuners. Features high transconductance and low noise.

†**ECC85/6AQ8**—High gain dual triode for FM tuners with shield between sections for reducing oscillator radiation.

**EBF89/6DC8**—Duo diode-pentode with remote cut-off characteristics. Suitable for RF & IF amplifiers.

**ECF80/6BL8**—High gain triode-pentode for RF amplifiers.

## RECTIFIER TYPES

**EZ80/6V4**—Indirectly heated, full-wave rectifier with 6.3 v, 0.6 amp. heater, 90 ma. output capacity and 9-pin miniature construction.

**EZ81/6AC4**—Indirectly heated, full-wave rectifier with 6.3 v, 1 amp heater, 150 ma. output capacity and 9-pin miniature construction.

**GZ34/5AR4**—Indirectly heated, full-wave rectifier with 5 v, 1.9 amp heater and 250 ma. output capacity. Octal base. Replaces the 5U4G without circuit changes with the advantage of lower tube voltage drop because of the unipotential cathode.

*Also Available:* **INDICATOR TUBE TYPES**

**EM84/6FG6**—Indicating pattern is a varying length bar. For use in broadcast receivers and tape recorders.

**DM70/1M3**—Subminiature type with "exclamation mark" indicating pattern. Features low filament consumption (25 ma.).

## GERMANIUM DIODES

**1N542**—Matched pair. Replaces 6AL5 in FM detector circuits.

**1N87A**—High RF rectification efficiency diode. Suitable for AM detector circuits.

*300, 450 & 600 ma series string versions available.
†300, 150 & 100 ma series string versions available.

# LETTERS

### More About the Decibel

SIR:

Mr. Westphal's article "The Decibel—Fact or Fable?" correctly states that the decibel is defined in terms of a power ratio and then concludes that it cannot be used to express voltage ratios except for equal impedances. I agree with Mr. Westphal's contention that some specifications using the term "decibel" should be made more definite, but I do not see why a voltage ratio cannot be expressed in decibels, regardless of impedance, as long as it is properly defined, purely as a voltage ratio. In this case, the formula $n = 20 \log E_1/E_2$ is applicable.

There are many cases where we are interested in this figure and *not* the power ratio. Mr. Westphal's own illustration of the use of the decibel in the specifications of an oscilloscope amplifier is a rather good one. A cathode-ray tube is driven by voltage and not by power, and when the specification says "response is down only 3 db at 200 kc," it means that the *voltage* gain of the amplifier at 200 kc is not one half of its mid-frequency gain, as stated, but 0.707 of its gain at mid-frequency. The specification is not concerned with the power output as such but only with the amount of voltage that is required to get a given deflection on the oscilloscope screen. In this case, gain is purely output voltage divided by input voltage, and the voltage definition of db should be applied.

In the paragraph relating to noise and hum rating, a manufacturer is quoted as stating that his amplifier has a hum level –90 db below 20 watts. If it is –90 below 20 watts, it must be 90 db *above* 20 watts. Although this is a common form of expression, it is wrong. The hum level should be stated as being –90 db with respect to 20 watts, or 90 db below 20 watts, but certainly not –90 db *below* 20 watts. Later in the same paragraph, the statement is made that "the hum is found to be down –80 db." One would not say that the temperature dropped –15 degrees, and I see no more reason to apply this practice to decibels.

Power amplifiers with input impedances of the order of 100,000 ohms or more are often rated in db. Is this power gain? If so, changing the input resistor will change the "gain" of the amplifier. We don't match impedances at the input, but usually drive the amplifier from a fairly low source impedance. The input power is of no concern to us; all we care about is what voltage it takes to drive the amplifier to full output. Here, decibels should not be used at all. I suggest the use of the expression: $P_o/E_i^2$, or watts output per volt input squared. Now if an amplifier is rated at $40\ W/V^2$, this means that 1 volt input will give us 40 watts, 0.5 volt will give us 10 watts, and so on. Thus we can get the information we want from the expression.

VICTOR BROCINER, Staff Consultant,
University Loudspeakers, Inc.,
80 S. Kensico Ave.,
White Plains, N. Y.

### Stereo Compatibility Translator

SIR:

Several recent requests for additional information indicate increasing interest in my Stereo Compatibility Translator, which was described in the August, 1958, issue. One inquiry has led to a slight circuit improvement.

This circuit revision eliminates a loud "plop" which accompanied operation of the LEFT CHANNEL PHASE switch. It requires one additional capacitor and two resistors, as shown in *Fig.* 1.

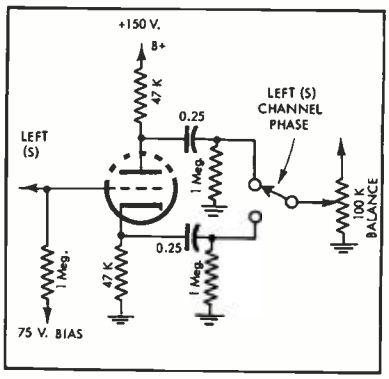


Fig. 1

As to the power requirements, let it be said that any supply delivering 100 to 250 volts d.c. at 10 ma can be used without deteriorating performance. If other than 150 volts is used, the nominal +75-volt bias will adjust properly to the correct mid-value, using the series 100 k resistors shown in the original schematic.

The translator can be used for many different applications. For general use it should be inserted between a pair of preamplifiers and power amplifiers. It is not recommended that it be used directly at the output of a stereo cartridge. For FM Multiplex, the translator can be used following the output of a sub-carrier filter and detector.

If the translator is incorporated as part of a preamplifier with direct wiring to succeeding circuits, the cathode followers may be eliminated.

HERBERT M. HONIG,
127 Lake Street,
Englewood, N. J.

### Acceptable or Not?

SIR:

After careful study of specifications and using the greatest care in the selection of components, I have a stereo system which all the local critics pronounce the best that they have heard.

You can well imagine my dismay upon reading our (*mis*)leading* consumer organization's reports to find that most of the components used are "unacceptable."

Should I destroy this system and build anew using "Check-Rated" components or go on enduring its "Wowing" turntable, "Shattering" pickup, "Groove-jumping" arm, and its $700.00 worth of "Unacceptable" speakers?

T. H. KUYKENDALL,
535 Daytona Ave.,
Holly Hill, Florida.

(* *Italics ours. By all means, replace everything immediately. Don't ever trust your own judgement. Be regimented like everyone else.* ED.)

# Easy-to-build

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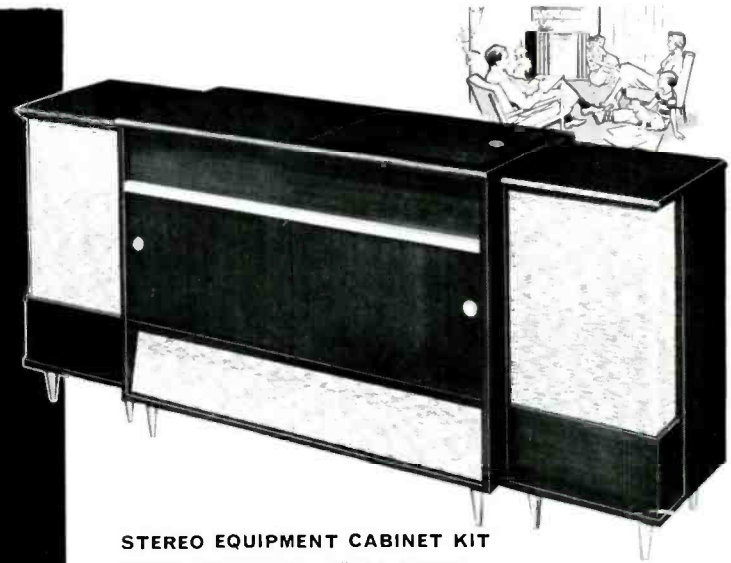

**STEREO EQUIPMENT CABINET KIT**

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

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

**MONAURAL-STEREO PREAMPLIFIER KIT (Two Channel Mixer)**

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

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

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

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MODEL PT-1 **$89.95**

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

**"EXTRA PERFORMANCE" 55 WATT HI-FI AMPLIFIER KIT**

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

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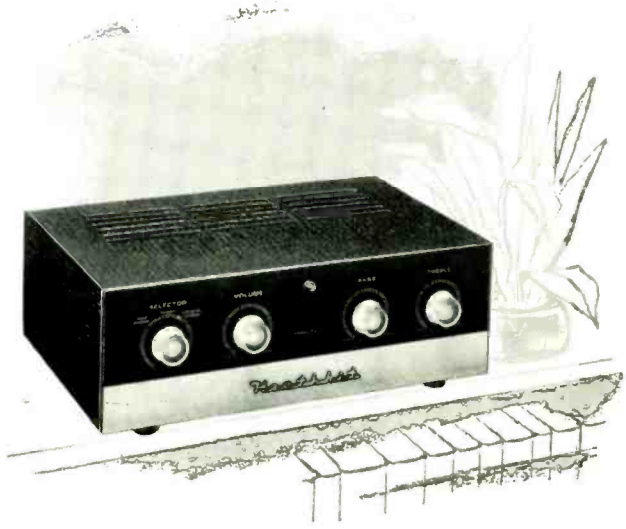

## "BOOKSHELF" 12 WATT AMPLIFIER KIT

MODEL EA-2 **$28.95**

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

## HIGH FIDELITY AM TUNER KIT

MODEL BC-1A **$26.95**

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

## HIGH FIDELITY FM TUNER KIT

MODEL FM-3A **$26.95**

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

## "MASTER CONTROL" PREAMPLIFIER KIT

MODEL WA-P2 **$19.75**

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

## "UNIVERSAL" 12 WATT AMPLIFIER KIT

MODEL UA-1 **$21.95**

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

## HIGH FIDELITY TAPE RECORDER KIT

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

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

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


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

MODEL SS-1B
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MODEL SS-2 **$39.95**
Legs: No. 91-26 Shpg. Wt. 3 lb. $4.95

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# Speaker Phasing With an Oscilloscope

BOB E. TRIPP*

**The same principle used for years by builders of two-way speaker systems to determine the proper phase relation between the units can also be employed to check the two channels of a stereo system.**

WITH THE ADVENT of multi-speaker hi-fi systems and stereophonic sound the proper phasing of speaker systems has become an everyday problem for the hi-fi dealer, the service man and the broadcaster. In order to realize the full advantages of stereophonic sound it is important that the speakers be properly phased, and from the broadcaster's point of view it is desirable to transmit both stereophonic and monophonic signals with the proper phasing to permit in-phase reception on a commercially built hi-fi installation.

Proper phasing can be accomplished hy the usual listening tests with connections being correct when the multiple speakers present a smooth wall of sound with no sharp transition point as the listener walks between the speakers. However, this method of phasing is often slow and laborious, and in some cases it is quite difficult when the physical location and characteristics of the speakers do not permit easy checking.

A foolproof, quick and positive method of phasing speakers is readily available by the simple use of an oscilloscope and two inexpensive crystal mikes. In operation, it is necessary only to place the two mikes in front of the speakers to be phased and observe their output patterns on the oscilloscope while the speakers are in operation on a monophonic program. With identical mikes connected to the vertical and horizontal amplifier inputs of the oscilloscope, in-

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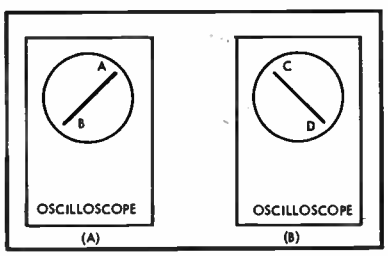


Fig. 1. (A), In-phase pattern on 'scope, and (B), out-of-phase pattern.

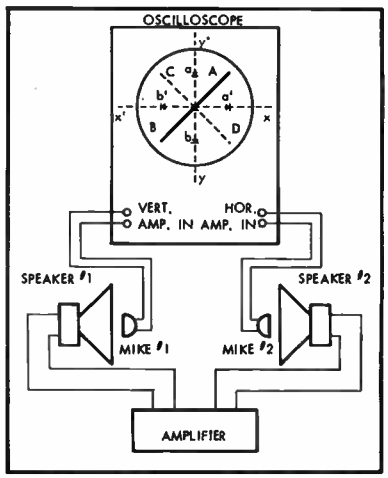


Fig. 2. Method of connecting oscilloscope and microphones to check speaker phasing.

phase operation of the speakers will be indicated when program material produces an oscilloscope pattern which is predominantly along the line A–B as indicated in *Fig.* 1. If the speakers are out of phase, program material will produce a pattern which lies along the line C–D as indicated in *Fig.* 2.

Referring to *Fig.* 3, an in-phase signal on the speakers is picked up by the crystal mikes which in turn apply in-phase voltages to the X and Y axis. On the positive peak of the cycle mike #1 produces a voltage o–a′ and mike #2 produces the voltage o–a′. The resultant of these voltages is at point A on the diagram. On the negative peak of the cycle, the voltage o–b is produced by mike #1, and o–b′ is produced by mike #2, with the resultant of these voltages being at point B on the oscilloscope. Program material will fall on a line between A and B.

If the speakers are out of phase, mike #1 will produce a voltage o–a and mike #2 will produce a voltage o–b′ with the resultant C. On the opposite half of the cycle mike #1 will produce voltage o–b while mike #2 produces voltage o–a′

(*Continued on page 47*)

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# AUDIO ETC.

## Edward Tatnall Canby

### 1. DYNA STEREO

That high-powered kit company, Dyna of Philadelphia, lent me a Mark III system last year, complete with power amplifier and the separate preamplifier that takes its power out of the main unit. This year, in line with the ever-present stereo development, Dyna has sent me *two* complete Mark III outfits—and, much more important, along with them, the Dyna DSC-1 stereo control unit. (Also a dual power supply unit, for the two preamps, to free the main power amplifiers for placement where convenient—more of that in a moment). And now I have had a Dynakit stereo conversion in action to see for myself what happens when one Dynakit system turns into two, for stereo. Very interesting, and it works, by golly, as far as the sound is concerned. Sound, after all, is the basic intention.

The way to approach this Dyna system is (as the scholars would put it) in its context. What is its purpose, intent; what gave rise to its design? Where does it fit in the picture? And the answers would seem to me quite forthright. The Dynakit stereo conversion is exactly that—a specific means of converting present monophonic Dynakit systems to stereo by (1) duplicating the components for a second channel and (2)—the big trick—adding a joint control unit, to operate both systems as one in all the desirable ways.

Of course you can buy two complete Dyna systems right from scratch if you want, and join them with the DSC-1 stereo control unit. But frankly, I don't think this was the basic idea in this development, even though such a system would work and work well. If you start from the beginning, you are likely to want not two separate systems, joined, but a complete integrated, designed-for-stereo outfit. It'll be simpler, involve less duplication of parts and functions, and above all it will be less complicated in the outward aspects.

Dynakit stereo, then, is Dyna's concrete answer to that nightmare cry now heard all over the land—"WHAT SHALL I DO WITH MY PRICELESS MONO HI-FI SYSTEM?" The fancier the old system is, the more agonized the screetch! The Dyna people are in a very neat position to answer it, for the Dynakit system ranks high in the quality scale but, thanks to kit-form economy, may be duplicated at a cost in dollars that is at least possible, if not exactly chicken-feed money. You CAN convert your Dynakit to stereo, you CAN use every bit of Dyna equipment you already have and all this can be done without quite breaking your local bank. Moreover, if you were able to put together your first Dynakit, the second will go a lot faster.

In these words, I think, you'll find enough to justify the Dyna stereo conversion in the face of every conceivable criticism. It does what it aims to do.

The joker, if any, could be that joint stereo control unit. That's the spot where most of us would tend to look with deep, deep suspicion. There aren't many problems involved in setting up two separate amplifier systems for stereo, each controlled on its own, independent except for the common stereo origin of the signals. Two Dynakit Mark III systems work more or less like one, in this respect at least, if you don't mind fussing with two different control panels, keeping things balanced, plugging and unplugging for changes in function and so on.

Unfortunately, most people do mind, and that includes me. So—let's have a ganged, joint control. But the instant you start to join up your two systems electrically you run into dire problems. You're positively yelling for trouble. Dyna, then, stepped bravely into a potential morass when it set out to develop its DCS-1 control to join up two of its systems for stereo. If hairs turned gray, then it was worth it. For, though I wouldn't have believed it possible, the darned thing *works*. That, I suggest, is the understatement of the year!

I am at this point, then, able to state a gratifyingly positive conclusion, a semi-miracle. On direct AB test in my home, two separate Dynakits *vs.* the same two hooked into the DSC-1 stereo control, I found no significant difference in sound, either way. There were slight, minor differences in the background noise at top volume setting, to be sure; but I could not possibly express a preference for one over the other. As far as I am concerned, then, the stereo sound out of this joint control unit is just as good as that from two separate Dyna systems, controlled individually from two preamps. And this, in spite of an outward wiring complexity that would suggest the system couldn't possibly work without *some* sort of hum or something. No such thing.

The only complications you'll run into at all, aside from the normal ones of kit-building, are those of the outward hooking-up and controls. These, however, are so utterly typical of stereo today that I can't help going into them at some length, even though I am aware that they are superficial, not fundamental, problems and should cause minimum worry to the man who can put together his own amplifier kit.

#### Macaroni

First, you finish your Dynakits for stereo, all six units. Two power amps, two preamps, the small PS-1 dual power supply unit (for convenient feeding of the two preamps) and the DSC-1 stereo control box. Everything is in order, we'll assume, and you are ready to go. All you have to do is hook up the system. That's where I came in, for as always, I was a sissy and got mine ready-assembled, factory-built.

Well, I hooked it up. But not before I had got my wires so tangled up, halfway through, that I had to unplug everything and put labels on the ends of the cables so I could figure out which was which 'mid the developing maze of wire macaroni* that quickly grows out behind your units as you prepare them for operation! You'd have to see it to believe it.

Now what I am unfolding here is not a criticism but an observation. Remember that every system of this sort is set up according to a purpose, an aim, a design objective; though other purposes may be encompassed too, they are side-lines. The purpose here, in Dyna stereo, is as already stated and—given these units, including the two separate preamplifiers—I can't really see how the wire macaroni could have been avoided, granted the standard stereo functions were to be well served. Complications lead to complications, the more switches and wires and inputs and outputs you have, the more difficult is it to make a neat, simple affair out of the wires and plugs that go with the system. Given the basic premise, the Dyna conversion just had to be complex in its external facilities and wiring. Let's look at it.

My earliest hi-fi home amplifiers, a dozen years ago, generally had one input on the rear, and one output, to speaker. There were soon two inputs—PHONO and RADIO—and then three, when the magnetic cartridge and the preamplifier came along. The complexities were setting in, and they increased when we got to HI MAG and LO MAG, then TAPE, TAPE HEAD, and so on.

Now I've just taken a look at the rear of my Dyna stereo system. I counted up the RCA-type phono jacks to be seen, and to be plugged into: they add up to no less than *twenty-six*—for the one basic system! And all but two are on the rears of the two matched preamps and the joint control unit, mounted in serried ranks, like cavalry, four to a rank. Looks like a telephone exchange, to mix my metaphors.

To hook up your stereo for disc only, you must make use of ten RCA-type plugs, eight of them on the ends of four short cables (provided) from the preamps to the stereo control unit and back; the other two are the usual pair from the stereo phono cartridge. For FM-AM radio you'll need four more plugs, on two cables from tuner to system. That's fourteen.

I went no further than this, though there are numerous other things you may do, of course. You can play stereo tape, or mono tape (through both channels), record on tape and all the rest—everything is possible; but the resulting cable macaroni is inescapable.

(The only way to get rid of it, you see, is to build a single stereo chassis with all the wiring inside and immovable. That is another kind of system, altogether.)

If your plugging job has been done right, everything works fine. But if you've pulled a boo-boo, made a *faux-pas*, plugged something where it doesn't belong, your macaroni is in the soup. Even the simple act of removing two phono cables, to plug in another pair, is apt to get you tangled in wire—and the odds are that you'll pull the wrong plug. Then when you try to find which one you did pull . . . your soup is in

(*Continued on page 73*)

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* Mr. Canby called it "spaghetti," which already has another connotation in electronic circles. We changed it to "macaroni." ED. OK! It's that enough. *ETC.*

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# EDITOR'S REVIEW

## THIRTEENTH YEAR

WITH THIS ISSUE, AUDIO becomes a teenager, since it enters its thirteenth year of publication. Starting twelve years ago without any organized industry to represent—and, in fact, with practically no industry at all, organized or not—this magazine started life with no professional publishing experience behind it. It did have, however, a wholehearted interest in what then was just a hobby for a small group of experimenters who were not satisfied with the sound reproducing equipment which was available to them on the consumer market. In 1947, you either bought a Brook amplifier or you scrounged around and found some way to get your hands on some broadcast or motion-picture theatre or studio equipment.

But in addition to that whole-hearted interest in sound reproduction of quality, there was one other precept in AUDIO's favor—the magazine was to be run for the reader, and the material chosen for its pages was selected with considerable thought to make sure that the reader would never be given a "bum steer" about equipment of all types—amplifier circuits, speaker cabinetry, and general audio information. The Musician's Amplifier, a modification of the British-designed Williamson was one of the first to be copied in both kit and completed form by manufacturers. The loudness control—which, in our opinion, did more to take high fidelity out of the hobbyist's "shack" than any other single advance—first saw light in May, 1948, in these pages. Remember how the early high fidelity "bug" was always criticized for playing his system too loud? The rear-loaded corner "horn" was first described here—in January and February, 1949—and that design, too, became a standard.

Little by little the industry began to assemble itself. The experimenter with an exceptionally good idea often became a manufacturer, and there are many examples among today's successful companies that started with one man's tinkering and diligent striving for still better sound.

We here at AUDIO feel that considerable of the credit for the entire high fidelity industry falls on us. We have been extremely fortunate in having loyal and competent contributors whose articles have actually contributed far more to the industry than they have received in return, and it is that kind of loyalty which has made AUDIO the authority on the technical aspects of high fidelity.

There is another kind of loyalty that is most heartwarming to those of us who attend the hi-fi shows—the subscriber and constant reader who comes up to one or the other of us and tells us proudly that he has every copy from the first issue, or perhaps from the second, whereupon he bemoans the fact that he doesn't have one of the first. We are more than grateful for this loyalty, from reader and contributor alike, for we could not exist without both.

Continuing in our aim to be of definite help to everyone who wants better sound and more effective operation of his equipment, we are inaugurating a tape section this month. Under the heading of "The Tape Guide," we will present reliable information to guide you in the purchase and use of tape machines, the techniques of editing, suggested ideas for recording microphone placement, maintenance procedures, and countless tips and aids to the art of tape recording. While we have lined up a considerable array of material about tape, we know that many readers have independently developed ideas and techniques that would be of interest to others, so we extend a special invitation to those intrepid tape experimenters who "think for themselves."

All contributions will be gratefully received, and all will be paid for. This applies also to photographs of attractive home installations which you believe others would like to see. Not everyone may want to duplicate your home installation, but perhaps you have some particularly attractive solution to a given problem in decoration or component placement and others may glean considerable help from your work.

Hope this doesn't sound as though we are being boastful, but we are—just a little.

## AND NOW, THREE-CHANNEL STEREO

Or at least that's what one company has announced in the headlines. But in the fine print it says that there are three speakers—the woofer (probably an enormous 6 × 9-inch unit) in the center handles the combined low frequencies of both channels, while two separate tweeters handle the highs, one for each channel.

This is a great idea, of course, but it is not new. It works, and it is a good solution, especially where it is difficult to find space for two separate full-range systems. However, we find fault with calling the system "three-channel," and we believe that the manufacturer should reconsider the idea. Three channel means just that—three *separate* channels from microphone all the way to loudspeaker. It seems that the FTC might take cognizance of this kind of misleading nomenclature.

# WE'RE LEARNING WHY TWO EARS ARE BETTER THAN ONE


Which speaker is making the sound? In echoless chamber at Bell Labs, Robert Hanson measures test subject's ability to localize sounds — observes how two ears operate in partnership. This and other tests may point the way to better telephone instruments.

In listening to stereophonic music, how is it that our ears and brain construct a picture of the entire orchestra with but two samples (the sounds from two speakers) to work with?

How is it that our ears and brain are able to pinpoint *one* voice in a roomful of talkers—to listen to it alone and ignore the rest?

What makes *two* ears better than one?

Bell Telephone Laboratories scientists are searching for the answers. For in finding them, better telephone instruments and better ways of transmitting sound will surely result.

Our hearing performs feats that no electronic system can yet duplicate. How? Laboratories scientists believe the secret lies in the way our two ears function in partnership and in the way our neural network connects them with our brain. *The problem:* to discover what functions the network performs and to see whether electronic duplication might enhance understanding.

The work is under way. Electronic circuits that simulate the operation of nerve cells have already been created—and conceptual models of the neural network are being constructed.

Alexander Graham Bell's interest in deafness and hearing led to the invention of the telephone. Bell Laboratories' current explorations in binaural sound may well lead to important new advances in the transmission of speech and music.

**BELL TELEPHONE LABORATORIES**
World center of communications research and development

# A Compatible Stereophonic Sound System

**If stereo broadcasting is to become acceptable, either transmission channel must be capable of presenting a complete signal to the listener not equipped for stereo presentation. This system is completely compatible for use with any two-channel transmission.**

FLOYD K. BECKER*

THE "NEW SOUND" of high fidelity stereophonic sound is far from new. At least as early as 1881 a demonstration of an electrical transmission of binaural sound, a close cousin of stereophonic sound, was made at the Paris Opera. That demonstration used two widely spaced microphones connected to a binaural headset. In 1925, the New Haven radio station, WPAJ, made binaural broadcasts by employing two separate AM transmitters on different wavelengths. Two standard studio microphones placed 7 inches apart originated the binaural signals.

In 1933, the Bell Telephone Laboratories culminated a series of auditory perspective tests in a three-channel system demonstration. Under the auspices of the National Academy of Sciences, a concert of the Philadelphia Orchestra was transmitted from the Academy of Music in Philadelphia to Constitution Hall in Washington. The orchestra was conducted by Associate Conductor Smallens while Dr. Stokowski, the Director, manipulated electrical controls from a box in the rear of Constitution Hall.

Three microphones were placed before the orchestra, one on each side and one in the center at about 20 feet in front of and 10 feet above the first row of instruments of the orchestra. The microphone outputs were transmitted to Constitution Hall in Washington by three separate electrical circuits specially tailored for the occasion. At Constitution Hall these transmission lines were connected to power amplifiers. The associated loudspeakers were placed on stage in positions corresponding to the microphones in the Academy of Music in Philadelphia. The comments of those who heard this reproduced concert proclaimed the development of a system with possibilities for even greater emotional appeal than that obtained when listening to the orchestra "live." Much of this reaction was undoubtedly due to the enhanced volume range.

In 1936, the Bell Telephone Laboratories produced disc recordings of two-channel stereo. In 1939, Philips of The Netherlands experimented with stereophonic sound reproduction in large auditoriums. In 1941, the Bell Telephone Laboratories demonstrated sound motion picture recording using three-channel stereo.

This chronology of early sterephonic sound is by no means complete. It only attempts to place a few of the salient efforts at stereophonic sound transmission and/or reproduction.

Radio broadcasting of stereophonic sound programs by two separate channels became popular in 1952–4. In various experimental arrangements, the two channels required have been selected from different combinations of AM, FM, and TV, the listener spacing appropriate receivers properly in his home. Results have been sufficiently favorable that more broadcasters are considering offering stereophonic sound programs. Many such programs have been originated on the national networks.

The major obstacle to vastly increased use of this type of stereophonic broadcasting, however, is the person who listens with only one receiver. If the broadcaster tries for the full stereophonic effect, the sound the single channel listener hears comes from only one of two widely spaced microphone pickups, and he misses a portion of the program. The effect in many cases is similar to listening to one-half of an orchestra or to one side of a two-way conversation. What the single channel listener does receive is poorly balanced, because of the microphone placement in relation to the sound sources. The broadcaster, in order to protect investment and sponsor revenue, has had to dilute the stereophonic effect in order to preserve satisfactory reception for the single channel listeners.

Most of the effort to produce a compatible stereophonic sound system has been directed at single channel systems. These systems generally comprise a frequency or time multiplexing of the stereophonic channels on a single carrier. Most of these systems are, indeed, compatible with present day single-channel receivers but require additional equipment—other than AM and FM receivers—to produce stereophonic sound.

### Compatibility Desirable

One solution to the two-channel problem is gained through the use of a compatibility circuit developed at the Bell Telephone Laboratories. This circuit, equally adaptable for a two- or three-channel system, depends for success upon a psyehoacoustic phenomenon known as the Precedence Effect. Before discussing this effect, it would be well to review the principles of sound localization. The localization of a sound source with respect to the observer requires three coordinates: the radial distance, the altitude angle, and the azimuth angle. Man's auditory pereception of distance seems to be primarily governed by the loudness and ratio of direct to reverberant sound. There is little or no altitude perception. Azimuth localization is extremely good, and accuracies of about 2 deg. are average. The mechanisms for azimuth detection are (1) phase differences between sound waves at the two ears; (2) differences in the time of arrival of transient sounds; (3) differences in intensity at the two ears due to shadowing by the head, which also has a frequency dependence and will result in an interaural quality difference. Azimuth localization of pure tones is possible only in areas approximating free-space. In reverberant rooms, even those with optimum reverberation time for music reproduction, the standing wave patterns destroy the sense of directivity. Hence the arrival time and intensity differences of transients assume the predominant roles in determining azimuth in ordinary listening environments.

### Loudness Differences

It is possible to trade loudness differences for arrival time differences. An observer seated before two in-phase loudspeakers which are separated by several feet will gain the impression of a single, centrally located source if the two loudspeakers have the same loudness. If the loudness of one speaker increases while the other correspondingly decreases, the apparent source will shift toward the more intense loudspeaker. The amount of the apparent shift depends upon the sound intensities at the ears. If the sound levels are the same in both speakers, but a time delay is introduced in one source, the apparent source will shift toward the undelayed speaker. Time delays as short as

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250 microseconds produce considerable shifts in the apparent source. These time delays are of the same magnitude as the time differences of transient arrivals at the two ears for a sound source to the observer's side. When the time delay in the one speaker system is increased to 2 or 3 milliseconds the delayed source must be intensified until it is ten times more powerful than the undelayed source before the observer will detect it to be of the same loudness! This condition holds while the delay is increased to about 35 milliseconds. In the neighborhood of 35 milliseconds time delay, the observer begins to detect a distinct echo. It is the reaction of the azimuth localization mechanism in the region of 1 to 30 milliseconds that is called the Precedence Effect. In this region, the localization of a sound source is determined by the direction of the first arriving sound. The later arriving echoes are virtually disregarded. This may at first seem an amazing phenomenon but a closer examination discloses that it is at least an every day experience. In the average indoor environment, the bulk of the sound power reaching a listener arrives by way of reflections or echoes. Yet, in this same environment the listener has no difficulty localizing the sound source.

Now to turn to *Figs.* 1 and 2 and an explanation of this form of a compatible stereophonic sound system. Referring first to *Fig.* 1, the circuits between the microphone pickups and their corresponding radio or TV transmitters are cross connected through two delay lines, each with its own buffer amplifier. Because of these cross connections, music or voice signals from the left microphone are transmitted directly to the left loudspeaker in the listener's home, while the same signal is slightly delayed before reaching the speaker to his right. The stereo listener will hear the sound as if it came only from the left loudspeaker because of the Precedence Effect. Conversely, the sound from the right microphone goes direct to the right speaker, but is delayed before reaching the left speaker, and is therefore unheard in the left speaker. Thus, the stereo listener localizes the sound he hears as coming direct from each of his two speakers, and full stereophonic effect is maintained.

However, monophonic reception is completely compatible with this, since a listener to each single channel hears the total sound from both microphones in a balanced reproduction. The slight delay of one signal does not affect his reception at all.

The three-channel system of *Fig.* 2 operates in a similar manner. The direct signal travelling only in the primary channels while a time delayed replica of the direct signal is added to the alternate channels in order to achieve compatibility.

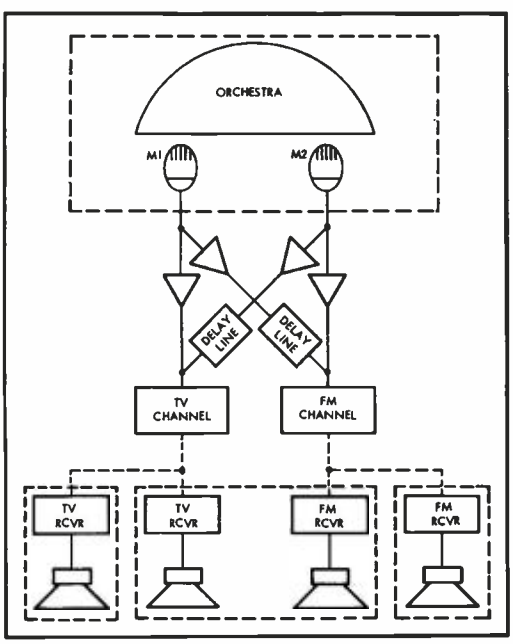
### Observations

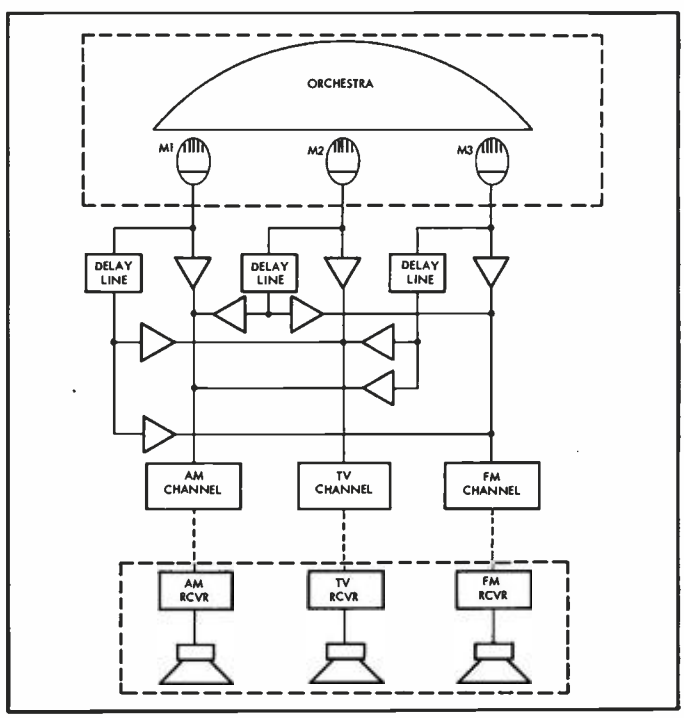
Results of two-channel subjective listening tests with musical material indicate a preferred time delay of about 10 milliseconds with the intensity of the delayed signal equal to the direct signal. A different set of parameters appear optimum for speech; e.g., 5 milliseconds delay and the intensity of the delayed signal 3 db less than the direct signal. A tested compromise of 10 milliseconds time delay and 3 db attenuation yields very good over-all results. The 8- to 10-db channel separation due to Precedence Effect added to the 3-db intensity difference gives results comparable to a system with 12-db channel separation.

It might be of interest here to mention some desirable side effects of these circuits. The literature is full of references to the "hole in the middle" and to the subjective reaction to the reproduction of the music of a full orchestra from a box occupying some 2 or 3 cubic feet. The employment of the Precedence Effect for channel separation causes the area of the apparent sound sources to seem quite large. The sound no longer emanates from the small speaker cabinets but appears to be produced by large area sound sources. The apparent area of these sources greatly diminishes the "hole in the middle" effect and is more suggestive of the appropriate size of loudspeakers required to reproduce orchestral music.

This development should make it possible for many more broadcasters to offer double or triple channel stereo programming without diluting the stereo effect or penalizing the single channel listener, who will make up the majority of their audience. Æ

Fig. 1. (below) Block schematic of Precedence system for two channels. Fig. 2 (right) The same system may be expanded to permit transmission of three compatible channels.



# Moving-Magnetic Stereo

## —The new horizon of stereo disc reproduction

**A discussion of the design features of the newest stereo pickup to reach the market with an analysis of some of the parameters which affect performance.**

HERBERT HOROWITZ*

FROM THE SLOW first steps towards new goals, our scientific and engineering progress creates and accelerates further progress. With stereo disc reproduction, as in all new moves forward, there have been inadequacies ranging from crude initial disc-cutting equipment to doctored and modified monophonic phono pickups attempting to make use of the new stereo media. The design problems of recording cutters and playback pickups have been the major technical bottleneck to public acceptance and appreciation of the new stereo technique.

New and improved stereo cutters have emerged during the past year, and new design approaches and principles have been applied to produce high-quality stereophonic phonograph pickups to equal and surpass the standards of excellence achieved during the monophonic era.

Initial attempts at stereo pickups followed the basic established patterns of ceramic, variable-reluctance, and moving-coil technical design.

All of these attempts bottlenecked in the miasma of high cost, high moving mass, difficult construction, high distortion, and so on.

Any new principle of technology must move by necessity to newer principles of technique. Designers of stereo pickups who were able to visualize the complex problems began to approach the solution from a new direction. This approach has now been formulated to the major breakthrough needed to give the final impetus to the bandwagon of stereo disc reproduction.

### Moving-Magnet System

This new concept is the "Moving-Magnet System." Phonograph pickup designers worked along this approach at the tail end of the monophonic era. Although the basic principles date back quite a while, it has only been the major technological advances in magnetic materials of the last few years that allowed the system to be feasible. Widespread fame eluded the moving-magnet monophonic pickup since it had to contend with the giants of variable reluctance and moving coil. Every new concept must have a *raison d'etre.* For the moving magnet it is Stereo.

The moving-magnet system is the reverse application of the moving-coil system. The generating magnetic element produces a variable flux which induces electrical energy into stationary coils ($\angle\ d\Phi/dt$). The parameter of low distortion is basic in the moving-coil system and is therefore true of its converse, the moving magnet.

The operation of this system can best be illustrated with *Fig.* 2. At (A) is shown the basic magnet structure, a rod magnet of rectangular cross section magnetized lengthwise and inserted into the coil structure shown at (B) and pivoted at its center. Coils A and B in hum-bucking series opposition form one coil structure which develops voltage from inner groove wall modulation while hum-bucked coils C and D develop the outer groove wall signal. Force $F_1$ as shown in (C) rotates the poles of the magnet toward and away from the pole faces of coils A and B creating a variable flux in the coil structure. However, force $F_1$ has not caused any air gap variation relative to poles C and D since the magnet is moving parallel to those

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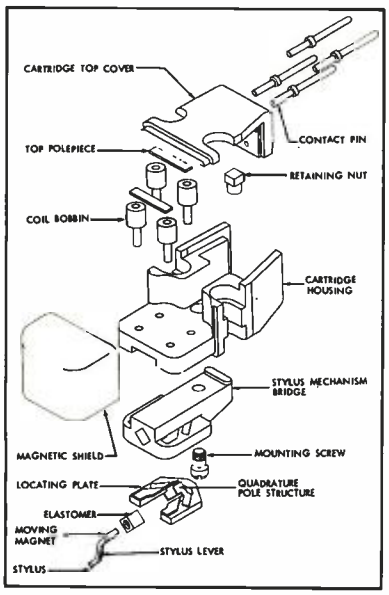



Fig. 1. Exploded view of the pickup.

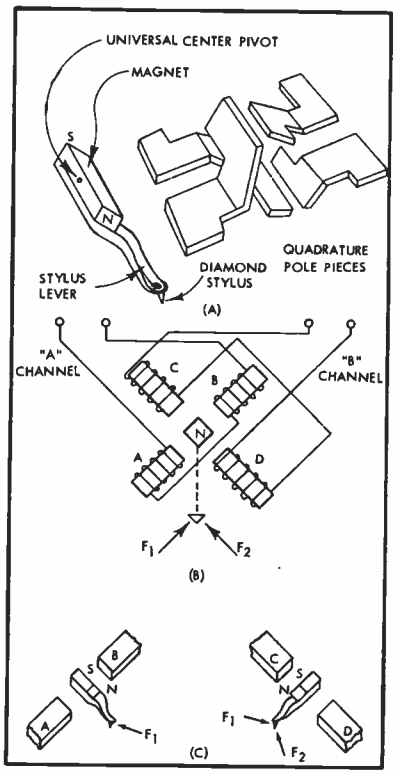



Fig. 2. (A) Diagram of stylus assembly and quadrature pole structure. (B) Relation of coils to moving magnet. (C) Effect of forces from two groove sides upon stylus and magnet.

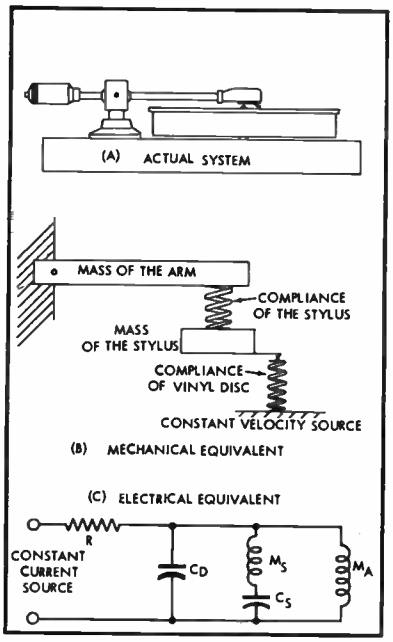



**Fig. 3. (A) Typical pickup-arm system, (B) its mechanical equivalent, and (C) its electrical equivalent.**

pole faces, and therefore there is no voltage generated in the C and D combination. Conversely force $F_2$ causes a flux variation in the C and D structure while isolating A and B.

It is not possible to locate coils A and D beneath the magnet physically because of the practicality of stylus lever length.

The Audio-Empire moving magnet pickup contains four vertical poles which mount coils as seen in *Fig.* 1. These vertical poles are mated with a quadrature pole structure, (A) in *Fig.* 2, designed to develop independent outputs from $F_1$ and $F_2$ modes of motion.

The quadrature pole structure is moulded into an independent structure; the magnet-and-stylus-lever assembly is inserted and mounted to its pivot. This allows simple stylus replacement by the complete removal of the moving-magnet mechanism.

### Why the Superiority of the Moving-Magnet System?

The technically minded audiofan has become familiar with the terms *dynamic mass, compliance, frequency response,* and *resonance.* These key parameters of phonograph pickup design are dependent upon one another for the over-all performance of the stereo pickup with its need for channel isolation.

Mechanical elements in motion have inertial effects which cause them to have inherent mechanical resonance at a frequency dependent upon the dynamic masses and compliances of the system. *Figure* 3 shows the physical, mechanical, and electrical equivalent configurations of a typical arm and cartridge. The arm contains mass $M_a$ and compliance $C_a$; the stylus mass is $M_s$ and stylus compliance $C_s$, while $C_d$ is designated as the compliance of the disc under the proscribed stylus force.

Since $C_s$ is much greater than $C_d$, and $M_a$ greater than $M_s$, we find that at very low audio frequencies the stylus mass $M_s$ has virtually zero impedance and the record disc has a very small compliance. This leaves the mass of the arm $M_a$ and the compliance of the stylus $C_s$ as the determining factors of low-frequency resonance.

$$f_r\,(low) = \frac{1}{2\pi\sqrt{M_a C_s}}$$

At the upper end of the frequency spectrum, the mass of the arm $M_a$ attains too high an impedance to be moved by the system while the high compliance of the pickup $C_s$ has virtually zero impedance. We can say, therefore, that for high frequencies

$$f_r(high) = \frac{1}{2\pi\sqrt{M_s C_d}}$$

which indicates that the high-frequency resonance of the system is determined by the dynamic mass of the pickup and the compliance of the record disc.

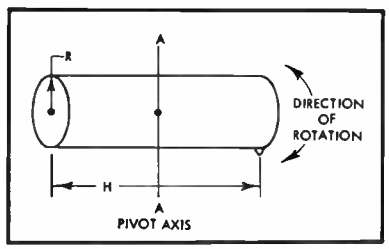



**Fig. 4. Diagram of stylus bar to determine moment of inertia.**

### Parameters of System Dynamic Mass

Any basic element turning about a pivot has inherent inertia which is reflected to the stylus tip. Let us examine a typical system, (A) in *Fig.* 4, where a mass is forced to pivot about axis AA. The inertia of the moving element about axis AA is given by:

$$J = \frac{W(r^2 + h^2)}{12}$$

where

$$W = \pi r^2 h D$$

and $D$ = density (7.68 gms/cm³ for steel). Therefore

$$J = \frac{\pi r^2 h D(3r^2 + h^2)}{12}$$

for a typical case where $r = h/2$,

$$J = \frac{7\pi D h^5}{192} = 0.115h^5$$

The radius of gyration of the above mass is given by the equation:

$$\text{Radius of gyration } K_{AA} = \sqrt{\frac{3r^2 + h^2}{12}}$$

and when $r = h/2$, $K_{AA} = \sqrt{0.146h^2}$

The effective mass of the system reflected to the stylus tip being

$$\text{Effective Mass at stylus} = J_{AA}\left(\frac{K_{AA}}{X}\right)^2$$

When $X$ equal the pivot-to-stylus distance

$$\text{or } 0.115Dh^5\left(\frac{0.146h^2}{X^2}\right) = \frac{.0168Dh^7}{X^2}$$

The significance of these calculations lies in the factor $h^7$. This indicates that in the determination of the effective mass of the system reflected to the stylus, the $h$ factor is overwhelmingly the major element.

Variable-reluctance systems whose mass is uniformly distributed over a long lever are unable to achieve low mass because of large $h$ factor. It is obviously necessary to keep the mass of the system concentrated as close to the pivot center as possible. *Figure* 5 numerically and more pointedly demonstrates the relationship of dimension to dynamic mass reflected to the stylus tip. The three moving-element systems shown have cross

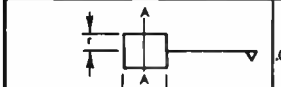
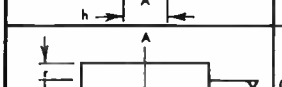
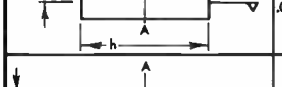
| PHONO PICKUP MECHANISM | | | MASS OF MOVING ELEMENT, $M_o$ Where $M_o = J_{AA}$ at radius of gyration $M_o = \pi r^2 h \times$ Density Density = 7.68 gms/cm³ | RADIUS OF GYRATION $K_{AA} = \sqrt{\frac{3r^2+h^2}{12}}$ | MASS REFLECTED TO THE STYLUS TIP $M = W\left(\frac{K_{AA}}{X}\right)^2$ |
|---|---|---|---|---|---|
|  | .020 in. | .050 in. | $7.7(10)^{-3}$ gms | $1.06(10)^{-1}$ cm | $.21(10)^{-3}$ gms |
|  | .020 in. | .050 in. | $23(10)^{-3}$ gms | $1.8(10)^{-1}$ cm | $1.9(10)^{-3}$ gms |
|  | .020 in. | .050 in. | $38(10)^{-3}$ gms | $2.3(10)^{-1}$ cm | $5(10)^{-3}$ gms |

**Fig. 5. Table of parameters pertaining to stylus assemblies of different designs.**

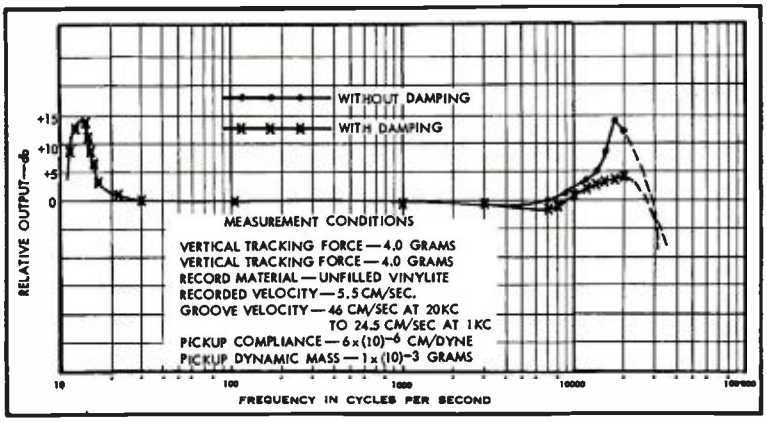



Fig. 6. Response of professional type monophonic pickup, corrected for equipment response and record deviation.

sections which are identical yet they differ in the $h$ dimension. *Figure* 5 shows the relative differences these systems exhibit in the parameters of weight, radius of gyration, and mass reflected to the stylus tip.

All phonograph reproducing systems exhibit mechanical resonance at both upper and lower end of the spectrum. A frequency response pattern of a high-quality monophonic system is shown in *Fig.* 5. Low-frequency resonance occurs at 12 cps while upper resonance occurs at 18,000 cps. The resonant frequency of the undamped system effectively extends over the full audible range from 16 cps to 15,000 cps within ± 3-db limits of amplitude.

Introduction of damping to the cartridge system deflates the high-frequency resonant peak. Damping—which is amplitude sensitive in character but not velocity sensitive—is a distortion-generating factor and this is especially true of transient response where the RC time constant of a damped system does not allow for sufficiently rapid recovery time to insure faithful reproduction of musical content.

The effect of mass loading, operating in several degrees of freedom in mechanical resonance, is a major concern in stereo pickups because of its effect on channel separation. *Figure* 7 compares the channel separations of a typical high-mass system with that of an inherently low-inertia moving-magnet pickup. The high-mass system at (A) shows a high-frequency mechanical resonance in the order of 11,000 cps. This pickup is heavily damped to suppress audible amplitude effects of this resonance. Note the gradual loss of channel separation as we approach resonance with the complete loss at 12,000 cps and beyond in the high-mass system. The moving magnet system shown in (B) can retain adequate channel separation throughout the audible range. Obviously as resonance is approached, the generating element mode of motion is no longer controlled by groove-wall modulation but becomes a function of natural resonant vibration.

Introduction of damping with its undesirable incorrect resistance character is the cause of the high distortion content encountered in many stereo pickups currently marketed. Pickup inefficiencies of this nature can no longer be attributed to poor cutterhead design.

The ideal cartridge mechanism is a virtually undamped system whose dynamic mass is so small that the natural resonance of the system, $1/2\pi\sqrt{C_d M_s}$, lies outside the audible range and allows for flat frequency response and adequate channel separation.

### Dynamic Mass of the Stylus

The $C_d$ factor, compliance of the disc, has been relatively standardized and is a function of disc fabrication techniques and materials. The only variable parameter of cartridge design capable of affecting high-frequency resonance becomes the dynamic mass of the system. The smaller the dynamic mass, the higher the point of resonance.

To calculate the dynamic mass of the moving-magnet system, previously shown in *Fig.* 4, let us examine its three major components, stylus, stylus lever, and generating element.

The mass of the diamond illustrated is given by $\left[\frac{\pi DH}{4}\right] + \left[\frac{\pi r^2 h}{3}\right]$ Density.

$$\left[\pi r_s^2 l + \frac{\pi r_s^2 h}{3}\right] \text{Density}$$

where $r_s$ = radius of cylindrical portion of stylus
$l$ = length of cylindrical portion of stylus
$h$ = height of conical portion of stylus.

With the density of diamond at 3.5 gms/cm³ we find for the nude stylus of .012 in. diameter × .030 in. long the actual stylus mass is $0.2(10)^{-3}$ grams or 0.2 milligrams.

The stylus lever, made of aluminum .005 in. thick is negligible in mass.

The mass of the rectangular generating element pivoting about its center axis (AA) is concentrated at its radios of gyration

$$K_{AA} = \sqrt{\frac{b^2 + c^2}{12}}$$

The mass of a rectangular element of dimensions $a$, $b$, and $c$ is

$$M = a \times b \times c \times \text{Density}$$

The effective mass of the moving element referred to the stylus tip is given by the expression:

$$\text{Effective Dynamic Mass} = \text{Mass of the Moving element} \times \frac{\text{radius of gyration}}{\text{distance from pivot center to stylus}}$$

$$= a^2 b \times \text{Density} \left( \frac{\sqrt{\frac{b^2 + c^2}{12}}}{X} \right)$$

where $X$ = distance from pivot center to stylus.

For the case of the Empire "88"

(*Continued on page 46*)

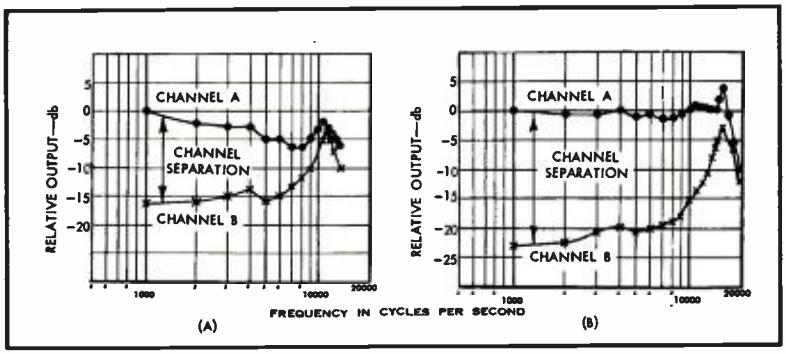



Fig. 7. Channel separation for typical variable-reluctance pickup (A), and for moving-magnet pickup described (B).

# Negative-Supply Outboard Codan

**Although relatively few AM tuners are provided with any form of "squelch," there are times when it would be of some advantage to have silence in the absence of a carrier rather than modulation. Interstation noise during tuning can be eliminated by this device, which is simple and effective.**

RONALD L. IVES*

OPERATING ADVANTAGES of a codan, squelch, or intersignal noise silencer are well known to most commercial and amateur radio operators, yet few commercially-made receivers incorporate the device. A number of technical descriptions of the CODAN (carrier operated device, anti-noise), have been published in recent years[1,2,3], and all of those cited, as well as a number of others embodying the same general principles, work, and work well.

Chief objections to addition of a codan to an existing receiver have been the great amount of circuit change necessary, the loading of the receiver AVC system, and the injection of contact potential from the codan into the receiver AVC system. This latter difficulty reduces the receiver sensitivity at low signal levels (where it is needed most), and generally messes up the AVC action, making extensive redesign of the AVC circuits necessary before optimum performance is again attained.

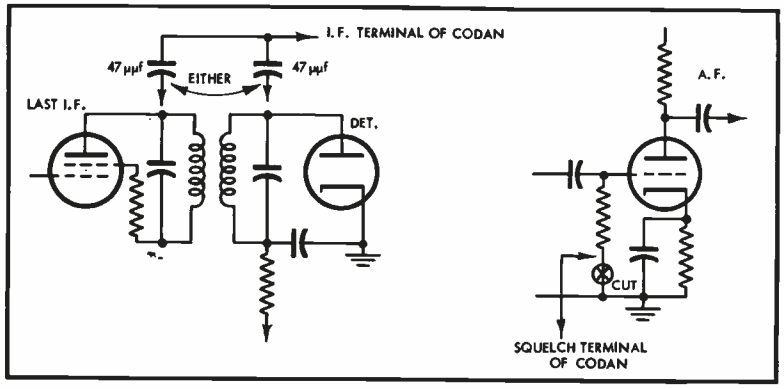



Fig. 2 Connections to receiver.

The prineipal function of a codan is to silence the audio system of the receiver when the carrier amplitude falls below a specific and usually adjustable value. By use of a "negative" power supply, and an I-F "stealer" eircuit, this function can be performed by a simple outboard device, requiring only two connections to the receiver, and one to the power line. This circuit, having no connection to the receiver AVC system, does not load it or alter its characteristics.

Circuit of this simplified codan is shown in *Fig.* 1. This is one of a family of similar circuits, all of which perform well, and all require about the same number of components. Differences between various members of the family are rather obvious variations in the location and method of sensitivity and bias adjustments.

In this circuit, the actuating signal is tapped off the last i. f. stage through a small capacitor, and fed to the grid of a pentode (half of a 6U8A) through a potentiometer, which provides grid return and sensitivity adjustment. Amplified signal is tapped off the plate of the pentode, and fed, through a small capacitor and glow lamp, to a rectifier. The pentode plate circuit is tuned, to narrow the effective frequency range of the codan, and the glow lamp provides

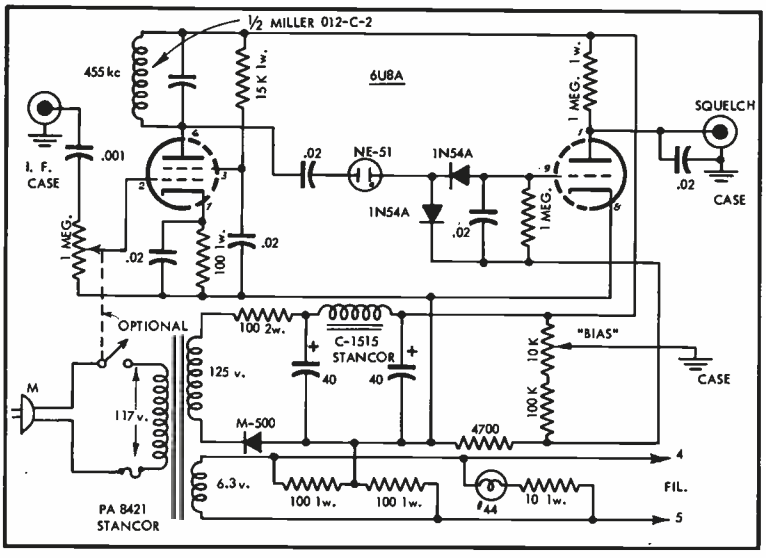



Fig. 1 Circuit of negative-supply codan.

*2075 Harvard St., Palo Alto, California.

[1] R. A. Heising, "Radio links to the telephone system," *Bell System Technical Journal*, Vol. 19, 1940, 611–646, or *Bell Telephone System Monograph*, B-1255, 1940, 36 pp.

[2] R. L. Ives, "Codan elimination of intersignal noise," *QST*, Vol. 36, No. 10, Oct. 1952, 36 et seq.

[3] U. S. Bureau of Standards, *"Handbook Preferred Circuits"* NAVAER 16-1-519, 1955, 64-3, N-12-2, N-12-3.

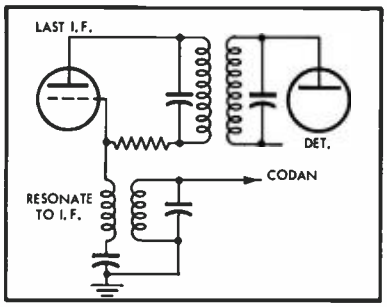



Fig. 3 Alternate "stealer" circuit.

"snap action". In consequence, there will be no audio signal output until the receiver is tuned very close to resonance.

After rectification and filtering, the signal, now d. c., is applied to the grid of a triode (the other half of the 6U8A), which is biased positive with respect to its cathode when no signal is fed into the codan.

Power supply is conventional except that the "ground" is not negative, but the arm of a potentiometer in the bleeder, electrically very close to B plus.

When signal at the pentode plate is too small to actuate the glow tube, triode bias is positive, and the triode draws appreciable plate current. In consequence, the plate, and hence the squelch terminal, will be strongly negative (about 150 volts) with respect to ground. This, when applied to the grid of any audio tube, very effectively silences the receiver.

In contrast, when signal at the pentode plate is adequate to operate the glow lamp, rectified current is applied to the grid of the triode, cutting it off, and reducing the plate current to a very low value (not zero). Voltage between ground and the squelch terminal is adjusted to exactly zero by use of the bias potentiometer (*Fig.* 1). When zero external voltage is applied to the grid of an audio tube, any signal applied to the grid will be amplified, and the receiver will not be silenced.

### How to Connect

Connections of the codan to any ordinary receiver are shown in *Fig.* 2. Note here the alternative i. f. connections. Slight "touching up" of the i. f. transformers may be desirable after the codan is connected.

An interesting alternate "stealer" circuit, which has no effect on receiver alignment, is shown in *Fig.* 3. This, which makes use of the signal frequencies always present in the screen circuit, has definite experimental possibilities, but is likely to introduce stability problems into a pre-existing receiver.

Construction of a codan of this type is simple and straightforward. Standard components of almost any brand may be used, and adjustment is a matter of a few minutes at most. In the prototype here shown, a standard 5 × 8 × 2 in. aluminum chassis was large enough to permit generous spacing between components. Front panel view comprises *Fig.* 4. Parts may be arranged differently, to suit operating convenience or personal taste, without impairing operation.

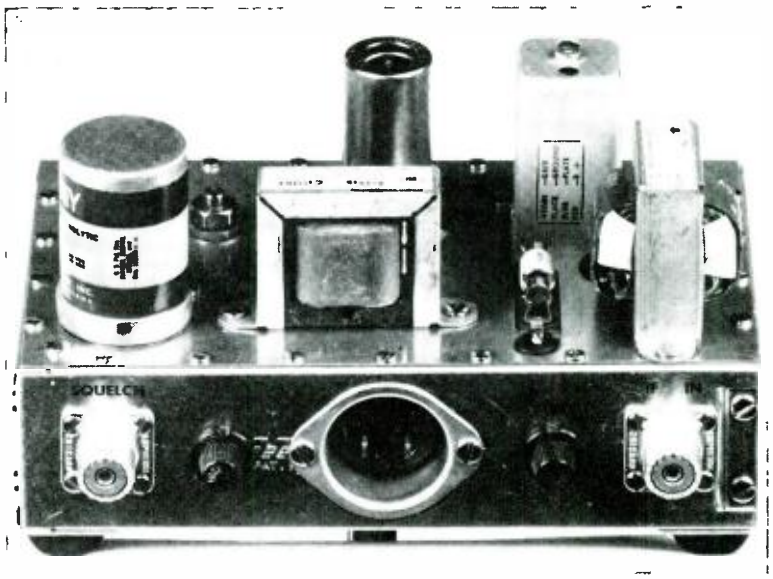



Fig. 5 Rear view of outboard codan.

Power and signal connections, and fuses, are mounted on the rear chassis skirt, as in *Fig.* 5. Co-axial connectors are used for both i. f. and squelch outputs for convenience, and because coaxial connectors and cables seem to furnish better shielding than "mike cable" and microphone connectors. Besides that, they were on hand.

### Construction Details

The power transformer shown in these figures is a Stancor PS 8415, whereas that specified in *Fig.* 1 is a PA 8412. The reason for this discrepancy is that the smaller transformer, used in the prototypes, is overloaded about 30 per cent. Even though it runs cool in this application, a larger transformer is recommended.

The two-section filter capacitor, a Mallory FP 214.5, is mounted in a Cinch socket, to facilitate replacement. Although this capacitor, rated at 150

(*Continued on page 72*)

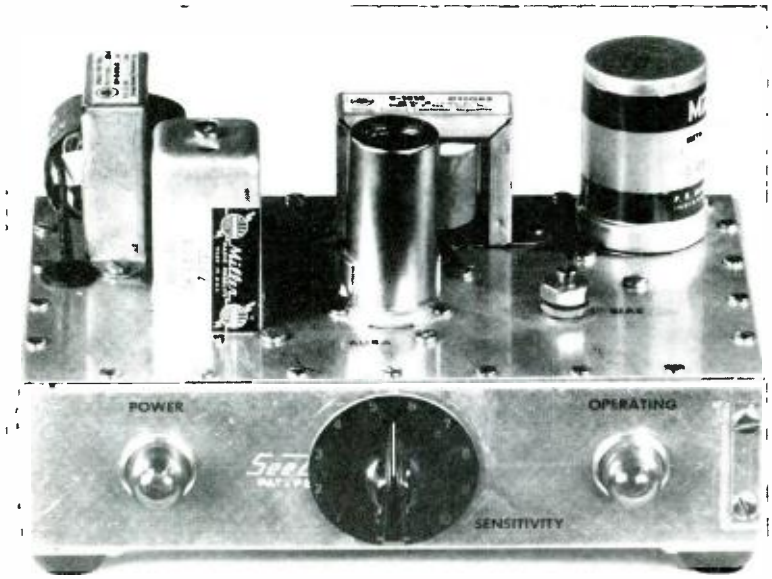



Fig. 4 Front panel view of outboard codan.

# The Amplifier Distortion Story

NORMAN H. CROWHURST*

**Many are the elements causing distortion in amplifiers, ranging from basic circuit design to deficiencies in the individual components. The author points out where some of the pitfalls occur, and shows how to use the transfer characteristic of tubes to study their performance.**

**In two parts—Part 2.**

THE next form of distortion we consider is one that is essentially a feedback-amplifier effect. The instability due to peaking that can occur at the high-frequency end is only one result of using too much feedback for the circuit constants involved. The other one revealed by a linear circuit analysis occurs at the low-frequency end, due to a low frequency, probably subsonic, peak. This has been loosely defined by some as low-frequency transient distortion. While it is quite true the effect is a transient one, it might be rather puzzling just what constitutes a low-frequency transient. Where would a frequency much lower than 20 cps come from?

Usually the phonograph pickup or radio input doesn't have appreciable output at any frequency below 20 cps, so the presence of a peak down here should not cause trouble. That is not quite true. Although the low frequency is not present *as a separate entity,* the program material contains even-order harmonics and other forms of waveform that produce considerable asymmetry. As has been mathematically shown, such an asymmetrical waveform is equivalent to a combination of symmetrical sine waves, plus a change in bias, a momentary d.c. variation in operating condition. This is what really constitutes the low-frequency transient.

* *216–18 40th Ave., Bayside 61, N. Y.*

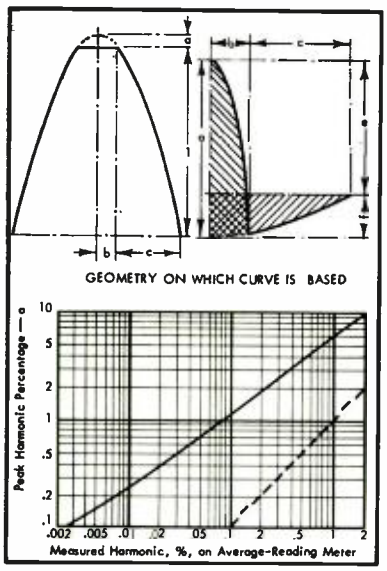



Fig. 10. Analysis of true peak-to-peak relationship for readings obtained with a normal average-reading meter used with a harmonic-distortion meter, on clipping.

It is something that normally is not audible and it should not produce any audible effects. But its presence in a feedback amplifier means that any program material with asymmetrical waveform can initiate a high-amplitude low-frequency fluctuation. This will not be audible itself but, being high amplitude, will introduce the changes in high-frequency response already referred to due to the changes in circuit parameters, plate resistance of tubes, and so on, on different points on this high-amplitude waveform. This will produce phase or frequency modulation as well as amplitude modulation of program components toward the top end of the range.

Feedback will attempt to minimize such fluctuations in the handling of individual signals. But still spurious by-products will occur that will become audible and deteriorate the quality of the program when such asymmetrical signals are present.

### Exaggerated Overload

Now we return to the overload characteristic question. Here we will consider three cases. First, a well-designed feedback amplifier which overloads by running into clipping and ceases to overload as soon as the waveform ceases to go far enough to cause the overload.

Suppose the input exceeds the clipping level by 10 per cent, which is a little less than 1 db. This would produce a deviation from true waveform by 10 per cent of the signal, sounding like a knocking or limitation of excursion at this point. The peak amplitude of the clip or knock component would be 20 db below the fundamental signal amplitude, This is quite audible.

Referred as peak deviation to peak signal it is a 10 per cent distortion. But

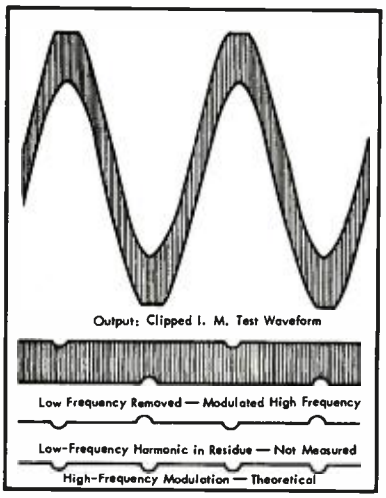



Fig. 11. Graphical analysis of clipping as shown with an IM test waveform. Indications on this kind of instrument are discussed in the text.

measured on a harmonic meter that averages the waveform over a complete cycle it will only measure about 2 per cent. A lower level of clipping, for example, a 6 per cent ratio on a peak-to-peak basis, will give an indication of only 1 per cent on a harmonic average-reading meter. This relation is plotted in detail in *Fig.* 10.

An IM analysis of clippings is shown at *Fig.* 11. If the filters associated with the meter to produce the residual components are all perfect in handling the range of frequencies they are supposed to, then the relationship between the indication and its effective value will be precisely the same as with the harmonic method. But the probability is that the deviations in amplitude of the modulated high frequency are for such short duration that the instrument indicates them at even less than their true value because of the integrating action of the rectifier and filter used for separating out the modulation from the high-frequency component itself.

It has often been observed, looking at the transfer characteristic on the 'scope and measuring the output for both harmonic and IM distortion, that quite a

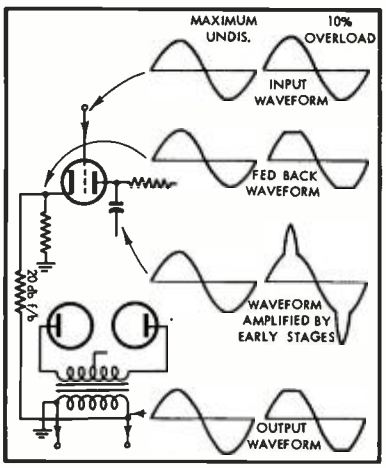



**Fig. 12. What happens in the "front end" of any feedback amplifier when clipping occurs. This may or may not cause distortion that is drastically noticeable, depending on various design factors.**

visible order of clipping can occur—and certainly an audible order—before the increase in harmonic or IM appears to show an overload condition at all on the meters.

This may be important if you want to listen to a sine wave, in which case the knocking effect referred to becomes quite audible. However, usually the limitation imposed by this kind of performance is one of transient short duration only. For example, the pluck tone of a guitar, which may be 20 db higher than the sustained tone, may get lopped off by this momentary clipping. But tests show that, subjectively, such losses are virtually inaudible. Maybe progressive listening education may render them more audible than they are at present. But certainly they are far less audible than one would think from listening to a great many amplifiers of today.

This is because there is a secondary aspect to the overload characteristics of many feedback amplifiers, our second case. Again assume that the amplifier has 20 db of feedback and that the input level is 10 per cent higher than the clipping point. At this point the feedback ceases to follow the input waveform. Consequently, the internal input to the amplifier suddenly shoots up by 100 per cent instead of 10 per cent. (*Fig.* 12).

If the input goes 20 per cent over the clipping point then the increase in input waveform will be 200 per cent and so on. It is evident that a high transient peak will produce a vastly exaggerated peak in the front end of the amplifier—in fact all the way through until something happens in the nature of clipping. Usually the clipping occurs at the grids of the output tubes. However, the drive stage will probably not have 20 db in reserve before it too goes into clipping. This means that a very small overload will very often cause clipping at several stages in a feedback amplifier.

These are usually resistance/capacitance coupled and consequently, blocking is likely to occur. Whenever a grid goes positive, particularly when it is driven a long way positive due to the sudden sensation of feedback, the bias on that stage is knocked back a long way beyond its normal value, perhaps four or five times. Then the time constant of the coupling network has to allow the bias to return to its normal condition before the amplifier can go on working.

This means that these very short duration excessive amplitude peaks in program material can cause blocking for an appreciable fraction of a second, perhaps more than a second, after they occur. This is then followed by a strangled return of the signal, due to the fact that the tubes do not suddenly return to their correct operating condition. The over-all effect is that the amplifier breaks up badly on these sudden peaks.

Several independent experimenters, constructing amplifiers that avoid this effect, have reported that considerable clipping can be allowed before the effect becomes appreciably audible. To achieve this requires careful attention to the design of the amplifier so that sudden removal of the feedback that occurs when the clipping point is reached does not overdrive some portion of the amplifier to produce a blocked condition. Or if such overdrive does occur it happens at a direct-coupled point where immediate return to operating condition follows removal of the excessive peak.

Some amplifiers add insult to injury by having almost a trigger condition as soon as maximum output is reached, which is our third case. This will be found when testing the amplifier. A point is reached on its overload characteristic beyond which it goes into quite drastic or violent distortion, after which the only way to obtain maximum output again is to bring the input down a long way below the maximum point and then bring it up very carefully, taking care not to exceed the desired maximum. Obviously any transient peak that exceeds this point on program waveform will produce the trigger effect that careless handling of the oscillator will cause in making the measurements.

The trigger effect can occur due to variety of combinations in circuit parameters, but one of them is illustrated at *Fig.* 13.

When the input exceeds clipping level by less than 1 db, such as to produce 10 per cent beyond the maximum permissible input, the output stage clips. This removes the feedback at this point and produces a sharply peaked waveform at the intermediate stages. In turn this drives the output stage into considerable grid current so as to over-bias it. The resultant over-bias produces crossover distortion and at the same time increases the high-voltage supply, which was previously drooping due to the approach of maximum output, and thus increases the gain of the earlier stages. The reason for this is that the output power actually drops when this input level is exceeded due to the pieces taken out of the waveform by the crossover effect. The over-all effect is that the waveform gets chopped by clipping and crossover distortion and stays that way until the input is reduced to a level considerably below the maximum permissible input.

### So What?

So much for the various items of distortion, some of which are analyzed in greater detail in the appendix. Now what can be done about them?

Two steps need to be considered: (1) how can an amplifier be designed to avoid these effects? And (2) what test facilities are necessary to measure an amplifier, so as to give a more effective indication of the audibility of the distortion it produces?

Oddly enough the first part seems to be the easier of the two. It is relatively easy, once you are acquainted with the possibilities, to explore an amplifier design and find out whether it happens;

(*Continued on page 70*)

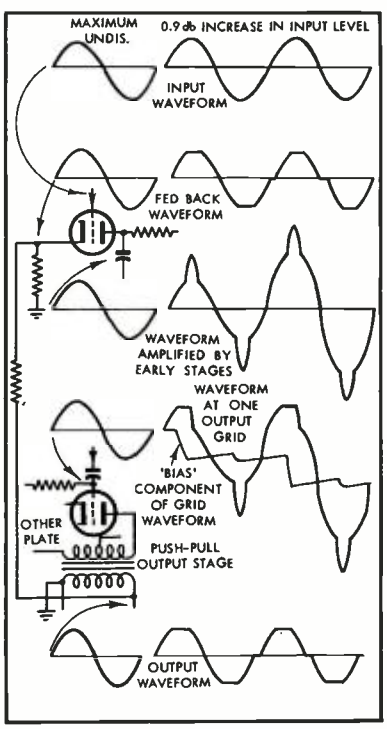



**Fig. 13. One form of "trigger" distortion that occurs on some amplifiers as soon as the input for maximum rated output is exceeded by the smallest amount.**

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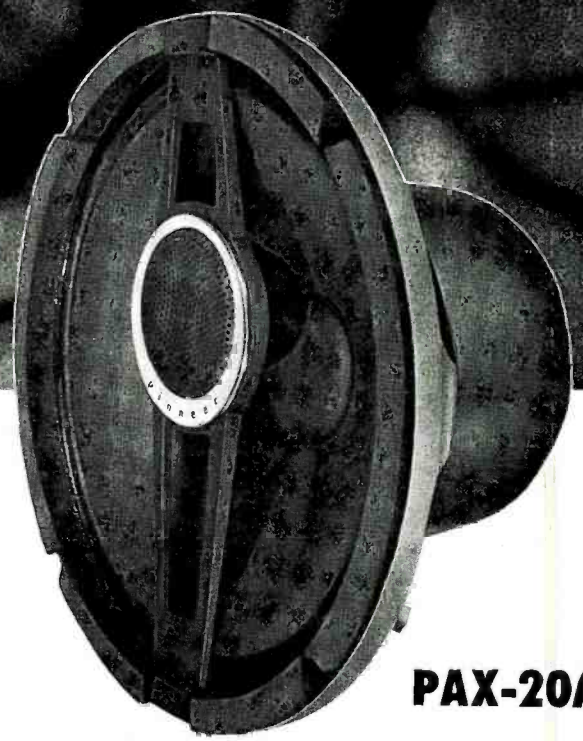

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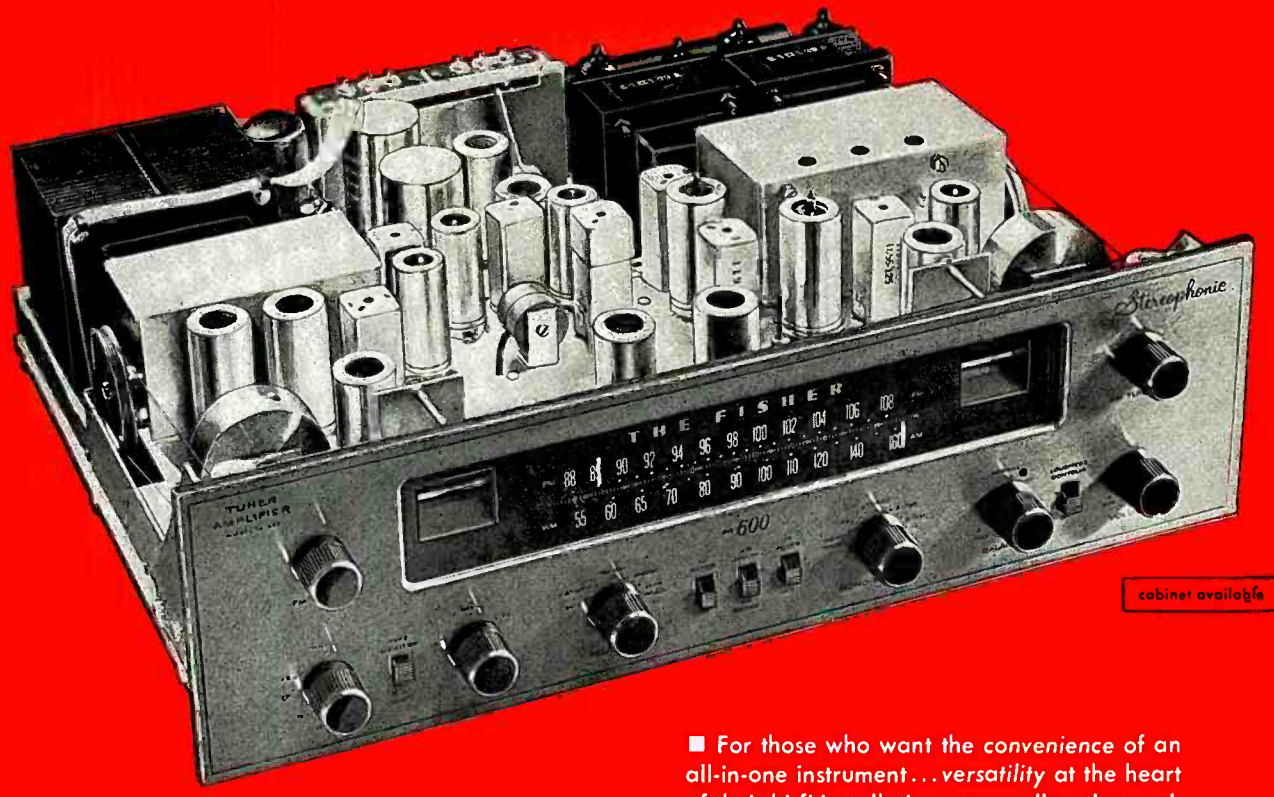


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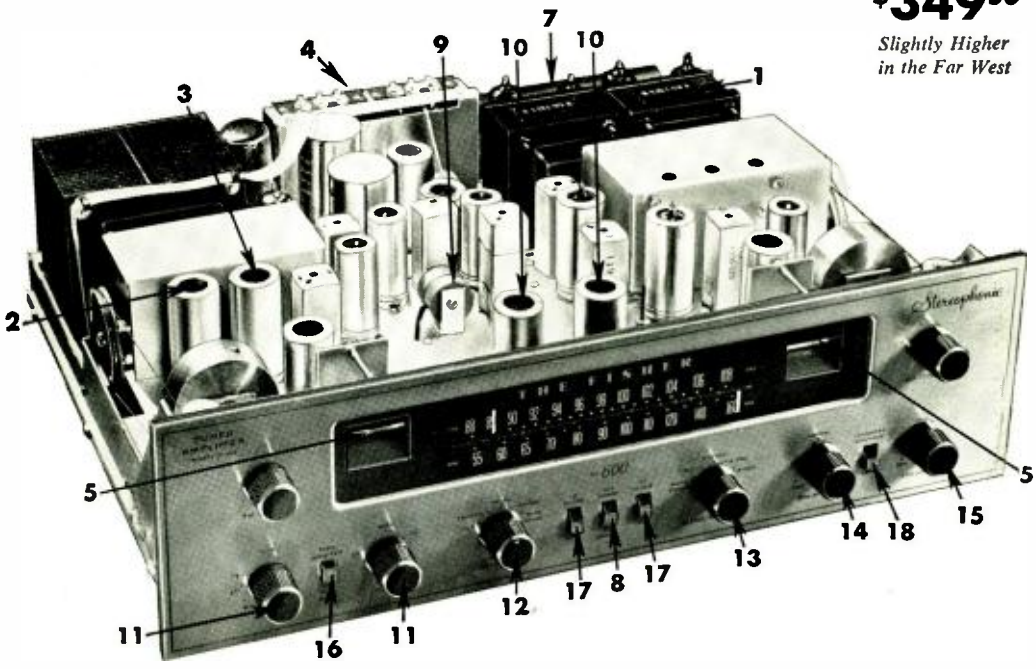


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# The Tape Guide

# What Kind of Tape Machine for Your Audio System?

HERMAN BURSTEIN*

**The first step in buying a tape recorder is to determine what your requirements are—some users want only to play recorded tapes, others to record their favorite music off-the-air, and still others want to engage in the most complicated of tape maneuvers.**

IF YOU PURCHASE an FM tuner, it is quite well understood what you are getting from a functional point of view. Essentially you are acquiring a device that will convert a radio signal into an audio voltage. It remains for *other* audio components to amplify this voltage, adjust its tonal balance if necessary, and finally convert it into sound. Similarly, if you acquire a control amplifier (often called a preamplifier) or a power amplier or a speaker, its functions are quite well defined; you do not expect a power amplifier, for example, to do what a control amplifier does (selection of signal source, control of gain, adjustment of bass and treble, filtering of highs and lows, preamplification and equalization of low-level signals, and so on), or vice versa.

But the province of a tape machine is not nearly so well defined. (For the time being we shall use the term tape machine in lieu of tape recorder because the device does not necessarily have to record.) The scope of a tape machine can range from merely transporting the tape to providing a complete self-contained audio system for the recording and reproduction of sound on tape.

There are five types of purchase that one can make in order to bring tape reproduction into the home:

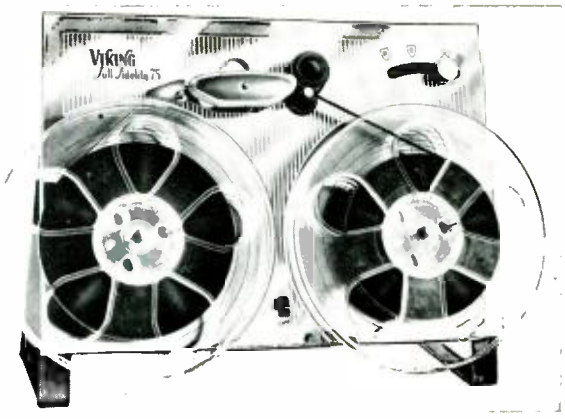
1. Transport only
2. Transport and separate playback electronics
3. Transport and separate record-playback electronics
4. Tape recorder proper—transport and integrated record-playback electronics.
5. Self-contained tape recorder—including power amplifier and speaker

The purchase suited to a given individual depends partly upon his wants,

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


Fig. 1. (left) A typical transport mechanism—the Pentron TM Series.

Fig. 2. (below) Another type of tape mechanism—Viking FF75.



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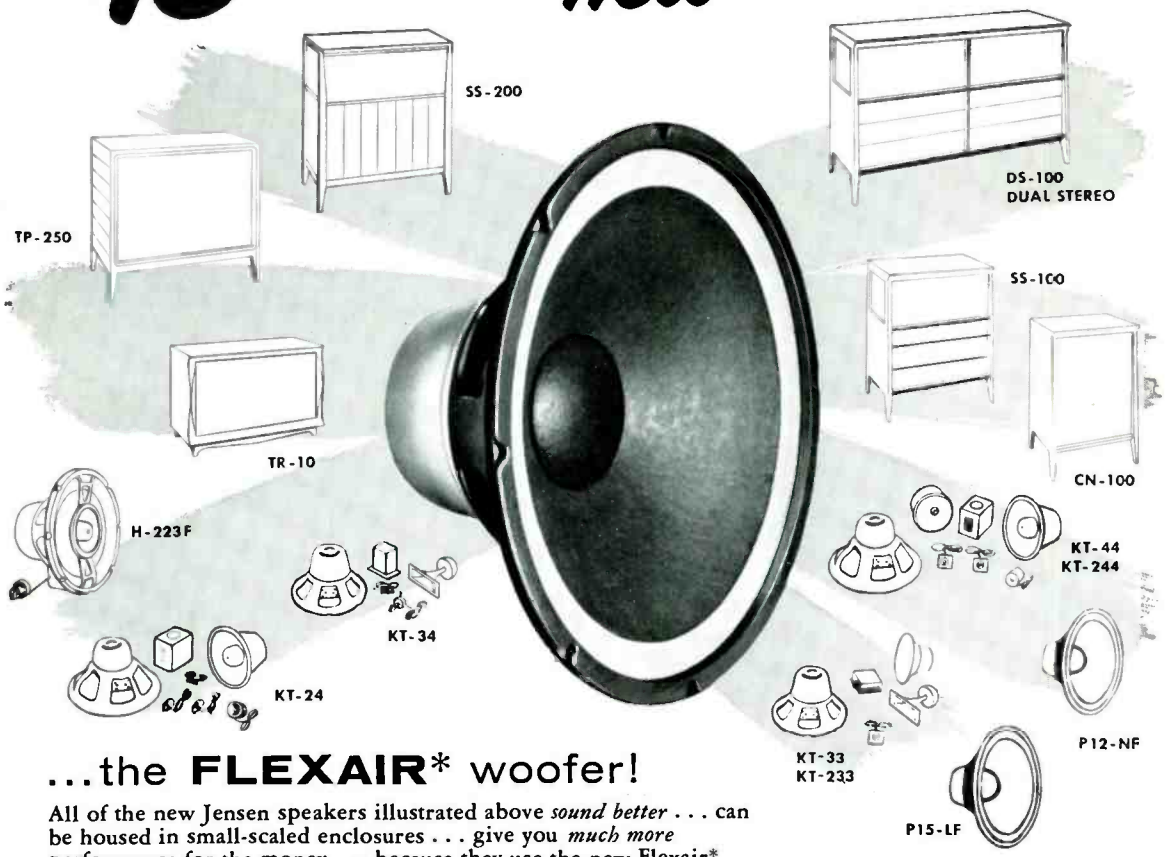


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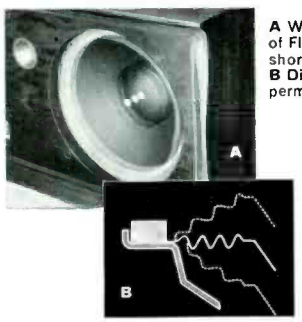
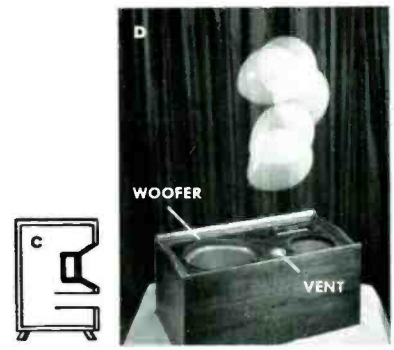
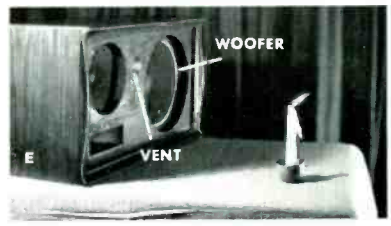



**A** White dot shows forward, central and inward positions of Flexair woofer cone during 1" movement. (Perspective shortens apparent distance between dots for inward travel). **B** Diagram shows extreme accordion action of annulus permitting linear extra-long cone travel.




**C** shows the scientifically proportioned tube vent used in the Bass-Superflex enclosure for extended bass and very low distortion with the Flexair woofer. Except for vent, enclosure is air-tight. Vent action during large motions of woofer cone is dramatically illustrated in the two unretouched photos at the right. Jensen TR-10 TRi-ette* (with grille cloth removed) was used in the experiments. In **D**, air filled balloon is kept in suspension by air flow from vent. Successive high speed exposures show rise of balloon when signal is turned on. In **E** a candle flame is deflected by air motion from tube vent with same low frequency signal.

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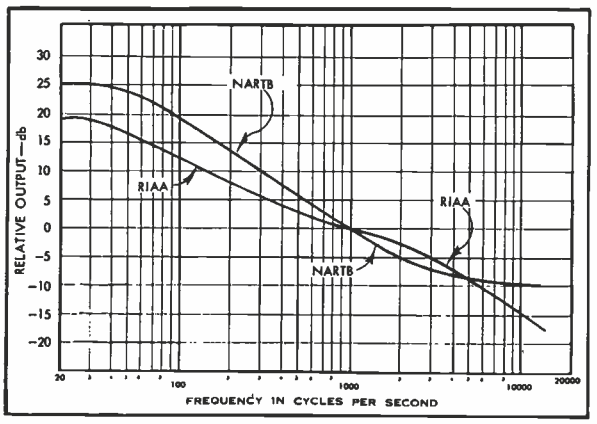


Fig. 3. NARTB tape playback equalization compared with RIAA phono equalization.

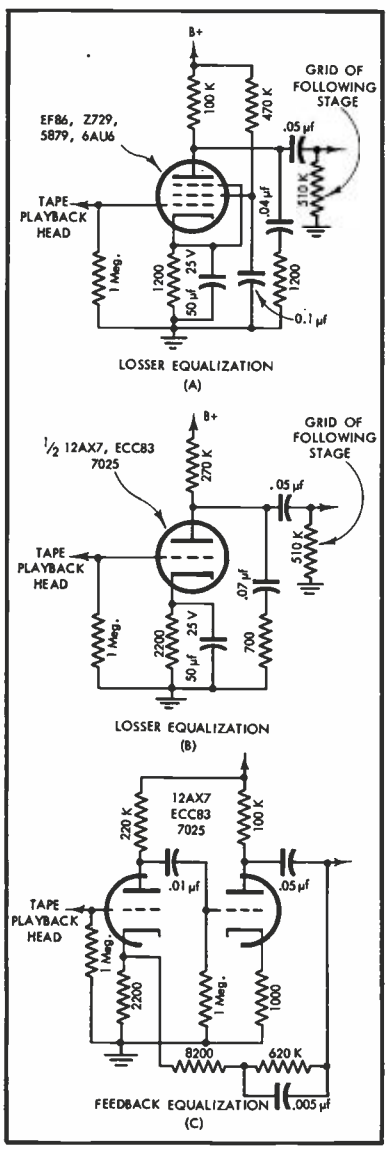


Fig. 4. NARTB playback equalization circuits.

partly upon his standards of audio reproduction, and partly upon the audio equipment he already owns. Through an understanding of each of these types of acquisition in terms of functions performed, quality of performance, limitations, and economy, the audiofan can decide which acquisition is best for him.

### Transport Only

As many people know, it is feasible to purchase simply the transport (*Figs.* 1 and 2), the mechanical device that moves the tape from a supply reel, past the tape heads, and onto a takeup reel. Transports capable of good performance can be had for substantially less than $100, although it is also possible to pay several hundred dollars for units of semi-professional and professional quality. Ordinarily, the transport comes with one or more heads, and in some cases the unit may provide space and facilities for adding more heads. To illustrate, if the owner wishes only to play recorded tapes, he can purchase a transport containing a playback head. However, if he plans on recording, he will need to add at least an erase head; if he desires the best possible results, he may wish to add a separate recording head instead of using one head for both recording and playback. The transport may contain room for as many as five heads; considering the diversity of types of heads—full-track monophonic, half-track monophonic, two-track stereo, and four-track stereo—and taking into account special practices such as sound on sound recording, some audiofans might want as many as five heads.

The transport plays a role in the audio system analogous to the phonograph. It is a mechanical device (like the turntable) incorporating a transducer (like the phono cartridge) that delivers a small signal requiring amplification to bring it up to a usable level and equalization to achieve flat frequency response.

To be able to limit one's purchase to a tape transport without electronics, it is necessary that the control amplifier in one's audio system contain preamplification facilities (including equalization) specifically designed to accommodate the signal directly from a tape playback head. This corresponds to the requirements imposed by a magnetic phono cartridge, where the control amplifier must provide RIAA compensation (equalization for earlier recording characteristics, such as LP and AES, are also usually supplied). In the case of the tape head, and assuming operation at 7.5 ips, NARTB equalization is required instead; it is also becoming the practice to use NARTB equalization at 3.75 ips, although this is not yet as common as at 7.5 ips. *Figure* 3 shows the RIAA and NARTB curves.

Most control amplifiers made today contain equalization for the signal obtained directly from a tape playback head. That is, they have an input jack marked "tape head." However, they do not all provide NARTB equalization. The writer has measured the tape equalization curves of a number of control amplifiers, and while some follow the NARTB curve within a decibel or two,

(*Continued on page 66*)

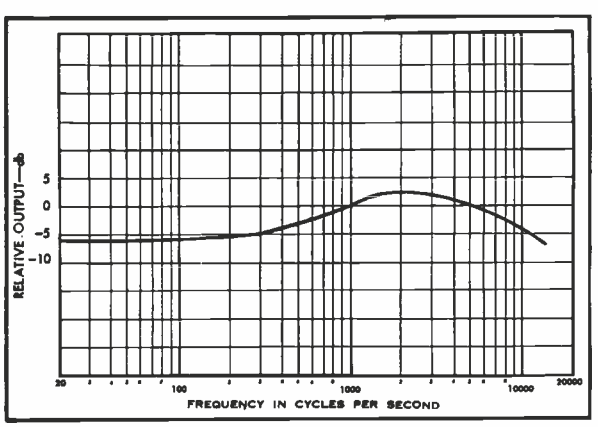


Fig. 5. Frequency response resulting from the use of RIAA compensation for a tape requiring NARTB equalization.

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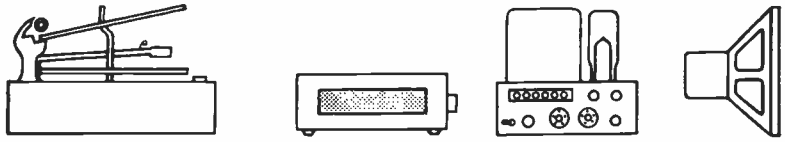


## LAFAYETTE KT-600 STEREO CONTROL AMPLIFIER

The Lafayette KT-600, shown in *Fig.* 1, is a stereo control amplifier in kit form. This is a skillfully engineered unit incorporating almost every mono and stereo function of value that has yet appeared. Because it seeks to provide the stereofan with all he may desire, it is necessarily an elaborate affair. It contains 12 inputs, 5 outputs, 12 switches, 7 front panel continuous controls, 9 rear panel continuous controls, 7 tubes, 97 fixed resistors, 63 capacitors, and various other parts—calling for 457 assembly steps. There are about 35 to 40 hours of work ahead of the constructor, and in the opinion of this reviewer the result justifies the labor. It is an excellent control amplifier (not a power amplifier), obviously designed to a standard of performance rather than a price, and such reservations as this reviewer may have are only two and relatively minor. Priced at $79.50 as a kit, it would probably sell in the region of $175 to $200 in finished form.

### Features, Functions, Modes of Operation

The KT-600 provides the following features and functions hitherto found in monophonic equipment.

1. Input jacks, on each channel, for six sources: tuner, tape amplifier, auxiliary (high-level), magnetic phono, constant-amplitude phono (ceramic, crystal, or capacitive pickup), and tape head.

2. Input level-sets for each high-level source, and one input level-set following the preamplifier, which accommodates the three low-level sources.

3. Tape recorder output.

4. Separate turnover and rolloff switches for phono and tape-head equalization. The turnover positions are LP, RIAA, AES, and TAPE HEAD (approximately NARTB). The rolloff positions are LP, RIAA, AES, 10.5 (db down at 10,000 cps), 5 (db down), and flat. Altogether, 24 equalization combinations are possible. The rolloff switch has a seventh position, which connects the tape-head jack instead of the phono jacks to the preamplifier.

5. Bass and treble controls. Separate controls, rather than ganged ones, are provided for each channel.

6. Rumble filter (ganged for the two channels).

7. Scratch filter (ganged).

8. Presence control (ganged).

9. Play-monitor switch. This enables one to compare the incoming signal with the signal being recorded on a tape and simultaneously played back, assuming one is using a tape machine with separate record and playback heads.

10. Loudness switch, that converts the gain control to a loudness control. Only bass boost is provided.

The stereo features, functions, and modes of operation are as follows.

1. Input Stereo Function Switch:

a. Mono A (Signal A to both channels).

b. Mono B (Signal B to both channels).

c. Stereo (Signal A to Channel A; Signal B to Channel B).

d. A + B (both signals to both channels, with separation between signals variable from 0 db to 12 db by means of a bridging control; with maximum separation, 25 per cent of Signal A is fed to Channel B, and 25 per cent of Signal B to Channel A).

e. Calibrate (both signals to both channels, with no separation). This has two purposes. (i) Channel balancing (discussed below) requires a mono source so that the full audio information can be fed to both channels. If a mono source is unavailable, the A + B signal simulates one. (ii) The bridging control (discussed above in d) is ganged with the gain control for a center-channel output, on the theory that center fill will be obtained either by partial mixing of the A and B signals or by use of a center channel, but not both at once. When playing mono records with a stereo pickup, it is desirable that both channels be fully combined in order to minimize vertical rumble. However, if the center channel gain control is below maximum position, which is likely to be the case, then the A and B signals will not be fully combined, because the bridging control will perforce also be below maximum setting. However, the calibrate position of the input stereo function switch permits complete mixing of the A + B signals.

2. Output Stereo Function Switch:

a. Reverse Channel, Reverse Phase (Signal A to Channel B output; Signal –B to Channel A output).

b. Reverse Channel (Signal A to Channel B output; Signal B to Channel A output).

c. Normal (Signal A to Channel A output; Signal B to Channel B output).

d. Reverse Phase (Signal A to Channel A output; Signal –B to Channel B output).

e. Calibrate (signal A – B to both channels). If identical signals, as from a mono disc, are fed to each channel, and if the input level sets and/or volume controls of each channel in the KT-600 are adjusted for equal gain, a null in the sound should occur. Hence the calibrate position is very useful for balancing purposes. (This assumes that the power amplifier-speaker combination of one channel has been balanced against the other, so that equal signals to each power amplifier will result in equal acoustic output from each speaker. Such balancing can easily be accomplished with the aid of the KT-600 by feeding a signal to one channel and alternating it between the A and B output jacks by means of the output stereo function switch (positions described above in b and c).

3. Center Channel Output. This mixes Signals A and B in the same proportion as they occur at the A and B output jacks. As previously indicated, gain of the center channel is variable independently of the A and B channels.

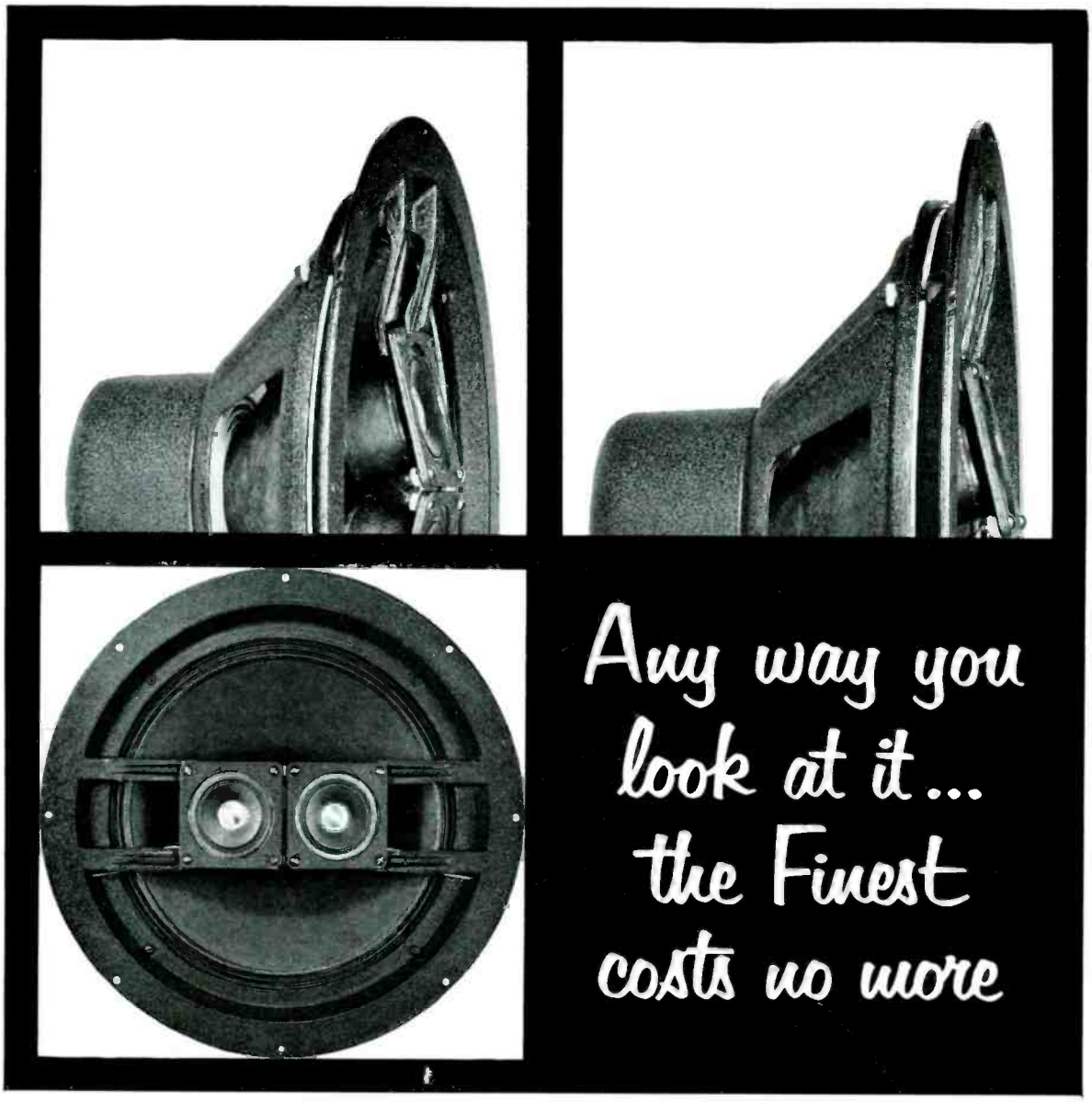
4. Master Gain-Balance Controls. Individual gain controls are provided for each channel, concentrically mounted and with a push-pull clutch device so the knobs can be operated independently or simultaneously. With the inner knob (Channel B) pulled out, the controls can be rotated individually for channel balance. With this knob pushed in, they operate together as a master gain control.

A feature considered desirable in a stereo amplifier is an "AB" switching facility that enables one to balance stereo program material by alternately listening to the A and B signals. Although this feature is not *specifically* incorporated in either of the KT-600's two stereo function switches, nevertheless it exists by virtue of the fact that the selector switches are not ganged but operate independently for each channel. To illustrate, if one is listening to an FM and AM pair of tuners bringing in a stereo program, one selector switch can be set to the tuner position while the other is set to another position; then the procedure can be reversed. The selector switches are concentrically mounted, which permits them to be turned together to facilitate the AB balancing process.

Fig. 1. Panel view of Lafayette KT-600 Stereo Control Amplifier.

### Design

*Figure* 2 is a block diagram of the KT-600, which contains many points of interest from a design viewpoint. Tubes $V_1 - V_2$ constitute Channel A, and $V_4 - V_5$ Channel B. $V_{7A}$ is a phase inverter that changes Signal B to –B. $V_{7B}$ provides a center

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(phantom) channel consisting of A + B. Since Channel A is an exact duplicate of Channel B, except for $V_{7A}$, comments in the following discussion about $V_1 - V_5$ apply as well to $V_4 - V_8$.

Negative feedback, mainly of the plate-to-grid variety (over one stage at a time) is used throughout the KT-600 in order to: minimize distortion; shape frequency response (phono and tape-head equalization, presence control, scratch filter, tone controls); maintain high-frequency response; adjust gain to circuit requirements; and enable the tubes to present a high input impedance and a low output impedance to other circuit elements, thereby minimizing loading effects upon each other, which in turn reduces distortion, maintains treble response, and permits accurate shaping of frequency response (equalization, tone controls, and so on).

The output stage, $V_{3B}$ (and similarly $V_{6B}$ for Channel B and $V_{7B}$ for the center channel), is not the familiar cathode follower but the rather unfamiliar plate follower. The cathode follower achieves a low output impedance, permitting a long cable run to the next piece of equipment, by *current* feedback via a large cathode resistor. The plate follower achieves a low output impedance by *voltage* feedback via a resistor from plate to grid. The designer of the KT-600 gave the reviewer his reasons for preferring the plate follower: It permits some gain, according to the value of the feedback resistor, whereas the cathode follower operates at a slight loss; that is, the plate follower enables the designer to trade the advantages of feedback for gain in whatever proportions he desires. Distortion is less when operating a tube on its voltage characteristic (plate follower) than on its current characteristic (cathode follower). On listening tests, the plate follower sounds better to the designer, having a more transparent quality.

Every tube in the KT-600 is a 7025/12AX7, so that the owner need keep only one replacement tube on hand. From the design standpoint, the 12AX7-type was preferred as more linear than the 12AU7, which is often used in some amplifier stages in order to limit gain; gain of the 12AX7 is about 30 db for each triode, and of the 12AU7 about 20 db each. To limit gain where necessary (the six stages in each channel have potential gain totalling about 180 db), negative feedback was employed by the designer.

It may be seen in *Fig.* 2 that the gain control is at a very late stage, just prior to the output tube. This raises the possibility of excessive signal input and consequent overloading, which is averted in some control amplifiers by placing the gain control at a very early stage. The problem is solved in the KT-600 by providing input level-sets for each high-level source and another level-set following the preamplifier $V_1$. These level sets serve a second very important purpose in permitting one to balance the two sections of a stereo signal source, such as the two sections of a stereo cartridge or stereo tape head. By having the gain control at a late stage, the noise of preceding stages is reduced as gain is reduced.

It will be noted that the constant-amplitude phono input is connected to the magnetic phono input by a small capacitor. In conjunction with the load impedance, this capacitor acts as a high-pass filter, causing the signal to rise with frequency in the same manner as the signal from a constant-velocity (magnetic) pickup. Thus the signal from a constant-amplitude pickup (ceramic, crystal, capacitance) can be handled by the preamplifier in the same way as a signal from a magnetic pickup, permitting a variety of equalization characteristics. One can use either a constant-amplitude pickup or a magnetic pickup,

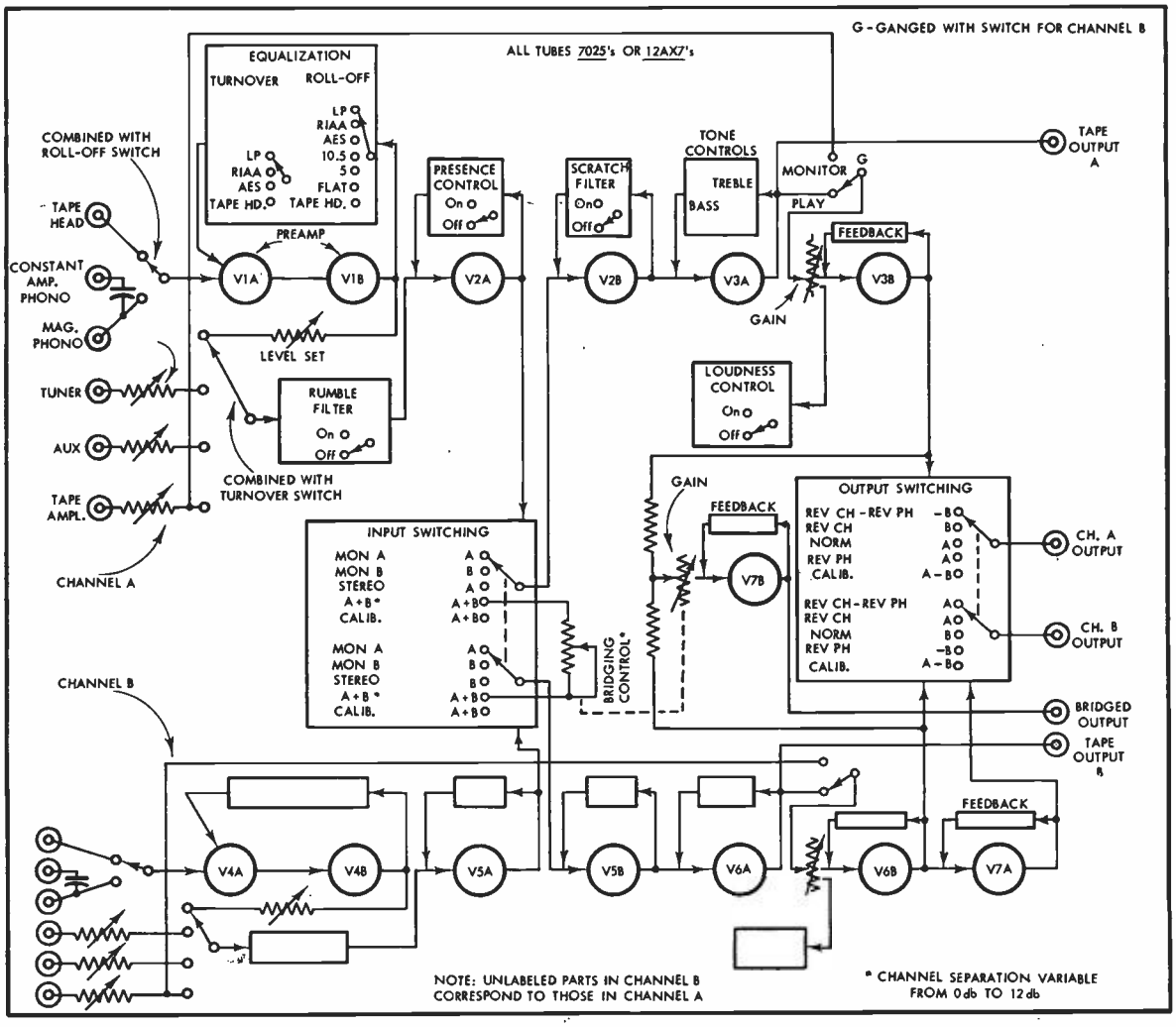


Fig. 2. Block diagram of the Lafayette KT-600 Stereo Control Amplifier.

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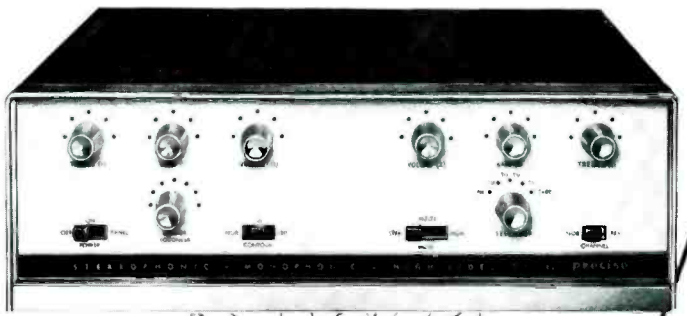

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but not both. It is not advisable to connect a constant-amplitude pickup to one of the KT-600's high-level input jacks, because the input impedance is only 250k ohms, whereas about 1 to 3 megohms is usually required.

From the selector switch, which is combined with the turnover switch, the signal goes to a two-stage rumble filter of the losser type—the only instance in the KT-600 where frequency-shaping is not achieved by negative feedback. Below 30 cps, where rumble is apt to be most pronounced, there is an attenuation of 16 db at 30 cps and 21.5 db at 20 cps. On the other hand, the filter does take a fair bite out of the lower audio frequencies. Attenuation measured 4.5 db at 100 cps and 10 db at 50 cps.

The block diagram shows that each of the remaining frequency-shaping circuits takes place at a different tube stage, so that these circuits are isolated from each other and one control does not affect another. High-level sources feeding into the KT-600 are isolated from each other by placing the input stereo function switch after $V_{1A}$. The output stereo function switch comes after the plate followers ($V_{2B}$, $V_{6B}$, $V_{7B}$).

A bridged-T network is employed in the feedback loop of $V_{1A}$ to achieve a presence rise. It should be clear that with the presence control switched off, there continues to be negative feedback, except that now it is the same at all frequencies. This is also true of the scratch filter in $V_{1B}$. The presence control is designed to provide about 5 db maximum boost at 2500 cps, with a 2 db rise at 1000 cps, 5 db at 2000 cps, 5.5 db at 2500 cps, and 0 db at 5500 cps. Response was down 1.5 db at 10,000 cps and 2.5 db at 15,000 cps with the presence switch on. With the scratch filter on, attenuation measured 0.25 db at 1000 cps, 5 db at 5000 cps, 13.5 db at 10,000 cps, and 18.5 db at 15,000 cps.

The bass and treble controls employ a configuration based on the Baxendall circuit. They are designed to assure the user of flat response when set to the 12 o'clock position. One can turn each control about 15 deg. to either side of mid-setting without affecting frequency response at the extremes of the audio range more than 1 db. Maximum bass hoost and bass cut is somewhat less—about 4 or 5 db—than usually encountered; the reviewer measured maximum boost and cut of 13 db at 50 cps. The treble control covers more nearly the usual range; at 15,000 cps, 16 db of boost and 20 db of cut were available.

The signal from $V_{3A}$ is fed to the gain control through a PLAY-MONITOR switch when the latter is in the PLAY position. With the switch in MONITOR position, the gain control is connected to the tape amplifier input jack, permitting one to compare the tape playback signal (from a machine having separate record and playback heads) with the signal that is being recorded.

The play-monitor arrangement of the KT-600 is unusual because it permits the output of a tape amplifier to be connected either directly to the gain control or to the selector switch; in the latter case, the signal goes through all the stages and is subject to the tone controls, etc. However, this arrangement does raise the possibility of a feedback loop when using certain tape machines—those which have one head for both record and playback, which employ the same tape amplifier stages for both modes of operation, and which do not disconnect the tape machine's output jack from these stages when the machine is in the record mode. With the output of such a tape recorder connected to the tape amplifier input jack of the KT-600, if the machine were in the record mode, and if the KT-600's selector switch were accidentally set to the tape amplifier position, there would be a feedback loop from the input jack of the KT-600 through stages $V_{1A}$ and $V_{3A}$, to the tape output jack, to the input of the tape recorder, to the output of the tape recorder, to the tape amplifier input jack of the KT-600, and so on. The result can be a growl, howl, or squeal. This is one of the reviewer's minor reservations about the KT-600. The solution might be to redesign the selector switch to disconnect the tape output jack from the circuit when the switch is in the tape amplifier position.

A more important question involving the tape output jack of the KT-600 is its location in the circuit. One of the dogmas of high fidelity has been that the tape output jack should appear *prior* to all frequency-shaping controls (bass, treble, filters) so that the tape recording will have the same frequency balance as the original signal. However, as may be seen in *Fig.* 2, the tape output jack of the KT-600 comes *after* the frequency-shaping circuits. It may well be that the dogma rather than the KT-600 bears criticism. For the optimum combination of high signal-to-noise ratio and low distortion, a tape should be recorded with proper frequency balance. If highs and/or lows are excessive, inordinate distortion may result. If highs and/or lows are deficient, one is wasting signal-to-noise ratio by not recording these in sufficient strength. In short, correct frequency balance should be achieved before putting the signal on tape rather than in playback. The KT-600 permits one to do so. On the other hand, if one desires electrically flat recording (same frequency balance as the incoming signal), it is merely necessary to set the bass and treble controls to flat position and turn off the rumble, presence, and scratch filters.

The loudness switch enables one to obtain a relatively moderate amount of bass boost at low settings of the gain control. At 50 cps, the reviewer measured 2 db boost with gain 10 db below maximum; 5 db at 20 db below maximum; 10.5 db at 30 and 40 db below maximum; 9.5 db at 50 db below maximum. These are rather small amounts compared with loudness compensation reaching as much as 25 or 30 db at 50 cps in some control amplifiers. On the other hand, this minimizes the danger of excessive boost, as sometimes happens with the switched-type of gain-loudness control. The total of about 23 db bass boost at 50 cps that can be achieved by setting the bass control at maximum and turning on the loudness switch should be sufficient in the great majority of instances requiring Fletcher-Munson compensation. The availability of individual level sets for each high-level source and for the preamplifier section makes it possible to obtain automatic bass boost (with the loudness switch on) at the correct sound levels.

### Performance

In evaluating a stereo preamp, we are interested in its performance not only in the usual sense—with respect to frequency response, distortion, signal to noise ratio, and accuracy of equalization—but also in terms of how well matched are the two channels. On both counts the KT-600 is essentially flawless, except for the tracking error which occurs when the gain controls are not locked at the same point of rotation.

With gain full on and tone controls at 12 o'clock, frequency response over the 20 to 30,000 cps range was between 0 and 1 db on both channels. With gain 6 db below maximum, where high-frequency loss is usually the greatest, response at 30,000 cps was only 0.8 db down on one channel and flat on the other.

IM distortion measured .08 per cent at 4 volts equivalent sine wave output on one channel, and 0.1 per cent on the other. Below 4 volts, IM could not be measured on the reviewer's meter, which has a residual reading of about .06 per cent. At 10 volts, IM measured 0.3 per cent on one channel and 0.5 per cent on the other. Since 1 volt or less is apt to be enough to drive most power amplifiers, the KT-600 is highly unlikely to be a source of distortion in an audio system.

Based on 1 volt input, signal-to-noise ratio for high-level sources measured over 90 db. Even with the KT-600's gain control at maximum and using the most sensitive scale of the reviewer's VTVM, the pointer fell so far to the left as to prevent a precise reading of noise. Based on the customary 10 mv input for measurement purposes, signal to noise ratio on the magnetic phono input was 64 db at 1000 cps. More likely, 20 mv or more will be produced on peaks by most magnetic cartridges, so that in practice the signal to noise ratio is apt to be 70 db or better. To measure signal-to-noise ratio for a constant-amplitude pickup, a 1000-cps signal of 0.5 volt was used, yielding a figure of 66 db. Based on 5 mv at 1000 cps into the tape-head input, signal-to-noise ratio measured 55 db, which compares with the top quality tape amplifiers. The excellent noise characteristics of the KT-600, practically identical on each channel, are attributable to the use of low-noise resistors in the preamplifier stages, to the use of a premium grade of audio tube, to a d.c. heater supply, to a hum-balancing pot in addition (for cancelling 120-cps ripple), and to the design and layout in general.

Sensitivity is high. For 1 volt output at 1000 cps, the KT-600 requires an input signal, as measured by the reviewer, of 93 mv on high-level inputs, 2.2 mv on magnetic phono input, 56 mv on constant-amplitude phono input, and 1.8 mv on tape head input. Requirements were just about the same on each channel, which differed a mere 0.2 db in sensitivity, including the preamplifier stages.

$V_{7A}$, which converts Signal B to –B for phase reversal and null balancing, should have zero gain. Actually, the reviewer found that the B and –B signals differed by about 0.5 db, which may be considered negligible in view of the fact that even the trained human ear cannot detect differences below 1 db on single tones, or below 2 db on program material.

Magnetic phono equalization was checked only for the RIAA characteristic and found very accurate. On one channel the error was between 0.5 db and –0.3 db over the 50–15,000 cps range; on the other, between 1 and –0.3 db.

Equalization for a constant amplitude phono cartridge requires a certain amount of bass cut and treble boost. Most ceramic and crystal cartridges have built-in treble boost, achieved through resonance, which approximates the RIAA requirement. Hence the equalization for a ceramic or crystal pickup should provide only bass cut and approximately flat treble response. The KT-600 conforms to this principle. For frequencies of equal magnitude fed into the constant amplitude phono input, bass cut measured within 1 db of the RIAA requirement, while response between 1000 and 15,000 cps was flat within 3 db.

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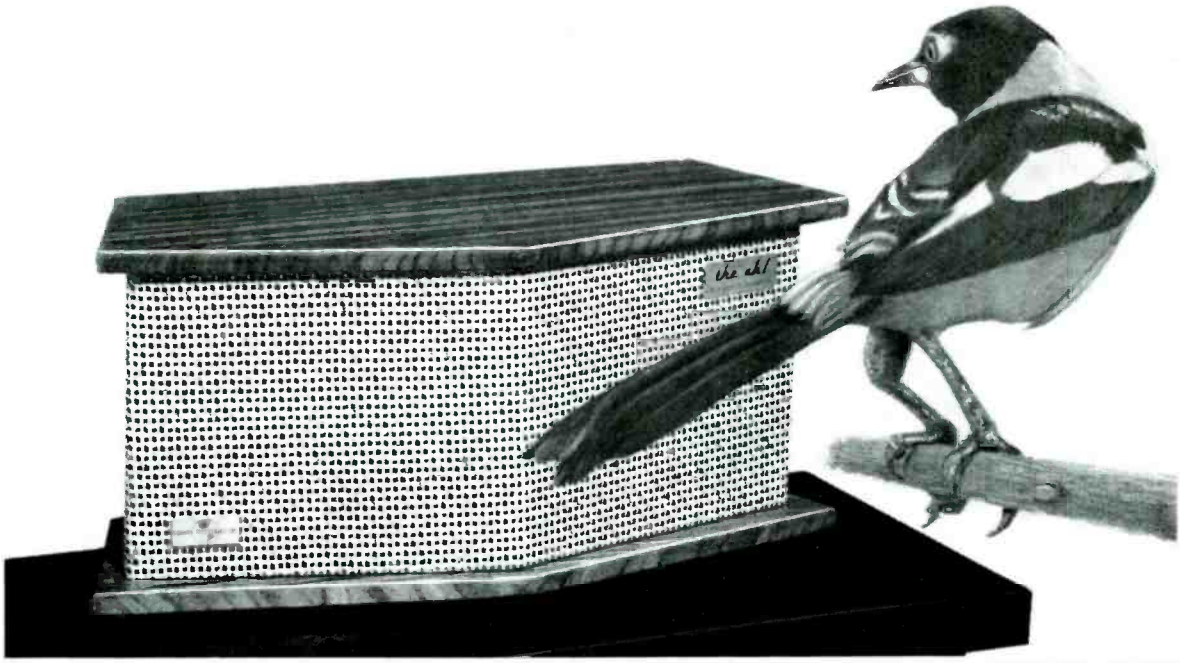


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❸ The 'ah!' electrostatic transducer is superior in quality and performance to speakers selling for almost twice as much, but, because of expert research facilities and newly developed materials it is offered at an unprecedented low price . . . **only $49.95.**

*Nothing else to buy – R/C crossover network and AC power supply are built in. 8 or 16 ohm L pad may be added to attenuate tweeter, if desired.*

*An American-made speaker – patent applied for by COSMOS INDUSTRIES.

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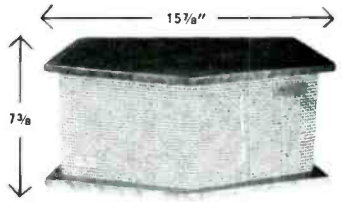


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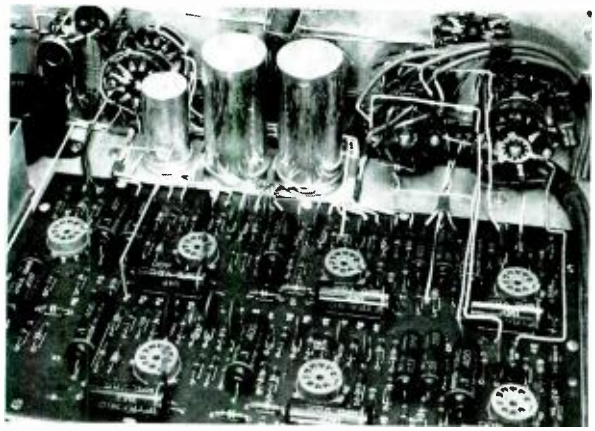

Fig. 3. Above-chassis view of the Lafayette KT-600.

The KT-600 claims to provide "correct NARTB tape playback equalization." Assuming an "ideal" playback head, namely one without treble losses, the NARTB curve, using 1000 cps as a 0 db reference, is +23 db at 50 cps, −7 db at 3180 cps, and −10 db at 15,000 cps. Based on these check points, the tape head equalization of the KT-600 measured about −3 db at 50 cps, +4 db at 3180 cps, and +7 db at 15,000 cps on each channel. At first there may seem to be excessive error in the treble region. However, the designer of the KT-600 has sought to allow for the treble losses of the typical tape head; NARTB equalization specifies that playback losses shall be compensated in playback. A typical head with a gap of .00025" (intended for speeds of 7.5 ips and higher) and eddy current losses may increase these figures by a db or two. Accordingly, what theoretically has about 2.5 db loss at 10,000 cps and 5 db loss at 15,000 cps. Hysteresis is in effect 7 db treble boost at 15,000 cps tends to be in keeping with *total* NARTB playback requirements, not merely the official playback curve. The designer has stated to the reviewer that the curve of the KT-600 was based upon test tapes containing NARTB recorded induction and upon the playback heads of several tape machines in popular use. For the audiofan desiring exact NARTB equalization, he recommends setting the treble control to 10 o'clock. The reviewer found that such a setting brought the response characteristic to within 1 db of the NARTB curve. In addition, the 3-db loss at the bass end can be overcome by setting the bass control to about 1:30 o'clock.

The effects of the rumble filter, presence control, scratch filter, and loudness switch upon frequency response have already been noted. It remains to say that in every instance the two channels were matched within .5 db of each other.

Crosstalk of the KT-600 is rated at "better than 55 db separation between channels." This apparently is a matter of what frequency one is talking about. At 50 cps, the reviewer measured 56 db separation; at 1000 cps, 49 db; at 15,000 cps, 28 db. Inasmuch as anything in excess of 20 db is considered sufficient for full preservation of the stereo effect, crosstalk should be no problem.

### Construction

Components and hardware are of the quality one expects in a high-grade instrument. The tubes, as previously remarked, are all 7025's, an improved version of the 12AX7. For low noise, both triodes of the preamplifier (in each channel) employ deposited metal film resistors in the plate and cathode circuits; these resistors are about ten times as costly as the ordinary molded carbon ones and about three times as expensive as the deposited carbon kind frequently employed in home audio equipment for noise reduction. For accurate equalization and control of gain, 5 per cent tolerance resistors are generously used. A large percentage of the capacitors are mica with a tolerance of 5 per cent or ceramic with a tolerance of 5 per cent or 10 per cent. The only component that gave the reviewer trouble was a noisy cathode resistor—a deposited metal film one at that—in one of the preamplifier stages. This is a rare occurrence for the deposited metal film type. It is interesting to note that signal-to-noise ratio was reduced about 20 db by the offending part. A temporary 1-watt resistor of the conventional type—while awaiting a replacement low-noise resistor from Lafayette—recaptured about 14 db of the 20-db loss.

Locating lugs on all switches and controls eliminates the problem of correct orientation of these parts, particularly in the case of tone controls, where it is desirable that 12 o'clock setting shall correspond to flat response. The chassis and related hardware are sturdy and fit properly. The top cover and front panel come together snugly, without the gaps that sometimes betray home-assembled equipment. The front panel is essentially attractive, although one observer remarked that the knobs could be more eye-appealing.

Although a lengthy project, the KT-600 is not a difficult one. Assembly instructions and pictorials are clear, and the reviewer found no errors in them. *Figures* 3 and 4 are above- and below-chassis views of the completed unit. Such errors as previously existed were corrected by addenda supplied with the construction manual. When the reviewer completed the assembly, the unit operated as it is supposed to do, with the exception of the noisy resistor. The only error he found in the manual was the statement on page 71 that the inner knobs on the front panel control Channel A. Actually, the outer knobs do so.

Because of the large number of assembly steps, the statistical probability of error is naturally greater than in a simple kit. Therefore the constructor is advised to proceed at a cautious pace and to recheck his work after every ten steps or so. If the amplifier fails to work properly, Lafayette, like other reputable kit manufacturers, stands ready to put the unit to rights at a standard service charge, provided that the constructor has followed instructions with respect to wiring and type of solder. Lead dress, as shown in the pictorials and photographs, should be followed religiously; a good many engineering hours have been devoted to this aspect of the kit in order to minimize hum, crosstalk, and the possibility of oscillation due to feedback (after all, there are 180 db of potential gain in Channel A and 210 db in Channel B, counting the phase inverter).

There is no excuse for using the wrong kind of solder, because Lafayette supplies an ample quantity of the best kind, 60-40, with the kit.

Good soldering technique is very important to successful assembly and operation of the KT-600. The neophyte should read the manual's instructions carefully in this respect and practice for a while before going to work on the kit. Excessive solder flow should be avoided on printed circuit board connections lest solder bridges form between adjacent printed leads, which often run very close together. A low-wattage iron with a small tip is advisable; also, it avoids possible damage to the board through excessive heat. The reviewer did his soldering with a pencil iron, using a 23½ watt tip most of the time. When soldering connections to ground or when soldering a group of leads to one lug—situations that quickly drain the heat from the iron—he switched to a 37½ watt tip, which provided ample heat in all circumstances. When soldering on the printed circuit board has been completed, it should be cleaned with a brush and one of the fluids recommended by Lafayette in order to avoid signal leakage due to rosin flow.

(*Continued on page 59*)

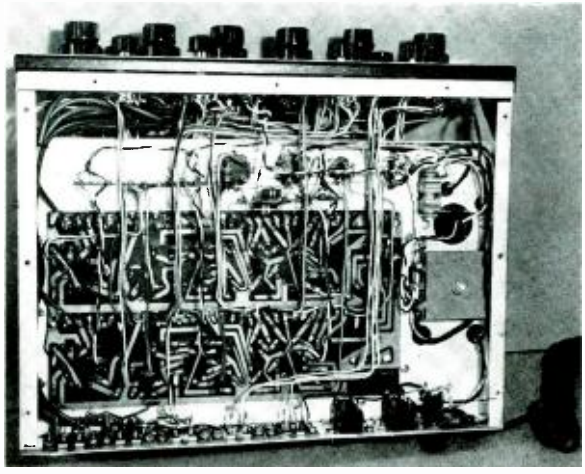

Fig. 4. Below-chassis view of the KT-600 Stereo Control Amplifier.

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# Standard Methods of Measurements for Tuners

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

**IN TWO PARTS—PART 1**

### 1.00 Introduction

Present-day high fidelity tuners vary considerably in their manner of operation. It is difficult to set down a single test procedure for each fundamental characteristic and have the procedure include all the allowances that should be made for peculiarities of different sets.

Reference is made to the following IRE Standards.

Standard on Radio Receivers, Methods of Testing Frequency Modulation Broadcast Receivers, 1947, and Supplements.

Standards on Radio Receivers, Methods of Testing Amplitude Modulation Broadcast Receivers, 1948, and Supplements.

Standards 56 IRE 27S1 and 51 IRE 17S1.

### 2.00 Definitions of Terms, FM

*2.01 Standard Test Frequencies*

The standard group of three carrier frequencies for testing is 90, 98, and 106 megacycles. The standard mean carrier frequency, for use when measurements are to be made at a single frequency only, is 98 megacycles.

*2.02 Test Input Signals*

Input signal intensities are expressed in terms of input voltage measured in microvolts across a dummy load of 300 ohms when supplied by a generator of internal impedance of 300 ohms. See *Figs.* 1, 2 and 3.

*2.03 Standard Test Modulation*

Standard Test Modulation in tests on frequency modulation tuners refers to a signal that is frequency modulated at 400 cps with a deviation of 100% of maximum system deviation. In this standard, maximum rated system deviation is taken as 75 kilocycles.

*2.04 Usable Sensitivity Test Input*

The usable sensitivity test input is the least 100%-modulated signal input which, when applied to the receiver through the standard 300-ohm dummy antenna and the audio voltmeter connected through a 400-cps null filter, reduces the total internal receiver noise and distortion to the point where the output rises 30 decibels when the 400-cps null filter is removed from the audio voltmeter circuit. It is expressed in microvolts. The results are to be given in X microvolts for 30 db usable sensitivity.

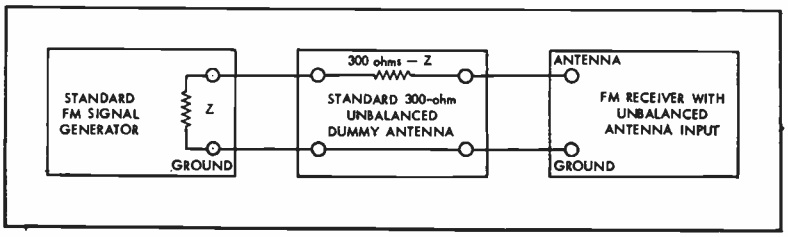



Fig. 1. Standard 300-ohm balanced dummy antenna and method of connection.

*2.05 Standard Test Output, Reference Level*

The standard test output is 1 volt with the tuner operating into a load of 500,000 ohms shunted by 500 μμf (see also section 8.01). This is a reference voltage only.

*2.06 Standard 300-ohm Dummy Antenna*

For tuners with a balanced input, the standard 300-ohm antenna comprises a pair of resistors, one connected in series with each terminal of the signal generator, of such value that the total impedance between the terminals including the signal generator is 300 ohms. For tuners with an unbalanced input, the standard 300-ohm antenna comprises a single resistor connected in series with the energized terminal of the signal generator of such value that the total impedance between the antenna terminal and ground including the signal generator is 300 ohms. It is intended to simulate the mean value of the impedance of a typical transmission line connected to an antenna. See *Figs.* 1 and 2. For those tests requiring the use of two signal generators see *Figs.* 4 and 5.

*2.07 Standard De-Emphasis Characteristic*

The standard de-emphasis characteristic has a falling response with modulation frequency the inverse of the standard pre-emphasis characteristic equivalent to that provided by a simple circuit having a time constant of 75 microseconds. The standard de-emphasis characteristic is usually incorporated in the audio circuits of the tuner.

*2.08 Frequency Deviation*

Frequency deviation is the difference between the instantaneous frequency of the modulated wave and the carrier frequency.

*2.09 Maximum System Deviation*

Maximum system deviation is the greatest deviation specified in the operation of the system. It is expressed in kilocycles. In the case of frequency-modulation broadcast systems in the range from 88 to 108 megacycles the maximum system deviation is 75 kilocycles.

### 3.00 Definition of Terms, AM

*3.01 Standard Test Frequencies*

The standard group of three carrier frequencies for testing is 600, 1000, and 1400 kilocycles. The standard mean carrier frequency for use when measurements are to be made at a single frequency only is 1000 kilocycles.

*3.02 Test Input Signals*

Antenna input voltages are to be measured in microvolts. Loop antenna input field intensities are to be measured in microvolts per meter.

*3.03 Standard Test Modulation*

Unless otherwise specified, standard test modulation is an amplitude modulation at 30% at a rate of 400 cps and applied to the receiver through a standard dummy antenna or through a standard loop generating a field of known intensity at the location of the loop antenna of the receiver.

*3.04 Usable Sensitivity Test Input*

The usable sensitivity test input is the least 30%-modulated signal input which, when applied to the receiver through the standard dummy antenna and the audio voltmeter connected through a 400-cps null filter, reduces the internal receiver noise and distortion to the point where the output rises 20 db when the 400-cps null filter is removed from the audio voltmeter circuit. The results are to be given in X microvolts for 20 db usable sensitivity.

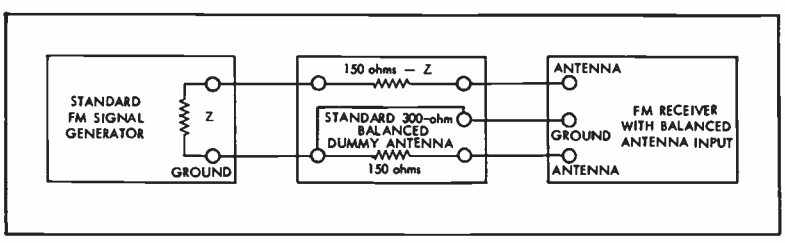



Fig. 2. Standard 300-ohm unbalanced dummy antenna and method of connection.

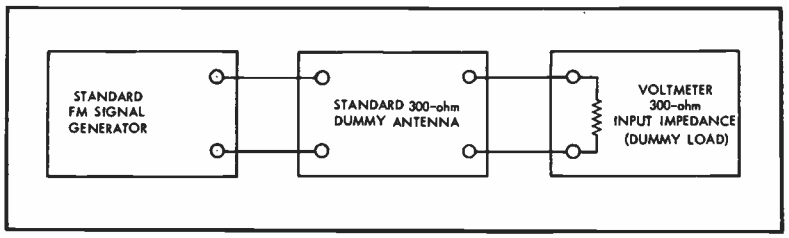



Fig. 3. Method of measurement of input signal intensities and method of connection.

*3.05 Standard Test Output*

See 2.05 above.

*3.06 Standard Dummy Antenna*

A standard antenna is taken as an open single wire antenna (including the lead wire) having an effective height of 4 meters. A dummy antenna which closely approximates such an actual antenna over the frequency range of 540 to 1600 kilocycles is a capacitor of 200 μμf.

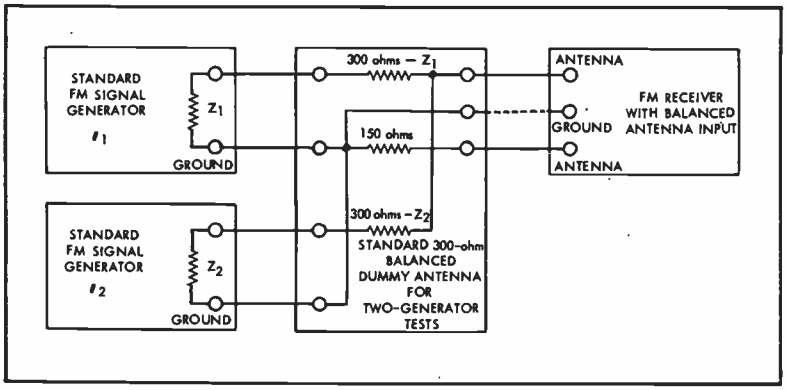



Fig. 4. Standard 300-ohm balanced dummy antenna for two-generator tests. Generator open-circuit voltage must be increased 2× over connection of Fig. 1 for same input signal intensities.

## 4.00 Operating Conditions

*4.01 Power Connections*

The normal test voltage is 117 volts root mean square, 60 cps, with less than 2% harmonic distortion. One side of the power input to the tuner is to be grounded.

*4.02 Shields and Covers*

Shields and covers are to be in place and securely fastened.

*4.03 Electron Tubes and Semi-Conductors*

The electron tubes and semi-conductors shall have standard rated values for those characteristics which most affect the performance of the tuner.

## 5.00 Requirements and Characteristics of Testing Apparatus

*5.01 FM Signal Generator*

A frequency-modulated signal generator is required for testing of frequency-modulation tuners.

The signal generator shall cover at least the carrier-frequency range from 88 to 108 megacycles.

The generator output shall be controlled by a calibrated attenuator and the output shall be adjustable over a range of at least 1 microvolt to 100,000 microvolts. The output meter and the attenuator of the signal generator shall indicate the open-circuit voltage at the terminals. The generator shall be capable of being frequency modulated at rates from 30 to at least 15,000 cps and at deviations from zero to at least twice the rated system deviation. The generator shall provide a frequency-modulated signal at 400 cps with less than 2% distortion at rated system deviation. Generator frequency deviation shall be calibrated to an accuracy of 5%. Residual noise and hum shall be at least 60 db below rated system deviation.

*5.02 AM Signal Generator*

An amplitude-modulated signal generator is required for testing amplitude-modulation tuners.

The signal generator shall cover at least the carrier-frequency range from 540 to 1600 kc. The generator output shall be controlled by a calibrated attenuator and the output shall be adjustable over a range of at least 1 microvolt to 100,000 microvolts. The output meter and the attenuator of the signal generator shall indicate the open-circuit voltage at the terminals and the internal impedance shall be negligible compared to the standard AM dummy antenna. The generator shall be capable of being amplitude modulated at rates from 30 to at least 15,000 cps. The generator shall provide an amplitude-modulated signal at 400 cps and be capable of being modulated in amplitude up to the required modulation percentage for the individual test with less than 2% distortion. Residual noise and hum shall be at least 40 db below 30% modulation.

*5.03 Output Meter*

A vacuum-tube voltmeter is required for testing of high fidelity tuners.

The vacuum-tube voltmeter shall cover a frequency range of at least 20 to 20,000 cps with less than 1 db error. It shall possess average rectifying characteristics. The output meter shall be capable of measuring over a dynamic range of at least 60 db.

*5.04 Audio Generator*

An audio generator is required for modulating the signal generators.

The audio generator shall be capable of modulating the signal generator to at least full system deviation or up to the required amplitude-modulation percentage for the individual test. The distortion of this generator shall be less than 1%.

*5.05 Distortion Meter*

A distortion meter is required for testing of high fidelity tuners.

The distortion meter shall be capable of measuring distortion over a frequency range from 30 to 15,000 cps. It shall be capable of measuring either total distortion or the amplitude of each frequency component.

## 6.00 Test Procedures, FM

*6.01 Normal Control Settings*

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

*6.02 Tuning Control*

A tuner for frequency-modulated waves is tuned accurately to a desired signal when the tuning indicator shows correct tuning. The tuning is to be performed at

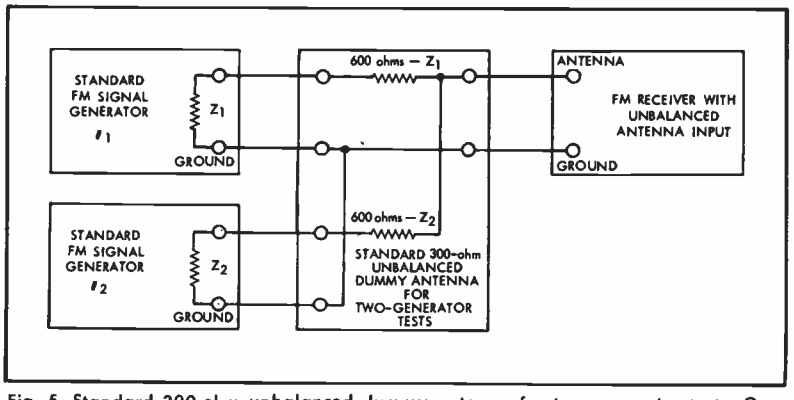



Fig. 5. Standard 300-ohm unbalanced dummy antenna for two-generator tests. Generator open-circuit voltage must be increased 2x oevr connection of Fig. 2 for same input signal intensities.

a signal level corresponding to the test input for 30 db usable sensitivity.

If a tuning position different from the one above is found giving minimum undesired noise, the frequency difference shall be stated. If no tuning indicator is incorporated in the tuner or if no usable indication is obtained, minimum undesired noise shall indicate proper tuning. A third possible tuning position may be found at which the harmonic distortion of the demodulated desired signal is a minimum. In this case, the frequency difference shall be stated.

*6.03 Performance Tests*

The performance of an FM tuner is determined by measurement of the several individual characteristics. The foregoing sections have specified the setup of measuring apparatus and the tuner under test; in addition, it is necessary to follow standardized test procedures in order that measurements made in different laboratories will be comparable. These test procedures serve to measure the individual characteristics of the receiver.

*6.03.01 Tuning Range and Frequency Calibration*

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

*6.03.02 Usable Sensitivity*

This test is performed at each of the standard test frequencies with the signal generator connected to the tuner under test through the standard 300-ohm dummy antenna. The signal generator shall be frequency modulated with standard test modulation. The controls of the tuner shall be set to the normal control settings. The signal intensity shall then be reduced to the least value which will produce a 30-db rise in indicated output with standard test modulation as compared with the indicated output with standard test modulation measured through a 400-cps null filter. This test serves to indicate the relative freedom of the tuner from objectionable internal receiver noise during pauses in modulation when receiver noise is least likely to be masked by modulation. This test also serves to indicate the relative freedom of the tuner from objectionable distortion during periods of maximum modulation.

The results are expressed in microvolts.

*6.03.03 Volume Sensitivity*

This test is performed at each of the standard test frequencies with the signal generator connected to the tuner under test through the standard 300-ohm dummy antenna. The signal generator shall be frequency modulated with standard test modulation. The signal generator shall be adjusted for an output of 100,000 microvolts. The output voltage of the tuner shall be recorded in decibels with respect to 1 volt. Then, the signal generator output shall be reduced to a value at which the audio output of the tuner has been reduced by 20 db.

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

The rated sensitivity of a tuner shall be equal to the highest number of microvolts obtained in all tests of sections 6.03.02 and 6.03.03 with the controls set to their normal settings.

*6.03.04 Capture Ratio Test*

This test is intended to show the effect of an interfering signal of the same frequency as the desired signal, and includes the inherent effect of the detector, the limiter, and the automatic volume control.

Two signal generators are required, only one of which need be capable of frequency modulation. The outputs of both are applied simultaneously to the receiver under test at the mean carrier frequency of 98 megacycles (see *Figs.* 4 and 5). The tuner controls are set to the normal control settings. With the desired signal frequency having 100% modulation at a 400 cps rate and an intensity equal to the test input giving 30 db usable sensitivity, the output control of the unmodulated signal generator is advanced until the audio output has fallen by 1 db. This value is to be recorded. Then the output control of the unmodulated signal generator is advanced further until the audio output of the tuner has fallen a total of 30 db. This value is again recorded.

The ratio of the two values recorded is to be converted to decibels, and the number of decibels is to be divided by 2. This last number is defined as the capture ratio for 100% modulation. It gives the ratio of desired to undesired signal required for 30-db suppression of the undesired signal.

The same test is repeated but with 30% modulation. The results will be the capture ratio for 30% modulation.

These tests shall be repeated at input levels of the desired signal in steps of 20 db above signal level of the previous tests.

The rated capture ratio shall be the highest number of decibels measured with the 100%-modulated signal generator set to produce a 1000-microvolt input into the tuner at each of the standard carrier frequencies.

*6.03.05 Selectivity Test*

This test is intended to show the effect of an interfering signal differing in frequency from the desired signal, and includes the inherent effect of the selective circuits, the limiter, the automatic volume control, and the detector. This test is useful in describing adjacent-channel and second-channel interference.

Test conditions are the same as those described in Section 6.03.04 except that the interfering signal generator is separated in frequency from the desired signal by one standard channel separation (200 kc). The desired signal, unmodulated, is applied at the value providing 30 db usable sensitivity and the output of the receiver is recorded as the level of the interfering signal, frequency modulated with 100% modulation, 400-cps rate, is varied from zero to a value corresponding to an output 30 db below the output obtained with 100% modulation.

The output voltages of both signal generators are recorded and the ratio of both voltages is expressed in decibels. The result is the 100%-modulation adjacent-channel selectivity.

The test is repeated with 30% modulation and the result is the 30%-modulation adjacent-channel selectivity.

The above tests are repeated with the interfering signal separated from the desired signal by twice standard channel separation (400 kc). The results are the 100%- and 30%-modulation alternate-channel selectivity.

These tests are repeated with the desired signal increased in steps of 20 db. The rated selectivity shall be the 100%-modulation alternate-channel selectivity with a desired input of 100 microvolts at the standard mean carrier frequency.

*6.03.06 Amplitude Modulation Suppression Test*

This test measures the suppression of amplitude modulation which may be present in a frequency-modulated signal. It is carried out at the standard mean carrier frequency. The frequency modulation is at a 400-cps rate with a deviation of 100% of maximum system deviation. A signal 10 db higher than the value giving 30 db usable sensitivity is applied to the tuner in the usual manner. The output voltage of the tuner is recorded and a 400-cps rejection filter is inserted between the output of the tuner and the meter. The input signal is then amplitude-modulated at 30% modulation with frequencies between 30 and 15,000 cps. The intensity of the undesired output of the tuner is measured and is expressed in decibels below the normal output obtained above.

The rated amplitude suppression is the ratio of the undesired output to the output with standard test modulation when the amplitude modulation is at 1000 cps.

The above tests are to be repeated at input voltages in steps of 20 db above the main and initial test.

It should be assured that no incidental frequency modulation be obtained when the signal generator is amplitude modulated. It may be desirable to use an amplitude modulator connected in the output lead of the signal generator.

*6.03.07 Frequency Response*

This test shows the manner in which the audio output of a tuner depends on the modulating frequency. It takes into account all the characteristics of the tuner. The tuner is tuned to a signal at standard mean carrier frequency and a signal level of 1000 microvolts, frequency modulated with standard test modulation. The tuner output is measured with all tuner controls set to the normal control settings. The output variation is observed while the modulation frequency is varied continuously from 30 to 15,000 cps. The results are to be compared to the response of the standard de-emphasis network and are to be expressed in db in reference to the 400-cps output.

It may be desirable to repeat these measurements with 30% system deviation and at input signals in steps of 20 db above the previously used input signal. If the results are plotted, semi-logarithmic paper shall be used and a 20-db change on the ordinate shall correspond in length to one decade of frequency variation on the abscissa.

If the frequency response changes with the volume control setting, this test should be repeated at selected attenuations differing in steps of 10 db from the position of maximum output.

*6.03.08 Distortion*

The test is intended to evaluate the spurious audio-frequency components which appear in the audio output of the tuner during normal operation. Care shall be taken to avoid appreciable harmonic distortion occurring in any part of the signal-generating equipment or in the output-measuring circuit. Distortion-measuring equipment is required in the output circuit which shall not appreciably affect the output load conditions. This equipment

may measure each frequency component individually or may measure all frequency components collectively. The proper tuning of the tuner is important in making distortion tests. For this test only, proper tuning is indicated by a minimum reading of the distortion meter. No one complete set of conditions can be prescribed for this test because distortion depends on so many details of tuner design and operating conditions. Distortion is caused by overloading and by many other phenomena and is present under various operating conditions, especially at high degrees of modulation. The following series of tests is intended to show the effect of operating parameters on distortion.

(*a*) *Variation of Output*
The receiver is tuned to the standard mean carrier frequency and a 1000-microvolt signal with standard test modulation is applied. The harmonic distortion is noted as the output of the receiver is varied by means of the volume control.

(*b*) *Variation of Modulation*
At the standard mean carrier frequency with the above signal input and a 400-cps modulating signal, the modulation is varied from a deviation of 10% to 100% of maximum rated system deviation and the distortion observed. The volume control is left in its maximum position.

(*c*) *Variation of Input Signal*
The distortion is recorded as the signal input level at the standard mean carrier frequency, deviated at 400 cps, is varied. The test is made at both 30% and 100% of maximum rated system deviation. The distortion shall be recorded as the signal input is varied over the entire range of input voltages in steps of 20 db starting with an input corresponding to 30 db usable sensitivity. This test indicates distortion due to inadequate bandwidth.

(*d*) *Variation of Modulation Frequency*
To disclose the effect of the modulation frequency on distortion, tests in Paragraphs (a) and (b) shall be repeated at several modulation frequencies throughout the audio-frequency range. The maximum modulation frequency at which harmonic distortion can be detected by this method is one-half the maximum frequency which can appear in the output.

In making distortion tests at the higher frequencies, special apparatus and special test methods (such as simultaneous application of two modulating tones) are required.

Harmonic distortion measurements are useful and significant up to modulation frequencies of approximately 1000 cps. At higher frequencies the de-emphasis characteristic of the tuner will attenuate the higher distortion products severely and will give rise to considerable errors in measurement.

Measurement of distortion at the higher modulation frequencies will show up deficiencies such as caused by inadequate bandwidth or phase shift of the selective circuits in the tuner, or an inadequate limiter or detector. Here the distortion product of most interest is the difference tone obtained when the carrier is modulated by two audio frequency signals differing by less than 500 cps.

Here the signal generator is modulated to identical deviations by the two different audio-frequency signals and the

arithmetic sum of both deviations is recorded as the signal deviation. This total deviation shall be 30% and 100%. The level of the difference tone between the two frequencies is measured in the audio output of the tuner and its value is recorded in decibels below 30% and 100% rated system deviation at 400 cps.

The rated harmonic distortion of the tuner shall be the percentage of distortion measured with the signal generator modulated to full system deviation at 400 cps, the receiver tuned to the standard mean carrier frequency, and the signal generator set to produce a 1000-microvolt input into the tuner.

The rated intermodulation distortion of the tuner shall be measured at the same input level and signal frequency as above and the total instantaneous maximum system deviation shall be 100% with the signal generator modulated with two signals of identical amplitude and frequencies of 15,000 and 14,600 cycles per second. The 400-cps output of the tuner shall be measured and shall be expressed in per cent of the output of the tuner obtained with 400 cps at rated system deviation.

*(To Be Continued)*

## STEREO PICKUP

*(from page 21)*

pickup shown, $X = 0.2$ inches. In this pickup, to achieve an effective dynamic mass of the magnet referred to the stylus tip of $0.5(10)^{-3}$ grams, we find the maximum electromagnetic sensitivity of the system occurs when the moving magnet is made of Alnico V and its dimensions are $.040 \times .040 \times .100$ in. long.

The total dynamic mass of the system is calculated to be

$$M_{total} = M_{stylus} + M_{effective\ of\ magnet}$$
$$= 0.2 + 0.5 = 0.7 \times 10^{-3}\ gms$$
$$= 0.7\ mg.$$

These dimensions allow from frequency characteristics surpassing those shown in *Fig.* 6. Thus the overwhelming strength of the moving magnet system, and the ability to use a moving element of very small dimension—thereby minimizing the effect of the $h$ factor on radius of gyration and weight and allowing for extremely low dynamic mass reflected to the stylus tip—will produce relatively high output with coils of moderate impedance.

### Superiority of Moving System

The moving-magnet stereo pickup system inherently allows for low-cost production and replaceable stylus assembly (long the problem of moving-coil systems). The system is rugged yet fully compliant, virtually indestructible, and with no service problems of delicate rubber bearings and fragile moving coils. The very small magnetic flux densities required are fully shielded and offer no magnetic attraction to steel turntables. Hum-bucking construction and magnetic

shielding prevent pickup of motor and transformer field radiation and there is no audible hum produced in the system. This coupled with high output creates a pickup of outstanding signal to noise ratio.

The moving-magnet stereo system has become the prime mover of stereo disc reproduction. With its arrival, stereo has arrived, and will not take a back seat to any other method of sound reproduction. We can now look forward to future growth, expanded repertoire, and greater appreciation of musical and sound experiences. Æ

## SPEAKER PHASING

(*from page 10*)

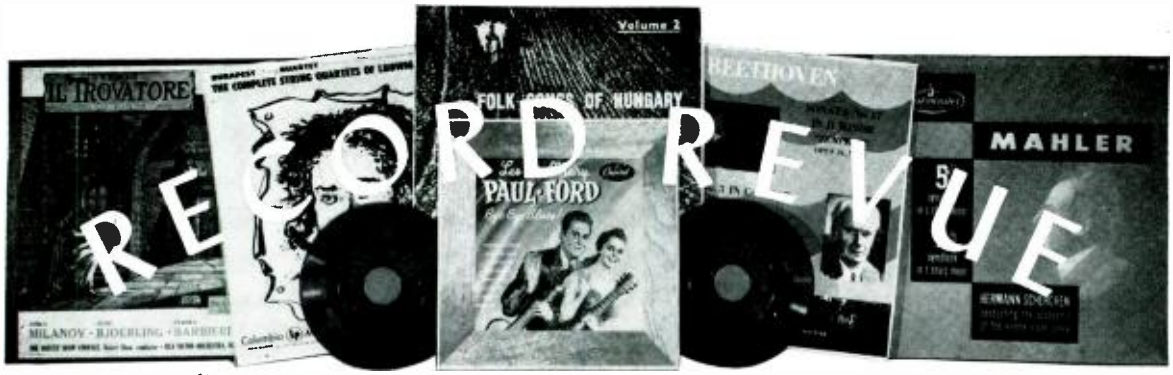
with the resultant of these signals being at point D. Program material will produce a pattern lying along the line C–D, and will thereby indicate out-of-phase operation of the speakers.

### Method of Operation

In using this phasing system, it is necessary to place the mikes immediately in front of the speakers, and it is desirable to use program material containing a predominance of low frequencies, or better still a low-frequency test record. At the higher frequencies, the distance between the speaker cone and the mike becomes an appreciable part of the wavelength of the note being reproduced and difficulty may be encountered in making a correct analysis of the phasing. This difficulty is overcome if a major part of the program material is in the low-frequency range.

Before using this equipment, it is desirable to make sure that both mikes are phased alike. This is readily indicated by placing both mikes side by side in front of the same speaker. Correct phasing will be indicated by a line on the oscilloscope in the direction A–B. If phasing is incorrect, leads to one of the mikes should be reversed to give the correct pattern before proceeding with tests of speaker phasing. The angles of slant of the line should be adjusted by balancing the vertical and horizontal gain controls of the oscilloscope, to give a pattern as indicated.

As a substitute for crystal mikes, a pair of high-impedance magnetic headphones with individual earpieces connected separately to the oscilloscope has been found to give a workable pattern. although a high-output crystal mike works much better. In professional uses where it is necessary to phase speakers located at considerable distances from each other, the user of this system will probably find it desirable to feed the mikes through identical amplifiers in order to avoid excessive hum pickup on the long high-impedance mike leads. Æ




## EDWARD TATNALL CANBY*

### 1. ONWARD AND MOSTLY UPWARD

**Delibes: Sylvia (complete ballet).** London Symphony, Fistoulari.

**Mercury SR2 9006 (2) stereo**

This is one of the finest all-around stereo recordings I've ever heard and strikes me as a real winner from Mercury. It has everything, but in modest good taste—fine music, fine performance, excellent recording and the most utterly suitable and natural stereo sound imaginable—plus hi-fi virtues that are the better because they don't shout at you.

Many a hi-fi man has picked Delibes' "Sylvia," "Coppelia," and "La Source" as his favorite music, in the short orchestral suites often recorded in the past. But "Sylvia" gains enormously from being played complete as one score—a whale of a lot of music, too. My respect for the piece has gone 'way up since a long, appreciative dinner spent with this recording as a closely-attended background. The piece really got me.

True, the sound is solidly old-fashioned for our ears and there are some items that tend towards corn, takeu by themselves—the famous *pizzicato* for instance, which you've heard a million times. Yet as part of the dramatic whole, these bits gain a dignity that you wouldn't have expected. Delibes soon has your admiration for the way that he can contrast a long succession of short pieces, keeping your attention ever more easily, maintaining complete freshness. You listen and listen—and *listen;* yet (in this playing, at least) "Sylvia" keeps you happy and contented, side after side without pause. I've found that the similarly long Tchaikowsky ballet scores are pretty wearing on the ears after a side or two; Tchaikowsky's music is too high-pressure, too blatantly dramatic, for such sustained listening interest. On records, I have seldom been able to keep my mind on Tchaikowsky for a full ballet. But "Sylvia" got me increasingly excited, and notably during the last two sides where the music becomes deeper, more compelling.

"Sylvia" dates from 1875 in Paris and so you'll also hear echoes of "Carmen," of the same time and place, though this music is less showy, more sweet, often more thoughtful and expressive than "Carmen" itself.

Lovely, melodious, musical playing, under Fistoulari. Soft, ingratiating stereo sound, the orchestra set in its normal manner and every instrument clearly where it belongs in an unassumingly natural balance. Liveness big enough for stereo presence, but not too big. And for you technicians, you'll find behind all this sweetness and light, a big dynamic range, ultra-quiet surfaces, enormous bass (when needed), sharp percussion and clean strings, plus almost distortionless inner grooves in spite of the length of play. That's Mercury's "Sylvia," and more power to the company.

**The French Touch (Dukas: Sorcerer's Apprentice. Saint-Saëns: Omphale's Spinning Wheel. Ravel: Mother Goose.)** Boston Symphony, Munch.

**RCA Victor LSC 2292 stereo**

If I'm right, this is a re-do of an earlier album, now in RCA's impeccably good triple-track stereo. The sound is really lovely, though not of the hi-fi spectacular sort—smooth strings, a bit distant and beautifully blended (they are about the best in any orchestra, to begin with), the brass rather pronounced and sharp, the echo just right.

The "Mother Goose" music of Ravel is the standout value here, filling side 2. The Sorcerer's Apprentice works away with his multiple brooms in a precise but not very exciting manner and "Omphale's Spinning Wheel" is similarly well played but lukewarm. (Of course it may simply be that I wasn't inspired by the sound of these familiar works. Or could it be that M. Munch wasn't?)

**Copland: A Lincoln Portrait. Schuman: New England Triptych. Barber: Intermezzo from "Vanessa."** N. Y. Philharmonic, Kostelanetz; Carl Sandburg, narrator.

**Columbia MS 6040 stereo**

Here is a striking recording of a piece that was uncannily well designed for stereo long before stereo was ever heard of in home reproduction. "A Lincoln Portrait" is very impressive in this version—more so, I'd say, than ever before in any form—and the credit goes not only to Copland (and Lincoln) but to Carl Sandburg, Kostelanetz, and, in particular, to the intelligent Columbia engineers who saw how this thing was just waiting to be done—after all these years.

The Copland music is of his most angular sort. On its own (as in the long introduction) it is just about self-sustaining and no more. But with the first words of the narrator, speaking of Lincoln and in Lincoln's own words (". . . and he said *this:*"), the whole piece suddenly takes on shape and sense. The narration, clearly, is the crux of the work and it has seldom been done so well, especially in view of the symphonic character of the orchestral framework.

Yes, the piece can be done "live" in the concert hall, the voice unamplified. The orchestration is expertly tailored so that the unaided voice may have its say even without the services of a master control.

But the piece is inherently more successful via recording or broadcast, for then the voice can easily dominate the music and the audience at normal speaking volume. And now, in stereo, the work finally comes fully into its own and is heard as it never before has appeared—with the advantages both of the concert hall *and* of recording. That's the effect you'll get on this record.

After the long musical introduction, first slow and then fast, the sudden entrance of Carl Sandburg, to one side and right close to you, is absolutely startling—you're likely to jump with astonishment. But what is best, as you will quickly realize, is that he is close-up, to one side, but he is also *in the hall along with the orchestra;* his voice can be heard filling the great space, as of a great man speaking to a vast audience.

Now I don't mean to suggest that he necessarily was there. He could have been. But in these days, most such narrations are recorded separately, to the playback of the music, then mixed in for the final version. The trick here is in the echo, so beautifully tailored to fit Sandburg's voice. It could be the natural hall echo—but it might just as well be straight out of those two famous stair wells, at either end of the Columbia building in New York, which serve as a pair of stereo echo chambers in many a Columbia recording.

Who knows? The real point is that it doesn't really matter. The proof of this pudding is in the listening. Here, you see, we have Art in the most timeless sense, a high skill, a persuasion, a trick that creates the illusion of reality, maybe even more convincingly than reality itself. It doesn't matter how Columbia did it, whether Sandburg spoke the words right out in Carnegie Hall or in a studio miles away and perhaps months away, too. The effect is what counts and the effect here is brilliant, new, perfectly-suited to this work beyond any possible mono recording—far beyond any concert hall presentation.

Incidentally, Sandburg is terrific here, in these short, simple, inconic bits of Lincolniana, just enough narration to give him play for his most persuasive tones, not enough to lead him into garrulousness. Kostelanetz, too, is good for this type of music—indeed, he originally commissioned the piece a good many years ago.

The rest of the program? Schuman's three short pieces based on our New England musical bard of the Revolutionary period, William Billings, are brash, expertly orchestrated, generally ugly to my ear. The "Vanessa" excerpt, from the recent opera, is short, sweet, nostalgic. Copland steals this show, decidedly.

**Bartok: The Six Quartets.** Fine Arts Quartet.

**Concert-Disc CS-207, 208, 209 stereo**

The Fine Arts Quartet is just too much to believe. This foursome is the most public-relations-minded quartet extant—you'll recognize them as the outfit, for example, that played in the recent and well-publicized New York live-*vs.*-stereo comparison, sponsored by three leading hi-fi companies. I get a publicity release about them practically every week and even receive an occasional "Dear Edward" letter, of the sort that—anywhere else—drives me into a tizzy. Not from them.

But these fellows can *play*. True, they were about the first quartet to dabble in stereo and almost the first performers of any sort to come out on stereo tape, in the original Concertape (once Webcor) recordings, 'way back. And any way you look at it, they were pioneers in getting themselves, as musicians, tangled up with audio and with audio's publicity media. Yet, against every conceivable expectation, these sharply enterprising fiddlers are, together, one of the best quartets in the U.S.A., from anybody's point of view.

Their Bartok, I say, is *the* best on records. To tackle all six Bartok quartets is roughly like producing all the plays of Shakespeare

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

at a throw—or maybe I'd better say Eugene O'Neill, just to be modern. They are gorgeous, difficult, exultant, superhuman quartets, timeless and timelessly difficult, their expression far beyond the bounds of anybody's quartets except Beethoven himself—who also knew how to make four men sound like four hundred or four million.

These playings—as far as I've gone, which is not all the way through—are at the same time strong, vital and superbly accurate. These men hear the music and play in tune —which makes things simple for us, the listeners. They are clean players, but they also have gusto and they react to the incredibly wild, raw, raucous Bartok—the grunts and slides and swoops, the bangs, twangs, screetches—just as handsomely as to the steely precision that is also part and parcel of Bartok's incredible writing. A rare combination, to put it mildly.

Best of all, for all audio hounds, the stereo recordings here are as good as claimed, no less, and they make the best quartet stereo I have heard. Distortion is nowhere evident, the balance between the four instruments happily separates them just far enough to be natural, and the liveness—possibly artificial —gives the music just the requisite bigness for easy home listening (where other quartet recordings are either too live, or too dead in sound for those who aren't already chamber music specialists). Top quality stereo disc and no less.

The recordings were done in conjunction with a Ford Foundation project that took down these same six quartets complete for TV, on film. That, too, represents some canny publicity work on the part of the Fine Arts boys.

What of all the other quartet groups, these days? They're too busy with music to spend time on hi-fi and public relations. They prefer to stick to one thing at a time. Not the Fine Arts!

**Mendelssohn: Symphony #4 ("Italian"); Trumpet Overture in C, Op. 101.** London Philh., Goossens; Vienna State Opera Orch., Swarowsky.

**Urania USD 1013 stereo**

**Mendelssohn: Symphony #4 ("Italian"). Haydn: Symphony #104 ("London").** N. Y. Philh., Bernstein.

**Columbia MS 6050 stereo**

The two versions of the "Italian" Symphony make an interesting contrast, representing musical points of view poles apart—and equally legitimate. The recording itself in both cases represents the best of current work, in somewhat different respects.

Leonard Bernstein's "Italian" is, first of all, a passionate, Romantic playing—but modern Romantic, full of anxiety and tension. It's odd that a young, twentieth century conductor should express himself (with the cooperation of his orchestra) through such an old-fashioned war horse of a piece but, obviously, the music brings out a powerful set of feelings in Bernstein. It tears its hair for him, so to speak, and—speaking of hair— I keep seeing a TV close-up of Bernstein in action as I listen. So will you, no doubt!

As for Goossen's British version, it comes from a senior conductor of an earlier generation, a musician who is inevitably closer to the continental Romantic tradition of music than Bernstein—and yet his concept is strictly a classical one, in the truest sense of that word. That is, Goossens does the "Italian" with marvelously accurate polish and shaping, every note, every phrase beautifully balanced and a delight to hear; the music speaks for itself and the outward passion is restrained, so much so that though his two outer movements are almost exactly the same speed as Bernstein's they seem to be much slower, more leisurely.

The inner movements are actually slower. The Goossens slow movement tells an old fashioned fairy tale, slightly mysterious, relaxed but expressively shaped in detail; Bernstein's slow movement is a Hebrew lament (and, after all, Mendelssohn was Jewish). Goossens' third movement is a true minuet, slow, rich, wonderful in detail; Bernstein's is faster, an *allegretto* like those in the Brahms symphonies.

The Haydn on Bernstein's other side shares similar qualities with his Mendelssohn. On the extra band of Urania's disc there is a seldom-heard late overture of Mendelssohn, well worth the space and played well (but not too accurately) by the Viennese orchestra under Swarowsky.

As to recording, Columbia's is both louder and more economical, thanks probably to variable groove control in both dimensions. Plenty clean, too, even in those last difficult loud inner grooves that end each symphony.

Urania couldn't have squeezed Goossens' slower "Italian" on one side in any case; so the music is spread out comfortably on Side 2. For my ear, the sound of the London Symphony on this Urania is close to the ideal for natural, effective orchestral stereo. It is clean, unpretentious, marvellously balanced as to the parts of the orchestra, the music at a fair distance and the surrounding space just perfect for enhancing realism, without intruding too much liveness. Never heard a better set-up for stereo. The Viennese sound on the other side ("Trumpet Overture") is considerably more live and there is incipient confusion in the music, as a result; the liveness tends to blur the details a bit and muddy up the harmonies. A common fault.

**Mendelssohn: Octet in E Flat, Op. 20; Sinfonia #9 for String Orch.** Arthur Winograd String Orch., Winograd.

**M-G-M E3668**

Two very pleasant Mendelssohn recordings, the Octet, in a version for string orchestra by the conductor (parts of it have long been played in orchestral form by other conductors) and a newly launched early string symphony, composed by Mendelssohn in his early 'teens for the famous Mendelssohn family show-off concerts—where the young genius did his stuff for Berlin society. Nice playing in both pieces and parts of the little Sinfonia are as pleasant as any later Mendelssohn.

This is one of the excellent Winograd series that the conductor produced for M-G-M before moving on to Audio Fidelity's First Component stereo, where he turned out the best music in the initial release—the record of Marches from Operas.

**Dvorak: Serenade for Strings in E, Op. 22.** Israel Philharmonic, Kubelik.

**London CS 6032 stereo**

I'm happy at last to report out this pleasing disc from my waiting list. It was one of the first batch of London stereos and, time after time, I found it musically lovely but technically fuzzy in the sound. My helpful sixth sense kept saying—wait, and try again. I did, and now at last I can safely say that it isn't distorted. Not more than a wee trace, at least, even in the tight, inner grooves. And so this record for me is a sort of symbol of continuing stereo progress—even though it hasn't itself changed.

The sweet, passionate string music has an Israeli intensity to it but the conductor is Czech in background and knows the style. A lovely piece, a good complement to the other Dvorak Serenade, the one for wind instruments, that has had several impressive recordings lately. (Best is on Boston stereo.)

**Brahms: Symphony #1.** Southwest Radio Symphony, Horenstein.

**Stereo Vox ST-PL 10.690**

**Brahms: Double Concerto; Tragic Overture.** Pierre Fournier, cello, D. Oistrakh, violin, Philharmonia Orch. Galleria.

**Angel S 35353 stereo**

Here are two different approaches to the grand musical problem of today—how to keep late Romanticism alive and natural.

Horenstein's Brahms First is a big, blowsy, outgoing version, rather untidy in detail, full of gusty emotions that aren't very subtle. It often lacks the big line and shape of Brahms but, nevertheless, puts over a great deal of the power of the music, especially in the last movement, which is very good. Perhaps the orchestra is simply not up to following Horenstein's no doubt somewhat impatient directions—he is a very positive conductor, as anyone who has followed his recordings in the past can say. More rehearsals needed? Maybe, but this is always a moot question, unanswerable by the record reviewer.

The Vox stereo sound is here quite convincing, still a bit strident in climaxes but generally clean and big; solo instruments within the orchestra still are oddly highlighted within the big liveness—a sudden close-up oboe, a distant clarinet for no observable reason.

As for the "Double Concerto," with the British orchestra, French cello, Russian fiddle, and Italian conductor, the mixture comes out with a British chasteness, every note played in exact place, a fine over-all shape and impeccable phrasing but, somehow, never anything but warmth, rather than heat. Odd, with these top-rank soloists; it just might be the conductor's fault. Who knows?

The Brahms "Tragic Overture" follows so quickly on the heels of the Concerto, with scarcely a decent pause, that many a listener will play it quite by accident as an unwitting fourth movement to the Concerto! I almost did, m'self. It blends very nicely. Surely another five seconds in between wouldn't have been too much. Angel's stereo is of the tastefully mild sort, perhaps a product of the M-S double-mike technique. I find I miss the more flamboyant American stereo approach, with all its faults. It is, at least, progressive, ours, barging brashly into new territories of aural experience. In the end, we'll get more good than bad out of our exaggerations over here.

**Schumann: Concerto for Four Horns; Cello Concerto.** Shapiro, Afanasiev, Starozhilov, Krivnetsky, horns; Rostropovitch, cello; Moscow Philharmonic, Samosud; State Radio Orch., Gauk.

**Monitor MC 2023**

Well, what with all those performers and two different orchestras, it's easy to mix up the names a bit; the Moscow Orchestra plays the "Cello Concerto," the State Radio does the horn piece. Monitor's Russian imports just bristle with long names but among them, keep in mind, are the top performers and composers of the U.S.S.R. Keep your eye out for these.

Schumann would seem to be far removed from Russia at this point but he seems to be as popular there as he is—with equal incongruity—in France, where he is played and played. The Russians do an old-fashioned, all-out Romantic job on this sort of music, which is more than a lot of Western outfits can do any more. All in all, Schumann from Russia is apt to be a good bet.

My main memory of this horn work is a sad mistake I made on an earlier recording (this is *not* the first, as claimed) when I ascribed a terrific buzzing and blasting to the violent acoustic intermodulations set up by four potent wind instruments in close harmony. It can happen—but this disc will quickly prove it doesn't, here. The horn parts are outlandishly difficult yet in this performance they pour forth with utter ease and polish, minus a trace of distortion. Nice music and an unusual item. The "Cello Concerto" is one of those over-intense Schumann works where you'll tend to think, every so often, that the old man really was trying too hard. (But on the next hearing you may be carried away. Nobody can say for sure.) It is very cello-ish, if you know what I mean.

**Horace Fitzpatrick Plays Music for the Hunting Horn on Instruments of the Period.** (with piano accpt.)

**Golden Crest 4014**

Just how Golden Crest got involved in this unusual recording project I could not tell you—it's distinctly not in the usual G.C. line! Nor is it clear where the job was done, since the horn player himself does notes on the album signed "Vienna, 1959" yet the technical notation mentions the new Golden Crest studio, which I would suppose is in the good old U.S.A.

Anyhow, the hunting horn is the forerunner of the present "French" horn and its final form was the valveless horn used in

classical orchestras right up until the middle of the nineteenth century. It could play lots of notes, due to a wide overtone series and the stopped effect, one hand inserted in the bell; but its basic melody always had that overtone-series sound. This recording project reminds me of the Vox "Spotlight" series concerning musical instruments. Also of the Saul Goodman lone-wolf percussion record for Angel.

No narration. Side 1 begins with 17 ultrashort bands each with a fine hunting flourish on it and you'll probably be lost in confusion by the second or third example. They all sound more or less alike, are very bucolic and quitee pleasing to hear—but, alas, are not at all in the proper locale since most were intended to be sounded out of doors from afar, via horse power.

Now if Golden Crest had only been able to hire a hunt, complete with hounds and maybe a fox, plus a fine big horse (like on the record cover) to mount the hornist on top of . . . but I don't suppose Mr. Fitzpatrick is the riding sort. He plays from a chair, probably, and he's definitely indoors in this performance.

This *is* intended as an indirect criticism. The examples are of scholarly and historical interest but they don't make much of a record for listening. And the samples of classical music for valveless horn should be done with orchestra, if at all, and not with piano—except for the nice little early Beethoven Sonata for Horn and Piano, Opus 17, which is the musical high point of the disc.

Unfortunately, even this piece runs into trouble, for it is hopelessly mixed up in a gross labeling blunder of the kind only a musical ignoramus could let pass. It's *not* on bands 1, 2 and 3 of side 2, as both the record label and the jacket notes say, but on bands 6, 7 and 8. Which implies that Golden Crest needs a musician or two to help out around the office.

**Haydn: Cello Concerto in D, Op. 101 (original). Wagenseil: Cello Concerto in A. E. Mainardi; Münchener Kammerorchester, Mainardi.**

**Archive ARC 3110**

It gives me pleasure to re-write these Archive titles to make sense. In the usual standard format, this one starts out, like an address given backwards, with the general historical period, set forth in large letters, "Mannheim and Vienna, Series C, From the 'Galant' to the 'Biedermeier'"; then, just to be perverse, the record lists the unknown concerto first, followed—at last—by the real item of significance on the record, which should have been posted in HUGE letters: the first recording of the famous Haydn Cello Concerto in its original, unrevised form; Nothing like getting to the point hindside foremost.

You can forget about the Galant and the Biedermeier, (I've never heard of the latter though I can tell you about the former) and take this as of great interest to all those who habitually listen to cello music—or play it—and who, therefore, obviously know the Haydn Concerto in its usual amplified version, whomped up for turn-of-the-century taste (1890) by one Gevaert, from Belgium. The original is far more tasteful for our ears, though this performance isn't exactly a dazzling one.

Herr Wagensell, on the other side, was one of those worthy musicians who work like beavers—he turned out, in his busy life, a mere 87 symphonies and 32 piano concerti, not to mention this somewhat interminable but very melodious trifle, a cello concerto that turned up as recently as 1953 after a long life in total darkness. The style is 1752 and this guy was one of the founders of the German symphonic way of writing. Well worth hearing, for from such as he came the musical style of bigger men, including Haydn, Mozart, Beethoven. The Haydn concerto came thirty years later but you can hear how much they are alike.

**Music of the Bach Family, Vols. 1 and 2. Zimbler Sinfonietta, Burgin.**

**Boston BST 1006, 1007 stereo**

This pleasant collection of works by a batch of different Bachs has appeared and re-

appeared in various forms. Last time I ran into it was on Livingston stereo tape, via arrangement with Boston—this was before stereo disc, of course.

The stereo is excellent, even today, and the music is beautifully played by a group in part out of the Boston Symphony—maybe in the whole. Of the two discs, Volume 2 is much the most interesting, with lovely music by the three great sons of "the" Bach, written in what for most of us is roughly the Mozart manner. The earlier volume has a somewhat stuffy suite by a contemporary of old Johann Sebastian and a slight-bodied sextet for winds by the last of all the Bachs, one Wilhelm Friedrich Ernst, who lasted until the mid nineteenth century. Neither is much to listen to purely as music.

**Mozart: Symphony #34 in C. Haydn: Symphony #104 ("London"). Philharmonia Orchestra, Kempe.**

**Capitol-EMI SG 7150 stereo**

This is no great musical bargain as a stereo disc, I'd say. The music is played with a surprisingly hard, urgent drive, sounding as though done with too big an orchestra, the tempi hurried and excitable where the music should be poetic. I didn't enjoy either side very much, though the famed Philharmonia is technically accurate enough.

There's a curious lack of feeling here for the subtleties of phrasing and of harmony, especially in the Haydn, where Haydn's tricks of expression, his wonderful play of harmonic tension and color, are largely ignored as though the notes were just so many notes. Nope, not for me.

I'm utterly confused, at this point, as to the changing significance of Capitol's various brother-labels, under EMI. Until now, Capitol-EMI has been strictly mono, EMI's stereo going to Angel with Capitol producing the American stereo on its own FDS label. Now, Capitol-EMI goes stereo and where is Angel? We shall see. As far as we are concerned there's only one valid distinction in the EMI-Capitol family of labels, and that is between recordings made by Capitol in the U.S. and by EMI in England and on the continent.

**Debut—John Browning.**

**Capitol P 8464**

All I can say is that I thought this new young pianist did a creditable job with the batch of repertory standard pieces he records here—Chopin, Liszt, Schubert, Debussy, even that old finger-twister, the "Flight of the Bumble Bee," but one New York critic thought he was lousy. Same critic thought the same thing about another recording of repertory music that I found very good, the series of Chopin recordings in stereo by the German pianist, Kempff, on London. I thought them terrific.

Who is right? Remember, criticism is never absolute. The other critic is a top man; his main concern is the standard repertory and the daily recital concerts in New York City; he is an expert from that point of view. My own is more of an outside viewpoint, outside of New York and outside of the regular concert repertory, too. Our standards of value are undoubtedly somewhat different, and but legitimately so.

I found Mr. Browning quite musical, granted an early stage in his career, emphasizing finger brilliance. I found Mr. Kempff's Chopin musical and gracious, too, if perhaps unexpected and "different."

Too bad that we authorities can't agree. But, you know, the world really isn't that simple.

## 2. VOICES

**Bach: Mass in B Minor.** Soiler, Wunderlich, Bence, Wenk; Swabian Chorale, Orch. of 35th German Bach Festival, Grischkat.

**Stereo Vox STPL 511.282 (3)**

The Bach Mass was one of the big things in my early life. I practically switched colleges in order to get mixed up in it (college glee club)—and so I am prepared to swoon with joy at the slightest excuse, when a new recording arrives. That is, if it's a good one.

This is good in many ways, but especially good in the choral parts, even though the soloists are of high calibre and better than in many a performance. The trouble, as far as I can figure it, seems to be squarely with the conductor. He has fine performers throughout but he doesn't give his good soloists half a chance.

What happens is this. In the grand, powerful choral numbers, the huge, well-disciplined assemblage of performers simply takes over, within the conductor's fairly rigid beat, and the music soars in spite of him. So I hear it. A rigid beat, of course, has its value when large masses of tone must be controlled and coordinated. Good musicianship, high sincerity of purpose, emotional fervor, beautiful tone and remarkable accuracy are assets here, both in the chorus and in the instrumental ensemble, and nothing can stop their effectiveness.

But when the solo numbers come along—often just a single solo voice and an accompanying solo melody, to light figured-bass harmonies—the conductor's fast, rigid beat is devastatingly bad. You can hear the soloists struggling; you can feel that their conductor is simply not waiting for them, giving them no play, allowing their melodies and phrasings little chance for alive and human expression. I don't like it and I'm sure the participants didn't either.

The recorded sound, like much of Vox's stereo, is big, very live, impressive, but with curiously illogical details, the close-up elements and distant ones oddly mixed. Why are the two lady solo singers close to the mike on one side, but the solo tenor, in the center, at a considerable distance? (Could have been the exigencies of a concert performance, but that doesn't excuse it for us.) In spite of these oddities, the general sound is very pleasing and especially that of the chorus, which is beautifully picked up and, incidentally, produces a smooth tonal blend that should be the envy of any choral organization, amateur or professional.

Technically speaking, the recorded stereo

cut is adequate and no more, like other recent stereos from Vox. It has a gentle, but also a veiled sound, not really as crisp and clear in the highs nor as forceful in the lows as it should be. (Oddly, the Vox discs themselves have a veiled, grayish appearance; but this could be a coincidence.)

I admit that I'd prefer not to say the above, since the entire process of producing good stereo discs is a headache for all concerned and the people at Vox no doubt work just as hard at it as plenty of others in the business. I sympathize, but can't help myself, since this is supposed to be my business. Indeed—I feel so strongly about things like this that I find myself rooting passionately for every company that has trouble—and I practically whoop for joy when success does come, at last! Vox has improved no end since its first slightly unfortunate stereo discs and nobody could be happier that I about it. Not even Vox.

**Mozart: La Finta Giardiniera, K. 196 (highlights).** Soloists, Com. Acad. des Solzburger Mozorteums, Paumgartner.
**Epic LC 3543**

Lovely! This seldom-heard early Mozart opera is here recorded as an extension of the excellent Epic Mozart Year Series, which was mostly under Paumgartner. The music is from Mozart's 18th year and it is wholly mature, marvelously complex and wonderfully entertaining, even when the story is lost in the confusion—and it is, mostly, on this excerpt record.

Paumgartner is a curious Mozart specialist. His all-instrumental recordings haven't been particularly successful. But give him any sort of Mozart vocal music with orchestra and he is positively incandescent in his ability to understand the essence of Mozart's expression and to get it over to his performers and so, to you also. You won't need to know too much about the plot in this piece in order to feel the drive, the sweep of musical humor and passion that is in the music.

The story of the opera, if you want it, is boiled down to a couple of close-packed columns here that actually make sense—which is something to marvel at! Perhaps you have read some of the usual synopses of operatic plots.

**Haydn: Theresa Mass.** M.I.T. Choral Society, Grounke Orch., soloists, Liepmonn.
**Music at M.I.T. CS-58**

Several points of interest here. First, of course, is the mere fact that this entire project is part and parcel of a leading American school of *technology*. M.I.T. has been turning things inside out, these last years, by adding various arts and letters to its engineering coverage, to the astonishment of many. The M.I.T. Choral Society includes everybody in the M.I.T. family, down to the secretaries, but it is conducted by the Music Department—yep, there is a Music Department. You elderly M.I.T. graduates won't know your junior colleagues pretty soon. They'll be reading this column and telling me where to get off, musically.

The recording was made on tour, in Munich; the orchestra was local, the soloists imported from the U.S.A. along with the chorus. The music is, of course, European, and more power to M.I.T. for resisting the inevitable pressure on traveling choruses to stick to American music, come H. or high water. This is fine music and why shouldn't we Americans sing it—even on tour?

Performance? Enthusiastic on the part of the chorus and quite good, too; competent on the orchestra's part, considering they probably didn't have much rehearsal time.

What bothers me, though, is the group of four imported American soloists, who spoil the recording as far as I am concerned. Why do our singers have to bellow their ensemble solo parts, as though the high water would freeze over if they didn't yell? Why so strident, why so competitive?

This happens again and again, on U.S. records and in U.S. concerts. Soloists in our big choral performances act like spoiled movie stars, or maybe like scared puppy dogs; they seem mainly interested in getting out the loudest possible volume on their own parts; each one sounds more hysterical than the next, and nobody, but nobody, ever seems to listen to the piece as a whole. European soloists, in the same music, are very noticeably more musical, more thoughtful, more aware of the whole as well as its parts—their parts.

Don't ask me why, especially since some of these soloists with M.I.T. are excellent singers. Just that old American competitive urge, I guess.

**This Is the Mass.** Dick Jonover, narr.
**Carmelite Fathers Guild,** (Englewood, N. J.)

The words of the ages-old Catholic Mass have been the inspiration for vast quantities of top-quality music during centuries; thus everyone who does any singing or music listening has long since become familiar with them. It is an oddity of our artistic expression that these wonderful works of music convey a powerful emotional inspiration to vast numbers of people who are very largely unaware of the original (and continuing) intent of the Mass itself—music aside.

Some of the greatest of musical Masses weren't even intended for Catholic use in the actual service, notably the Bach Mass in B Minor. A large number of fine musical Masses are no longer usable by Catholics due to changed practices—most particularly, those of Mozart, Haydn, Schubert, and others of recent times.

All of which is the background for my own curiosity about this disc, which, I thought, might add perspective to my purely musical knowledge of this religious rite. It did, to an extent. There is quite a lot of interesting information included in the commentary which helped to relate the familiar words of the musical texts to the actual Catholic Mass itself, as now practiced, and in its long history over the centuries.

But for those who are not Catholics the record will not be easy to appreciate. Its intention would seem to be primarily to educate Catholics in their own faith and, point-

(*Continued on page 77*)


CHARLES A. ROBERTSON*

## STEREOPHONIC

### Harold Farberman: Max Roach With The Boston Percussion Ensemble
**Mercury SR36144**

Known in previous recording to most audio fans who delight in percussion displays, Harold Farberman's *Evolution*, in this expanded version, now has parts in each of the three movements for Max Roach. A colorful work, originally written to show the capabilities of this section of the symphony orchestra, it becomes even more revealing of the contemporary percussionist's art by the addition of cadenzas invented by an extraordinary jazz drummer. He settles into the strange setting with characteristic ease and, in his capacity to swing, is certainly not inhibited by the surroundings. Everette Firth, Charles Smith, Arthur Press, Harold Thompson, Walter Tokarczyk, Lloyd McCausland, and Irving Farberman comprise the ensemble. It enlists an awesome number of accessories, including a nail file to strike the triangle. Corinne Curry and Al Portch join in an interlude for soprano voice and French horn.

The scene of the recording last August was the Music Barn of the Music Inn, and Farberman, besides conducting, was impelled to write a suite especially for his guest artist. It is composed of eight brief sketches, each inspired by some place, or person, connected with the summer school at Lenox, Mass. By way of a warmup, variations are played on *Pop! Goes The Weasel*, designed by Farberman to demonstrate in turn how Bach, Beethoven, Debussy, and Stravinsky might score it for the ensemble. The final episode is in Roach's own distinctive style. The fine performance is well-realized in stereo.

### Rex Stewart: Rendezvous With Rex
**London SJA2001**

Two varied groups are concerned in this production by the English critic Stanley Dance, and the contrast between them is as broad in mood and style as the talent of Rex Stewart. On the first session, the cornetist indulges in an outing with a loosely knit septet, playing in the free-swinging style of the 30's. The accent is on the blues, and they are well represented by George Stevenson, sounding like a younger Higginbotham on trombone, and Haywood Henry, alternating on clarinet and baritone sax. George Kelly, a newcomer on tenor sax, lives up to Coleman Hawkins' recommendation and aided in arranging Stewart's themes. But much of the drive comes from a spirited rhythm section, in which the vigorous Willie "The Lion" Smith, on piano, is abetted by Leonard Gaskin, bass, and drummer Art Trappier.

The second session is an example of what Stewart is doing today and another instance of his collaboration with Dick Cary, who doubles on piano and trumpet. The three originals are graceful vehicles for Hilton Jefferson's attractive alto-sax passages, with the embellishments of Garvin Bushell, playing bassoon and clarinet, and of guitarist Everett Barksdale. Joe Benjamin is on bass and the drummer is Mickey Sheen. The compositions carry mainstream jazz to the furthest point reached on any of the recordings made under Dance's aegis, and are an extension of the work Cary did with Bobby Hackett. Stewart will be returning Dance's visit this summer, leading a group of tourists on a jazz junket through England and the continent, via Sabena Airlines, from July 11th to August 8th.

### Coleman Hawkins. The High And Mighty Hawk
**London SJA2005**

The theme of this date, another produced by the English critic Stanley Dance, is set on the opening ad-lib *Bird Of Prey Blues*, which finds Coleman Hawkins taking as many choruses as he pleases. He stops at seventeen, but Buck Clayton, trumpet, Hank Jones, piano, and Ray Brown, bass, stretch it out to a total of eleven minutes. The tenor saxist is in rare form, and his marvellous tone sounds bigger and fuller than ever when given the depth of stereo. He plays two ballads against bowed bass, rhapsodizing over *My One And Only Love*, and *You've Changed*. Mickey Sheen is on drums, and Jones contributes two bright originals in *Vignette*, and *Get Set*.

### Monday Night At Birdland
**Roulette SR52015**

The musician's traditional night off is observed at Birdland by the engagement of a group of his fellows, ranging from a corps of Afro-Cuban drummers to a fair portion of a big band, who happen to be at liberty. For the purposes of recording one of these informal gatherings, the conventional small band lineup is followed, with Hank Mobley and Billy Root on tenor sax, Lee Morgan, trumpet, and trombonist Curtis Fuller. On *Walkin'* and *Bag's Groove*, the solos flow unrestricted and unedited. *All The Things You Are* and *There Will Never Be Another You*, two shorter melodies, fill out each side. The rhythm is Specs Wright, drums, Tommy Bryant, bass, and Ray Bryant, an agreeable pianist. Syd Torin, who selected the players, announces them briefly.

Bell Sound Studios is responsible for the stereo setup and, as one who was present during part of the proceedings can attest, it conveys a better impression than can be found in some sections of the club. It provides a seat midway back and in the center. Two microphones, placed to register audience reaction in stereo, find the relatively sophisticated crowd saving its response until a number ends. But they do make use of the hall as a natural echo chamber, giving the horns a depth which few studios can attain without an artificial effect. A second set of four numbers from the session is due under the billing, "Another Monday Night At Birdland."

### Edmond Hall: Petite Fleur
**United Artists UAL4028**

The hit parade status of *Petite Fleur*, popularized by Chris Barber's band, has returned clarinetists to favor and given Edmond Hall his first LP as a leader. You can forget about comparisons with Monty Sunshine, the soloist who started it all, for Hall is a much hotter player, easily the most incendiary around today. Better yet, forget about the title tune altogether and concentrate on an Ellington medley, of more than nine minutes duration, and Hall's two original blues. They are played by a sextet in which he is joined by Emmett Berry, trumpet, and trombonist Vic Dickenson. On four numbers, Hall solos with the rhythm section of Ellis Larkins, piano, Milt Hinton, bass, and drummer Jimmie Crawford. His Louisiana origins are recalled on *Good Cook*, and *Don't Give Me Sympathy*. Nat Hentoff produced the date and the engineer was Lewis Merritt.

### The Kingston Trio: Stereo Concert
**Capitol ST1183**

### Harry Belafonte: Love Is A Gentle Thing
**RCA Victor LSP1927**

The production facilities at Capitol finally have caught up with stereo and current releases are appearing at the same time as the monophonic versions. This concert seems to be something special for stereo though, and it presents Dave Guard, Bob Shane, and Nick Reynolds in Liberty Hall at El Paso, Texas, during a recent tour. All but one number are contained in their two previous albums and the exception, *Raspberries, Strawberries*, is enjoying popularity as a single. New are the personable introductions, the ready audience reaction, and the you-are-there presence of stereo.

Harry Belafonte's program of folk songs is finely wrought, encompassing the Italianate *Bella Rosa, Green Grow The Lilacs, Delia's Gone*, and *Times Are Gettin' Hard*. As is the case with Frank Sinatra, his voice becomes more intimate and immediate in stereo. Both of these albums will sell and sell, and they will sell quite a few people on the value of stereo.

### Stewart-Williams & Co: Porgy And Bess Revisited
**Warner Bros. WS1260**

With the release of the film, the Gershwin melodies from his folk opera are due for a bounteous reprise on records. Among the first to arrive is a setting, arranged by Jim Timmens, which aims at preserving the work's operatic aspects in the medium of jazz. This is accomplished by assigning roles to the most vocal of jazz instrumentalists and supporting them with strings and woodwinds on the ballads, switching to a big studio band for such lively excursions as *There's A Boat Dat's Leavin' Soon For New York*. Trumpeter Cootie Williams is cast as Porgy, and Rex Stewart swings his cornet into action as Sportin' Life. As Serena, Lawrence Brown sadly intones *My Man's Gone Now*, and employs his opulent trombone to sketch the beauties of *Summertime*.

Hilton Jefferson, alto sax, plays Bess, and Pinky Williams' baritone sax is heard in Jake's *A Woman Is A Sometime Thing*. With so many alumni participating, a distinct flavor of Ellington, from one of his best periods, permeates the ten selections. The soloists occupy the center of the stereo stage.

### Si Zentner: Swing Fever
**Bel Canto SR1014**

Organized to participate in the revival of big band sound on its first date for this label, the Si Zentner unit now is filling engagements on the West Coast. In an encouraging reversal of the trend that sent bands into the studios, it also employs a manager who believes, "stereo recordings—like this album—will have to be the medium to sell the youthful public to the point where they'll want to go out and dance again." The formula seems to be working for Zentner who, playing in the Dorsey style, leads one of the best trombone sections in the business. *Engarde*, one of the four band originals among the dozen numbers, spots Don Lodice and Modesto Briseno in stereo on a tenor sax duel. Other soloists are pianist Bruce McDonald, Vince Falzone, trumpet, and Mel Pollan on bass. Danceable qualities are stressed on *Beautiful Friendship, The Song Is You*, and *Bye Bye Blues*. And Bel Canto, which started with stereo tapes and jumped to stereo discs, branches out into the monophonic field by also issuing a brilliantly recorded version on single channel.

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

**Henri Rene: Compulsion To Swing**
**RCA Victor LSP1947**

With every mood master from Jackie Gleason to Michel Legrand sticking a thumb into the jazz pie, it was inevitable that Henri Rene also would try to pull out a plum. By depending upon musicians deft enough to make them swing, he loads his arrangements with musical pleasantries and often voices the brasses and saxes like a string section. They are nicely grouped around the soloists in stereo, with Hymie Shertzer's alto sax featured on *Cry Me A River,* and clarinetist Walt Levinsky describing *Nature Boy.* Urbie Green, trombone, and Doc Severinson, trumpet, appear at frequent intervals. *It Don't Mean A Thing If It Ain't Got That Swing* is defined by Al Caiola, Arthur Godfrey's favorite guitarist. And when is Arthur going to take time from affairs of state to prepare a jazz album?

**Robert Prince: Western Sunset**
**Warner Bros. WS1259**
**Jack Fascinato: Palm Springs Suite**
**Capitol ST1157**

Admirers of Robert Prince's *Opus Jazz,* written for Ballets U.S.A., may be disappointed to find him arranging a mood album, but it turns out to be a mood with a difference. A lonely harmonica and a soulful guitar are balanced against a string section, headed by an admirable cellist. His writing is always tasteful and close to the folk song tradition. The tunes have all worn well, and include *Colorado Trail, Cool Water, Red River Valley,* and *Streets of Laredo.* After using considerable space trying to trace song origins, the liner writer neglects to mention soloists.

Jack Fascinato depicts a newer West, one tamed into a desert playground for the tired personnel of Hollywood studios and drive-ins. His scenes are gaily colored and more animated than some of the native chamber jazz groups. In fact, John Graas plays a livelier French horn than he does on his own LP's. John Williams, piano, and Bob Gibbons, guitar, solo among strings, woodwinds, and marimba. Both sets are well contrived in stereo.

**June Christy: The Song Is June**
**Capitol ST1114**
**Irene Kral: The Bond And I**
**United Artists UAS5016**

Always noted for the ability to project her warm personality, June Christy embraces half a dozen ballads with the maturity which comes from experience. Most young singers pick up a set of mannerisms, loosely known as a style, to make a quick impression on the listening public. Those adopted by Miss Christy hit the mark and were widely copied, but the time came when they hampered her further development. Now they are integrated into a larger frame, to be accentuated only when essential to a song, as may be witnessed on *Saturday's Children,* and *Spring Can Really Hang You Up The Most.* Among the four contrasting jump tunes are *The One I Love,* and *As Long As I Live.* Pete Rugolo affords a backing that emerges brightly in stereo.

Irene Kral, still very much a band singer after a tour with Maynard Ferguson, credits Miss Christy as being her first inspiration. In recording with a band which has never had a vocalist, she proves that a temerity to enter where others have feared to tread will never prevent her from gaining experience. She prefers fast tunes, plunging recklessly into *Detour Ahead,* and *Comes Love,* but relaxes on *Lazy Afternoon,* and *I Let A Song Go Out Of My Heart.* Boston's pride, the Herb Pomeroy band, is also less tense than on some of its own LPs, and engineer Ray Hall set it up for stereo. If you wonder where the good songs are, after listening to radio and TV, try looking into these albums.

**Ray Martin: Parade Of The Pops**
**RCA Victor LSP1960**

A visit to a college football game, or one to see the local high school team in action, will disclose that the music of the marching band is being invaded by a new sound and beat. The top tunes of the day are featured in arrangements which stem from rock and roll, jazz, gospel song, and country and western music. Ray Martin captures the spirit of this new approach on a dozen numbers, making exciting display pieces of *Manhattan Spiritual, Peter Gunn, Red River Rose, Gotta Travel On,* and *The Children's Marching Song.* Designed to serve as models for music educators, they will influence an estimated three million young musicians in 60,000 bands. If you want to know what you will be hearing at the game next fall, here it is in the full impact of stereo, with irresistible tempos played by a crack band.

## MONOPHONIC

**Elektra Folk Song Kit**
**William Loughborough: Bongo Drum Instruction** **Folkways FI8320**

Everything that falls within the scope of the folk song kit seems to be accounted for, and the painstaking care of its preparation results in an ideal for other fashioners of instructional guides to aim at. To withstand repeated playing, the record itself is pressed of a special hard material. The level of the guitar is kept high in relation to the vocals and the accompaniments are clearly heard. At the start of the basic course, which occupies one side, Billy Faier explains various tuning methods, including one using the Standard A note sounded on the first band. On the second side, Milt Okun sings twenty songs, slowing fast tunes to a walk for the first verse. Besides the manual containing exercises and texts, there is a separate chord chart.

Although Faier stops just when things become complicated and Okun barely touches on the blues, an effort is made to help the student in further progress. Lee Hayes writes a personalized and informative review of the subject. In addition to a bibliography and discography, there is a directory of where to go in principal cities across the country for advice, the purchase or repair of instruments, and the all-important association with other aspirants. For the student removed from these centers, a sequel might attempt an analysis of various guitar styles, including blues artists, and give hints as to how some effects are accomplished.

Already on the market with Pete Seeger's guitar guide, Folkways moves on to offer a rhythm primer for the beginner on bongo drums. William Loughborough, a West Coast percussion expert, demonstrates the rudiments and gradually leads into more complex patterns. He concludes with a startling exhibition of the tones it is possible to extract from two-octave chromatic tympani, bass marimba, and a chromatic log drum set. His manual is limited to the required exercises, and the pupil who masters the fundamentals may want to consult the Elektra directory. It should help him meet a rhythmically-insecure folk singer.

**Annie Ross Sings A Song With Mulligan**
**World Pacific WP1253**
**Peggy Lee: I Like Men** **Capitol T1131**

If you have waited twenty years, as I have, to witness as close a marriage between vocalist and instrumentalist as the one which existed between Billie Holiday and the late Lester Young, be advised that for me the wait is over. The association of Annie Ross and Gerry Mulligan is surrounded by the same magic and, even though it should prove not to be as productive, this record will be spoken of twenty years from now. Her experiments in vocalese, so well realized with Jon Hendricks and Dave Lambert, appear but briefly to frame Leonard Bernstein's *I Feel Pretty.* The uncanny sense of timing gained from this training, however, leads to her remarkable phrasing of such ballads as *All Of You, Let There Be Love,* and *This Is Always.* The blend of her voice and the leader's baritone sax is a deeply emotional experience. Because two sessions were held, the quartet varies between Art Farmer or Chet Baker, trumpet, Henry Grimes or Bill Crow, bass, with drummer Dave Bailey.

Perhaps this sort of emotion is too much to expect from female vocalists when so few of them can manage humor without seeming coy or cute. Peggy Lee, an exception, treats her men with a largesse that is witty and appealing, and one can only wonder what she will say next to *My Man, Bill, Good For Nothing Joe,* or *Charley, My Boy.* Jack Marshall's settings are jauntily played.

**George Lewis: Concert!** **Blue Note 1208**

In his prefactory remarks to this concert, held in California in 1954, George Lewis makes the comment that "After a year or so you may not hear this music any more." On his second successful tour of England, at this writing, he is still going strong at fifty-eight and plans to pay his first visit to the continent. But it marks the last time banjoist Lawrence Marrero recorded with the band, and pianist Alton Purnell is now settled in Los Angeles. The performance is relaxed and uninhibited, with no advance notice to the musicians that it was to be taped. Ten of the familiar tunes are played, including *Gettysburg March, Red Wing, Ice Cream, Burgundy Street,* and *Walking With The King.* Kid Howard and Joe Watkins share the vocals. The circumstances limit the recording quality and Jim Robinson's trombone is off mike at times. The brilliant Lewis tone is favored, however, and his clarinet is heard clearly as it weaves in and out of ensembles. And that, after all, is the reason for buying the record.

**Cannonball Adderley: Things Are Getting Better** **Riverside RLP12-286**

In one of his all too rare appearances away from the Modern Jazz Quartet, vibist Milt Jackson joins Julian Adderley on a blues-studded album calculated to show their respective talents as improvisors supreme. They experience the same instinctive reactions to the blues and hold views on the subject which lead to complete rapport on Adderley's two originals, and on Jackson's *Blues Oriental.* Included is Budd Johnson's *Serves Me Right,* and Jackson illuminates his present position on Gillespie's *Groovin' High.* They stray lightheartedly into the pop field for tuneful invention on *Sidewalks of New York,* and *Just One of Those Things.*

Percy Heath, also on leave from the MJQ, underscores the vibes with a well-timed bass line. The pianist is Wynton Kelly, and Art Blakey shows the subdued side of his drumming. As to the sound, Jackson's vibraharp has rarely fared better than in this recording by Jack Higgins. But it is Adderley, playing with emotion and fine conception, who captures the imagination by reaffirming his newly acquired stature as a major figure on alto sax.

**Cecil Taylor: Stereo Drive**
**United Artists UAS5014**
**Ornette Coleman: Something Else!**
**Contemporary C3551**

Now that a large portion of the jazz public is busily absorbing Thelonious Monk, those individuals who like to consider themselves in the vanguard are looking for more abtruse subjects. On the East Coast, they are already learning to cope with a challenging pianist who studied at the New England Conservatory of Music and is quoted on the liner as stating, "The object of any jazz musician who has had this background is to bring it to jazz—combine it with jazz, and see what happens." Another youngster who picked up a few classical devices to glibly pad out pop tunes? Not a bit of it. Sample any of Cecil Taylor's choruses and you will find him working entirely within the framework of jazz, using his knowledge to create new rhythmic and harmonic lines. His originality is such that the difficulty of finding compatible instrumentalists is at once apparent.

Possibly because John Coltrane worked so well with Monk and because Taylor is most often compared with Monk for want of a better example, he is used on this date, playing tenor sax under a pseudonym. As valid as this theory may seem, there is no great meeting of minds until Taylor subjugates his personality to that of accompanist for Coltrane and trumpeter Kenny Dorham. By adapting to his plastic rhythm patterns, Chuck Israels, bass, and drummer Louis Hayes come closer to his concepts. Neither of the originals is his own and his style is

best typified on *Like Someone In Love,* and *Just Friends.* The producer, Tom Wilson, first brought Taylor to light on the defunct Transition label. That record soon may be a collector's item. If you can find a copy, hang on to it.

Ornette Coleman, his counterpart on the West Coast, has a strikingly similar harmonic approach and is equally evasive of a stated beat. A self-taught alto saxist from the Southwest, he played in territorial bands before settling in Los Angeles. Finding musicians willing to accept his style is among his troubles also, one leader even paying him not to play. On the nine originals chosen for his debut, he heads a disciplined quintet, with Don Cherry on trumpet, Bassist Don Payne, pianist Walter Norris and drummer Billy Higgins form an exceptional rhythm section. If these two unique figures meet some day in their travels, they are likely to find a common ground and it should be interesting to "see what happens."

**The Other Side Of Benny Golson**
**Riverside RLP12-290**

An intent to give Benny Golson the freedom to emphasize his playing ability, rather than make the usual demands on his talent as an arranger and composer, explains the album title. Its significance seems somewhat diminished in the presence of the three originals he prepared for the date, not to mention several other LP's on the market with examples of his skill as a tenor saxist. But it does grant him more extended solo space than before, and presents him with different musicians. Pianist Barry Harris is brought in from Detroit, and Curtis Fuller plays trombone. Drummer Philly Joe Jones and bassist Jymie Merritt are old friends from Philadelphia.

As Golson's natural tendencies are toward form and order, he would not seem comfortable playing some of the empty phrases current today and it is just as well that his own compositions are included. They reflect an interest in the work of John Coltrane and indicate, to these ears, an endeavor to render its substance into more digestable portions. Other numbers are Fuller's *Symptoms,* Junior Mance's *Jubilation,* and Richard Evans' *This Night.*

**Randy Weston: Little Niles**
**United Artists UAS5011 (stereo)**
**Mal Waldron: Mal-3/Sounds**
**Prestige 8201**

Contrary to the impression conveyed in the popular press, many jazz musicians are reasonably domesticated and willingly forego lucrative road trips for the comforts of home. Being dependent upon the festive nature of dancers and nightclub crowds, the opportunities to express this aspect of their social life are scant in the normal course of events. The LP audience has proven more receptive, however, even developing to the point where it demands a fuller portrait of the artist than the conventions of entertainment permit. Perhaps more than any other factor, this outlet has encouraged the artist and broadened the base of jazz. Without it, these two young composers and pianists would hardly venture to go on record so firmly as heads of households and write so tellingly of the joys of parenthood.

Randy Weston's seven vignettes, all in three-quarter time, revolve around his two children and their playmates. His followers already know them from piano versions of the title tune and *Pam's Waltz,* but they are reintroduced here in Melba Liston's arrangements for a sextet, in which she plays trombone. Ray Copeland, trumpet, and Johnny Griffin, tenor sax, seem to regard children as boisterous imps and are inclined to be disruptive of Weston's intentions. They are best realized on a trio number, *Let's Climb A Hill,* with bassist George Joyner and drummer Charlie Persip. Stereo gives the piano a little clearer definition.

Mal Waldron, in pieces dedicated to his daughter and wife, is more fortunate in his choice of companions. His sextet includes flutist Eric Dixon, cellist Calo Scott, and Art Farmer, whose muted trumpet adds

(*Continued on page 58*)

greatly to the beauty of *Portrait Of A Young Mother*. The subject joins in with a wordless lullaby and also sings Harold Arlen's *For Every Man There's A Woman*. Familiar jazz paths are traced in two of Waldron's compositions, but there is much in both albums to intrigue anyone who is seeking something off the beaten track.

**Prestige Blues-Swingers: Outskirts Of Town** **Prestige 7145**
**Eddie Barclay: Americans In Paris** **United Artists UAL3023**

Jerry Valentine, an arranger who started with Earl Hines and Billy Eckstine, indulges in fond remembrances of their sound to help introduce Prestige's new policy of recording studio bands under a house name. By way of updating, Jerome Richardson's flute is scored where Omer Simeon's clarinet once would be heard on *Blue Flute*, and *Jelly, Jelly*. The hearty tones of Jimmy Forrest's tenor sax are a feature of the title tune, and two Valentine blues originals. Other soloists are Art Farmer, Buster Cooper, Pepper Adams, Ray Bryant and Tiny Grimes. In their revival of big bands, other labels have scarcely touched these freewheeling Chicago groups and this healthy example may impel one of them to place Earl Hines at the helm once more.

Quincy Jones, an arranger who enlivened various European bands during his recent stay on the continent, attempts to confer a like favor on the works of such composers as Henri Salvador and Michel Legrand. That he succeeds in lifting these polite tunes above the level of mood music is due mainly to the presence in the Eddie Barclay orchestra of jazz expatriates Don Byas, Lucky Thompson, and Kenny Clarke. The relief they show when permitted to attack Nat and Julian Adderley's *Sermonette*, the most successful number of a dozen, is quite joyous. Among the French soloists is violinist Stephane Grappelly.

**Ravi Shankar: India's Master Musician** **World Pacific WP1248**

This release is timed to coincide with Ravi Shankar's second concert tour of the United States and needs no recommendation as far as his earlier audiences are concerned. They will welcome a refresher course in the principles behind his music before meeting him again. And those persons who plan to observe his remarkable troupe in action for the first time will benefit from a modicum of preparation before attempting to unravel the mystery of a Raga, or the rhythmic cycle known as Tala. The exciting climactic passages of one of his sitar improvisations, however, speak a universal language and require no introduction, especially when his accompanists make their entry. They are Nodu C. Mullick, playing the dronelike tamboura, and Chatur Lal, whose responses on tabla comprise some of the most accomplished drumming ever recorded. The sound is excellent, but you may wonder in passing why ASCAP's protective seal is considered necessary on this difficult Indian music.

**Jo Basile: Cafe Italiano** **Audio Fidelity AFLP1893**
**Renato Carosone!** **Capitol T10163**

Aldo Conti, in joining his tenor voice to the accordion of Jo Basile, defines the romantic side of Italy, singing a dozen tunes much as any armchair tourist might expect to hear them after a meal at a small cafe. Aided by a chorus and complement of strings, he is warmly sentimental and creates a mood reminiscent of a sunny land. Included in the fine recording are Domenico Modugno's *Lazzarella*, and Renato Carosone's *Maruzzella*.

When the armchair dreamer actually makes the trip, a phonograph most likely will displace the live tenor of his imagined cafe and the voice will be that of one of these popular singers. A dozen of Carosone's hits, recorded in Milan, find him borrowing a boogie-woogie beat from this country, and going to Spain for *Torero!* His style, as spirited or humorous as the latest novelty song, can also be romantic. Æ

## EQUIPMENT PROFILE

(*from page 40*)

Special care should also be exercised in soldering the switch lugs. The danger is of solder flowing into the switch contacts and preventing operation; one will only damage the switch by forcing it. When soldering, the lug should be oriented sideways or, better yet, downward, to prevent solder from flowing into the contacts. Again, use of a low wattage iron with a small tip and avoiding excessive solder flow will minimize the danger. Should solder get into a switch contact, apply the soldering iron close to the contact until the solder melts, and immediately rap the switch on a hard surface, which should shake out all the solder. Guard your eyes.

Lest these cautions on soldering frighten away the would-be constructor, it should be noted that a fair amount of the soldering in the reviewer's kit was done by his 9½-year old son, with no damage to either party.

When inserting the tube sockets into the printed circuit board, make certain that all nine of the pin lugs and the ground lug have gone through their respective holes; there is a possibility of one or more of the lugs being bent so that they remain on top of the board instead of coming out on the under side. Be sure that each lug has gone through as far as possible, making a snap fit with the under side of the board. Finally, be sure to solder each lug to the board. There is a possibility of misunderstanding the instructions and assuming that the snap fit between the socket lugs and the board is sufficient. The reviewer understands that at least one constructor who sent his amplifier to Lafayette for service came to grief because he failed to solder the socket lugs.

In one respect this reviewer does not agree with the soldering instructions, namely that "a good mechanical connection should *always* (reviewer's italics) be made before soldering, by crimping the leads on the terminals with your pliers." Not that Lafayette is wrong, but the reviewer belongs to the school of thought that crimping is unnecessary unless its purpose is to hold a component in place while awaiting soldering at a later time. A good mechanical connection is not sufficient in itself, whereas a good electrical connection (a well-soldered one) is. This means inserting a lead straight into a lug without crimping and then soldering. The advantages are quicker assembly and greater ease of removal of a component should the need arise. If the lead is crimped around the lug, heat must be applied while the lead is unbent, possibly long enough to damage other components soldered to the same lug. Moreover, in the process of wrestling with the crimped lead one may physically damage the component in question, other components, or the lug. To illustrate, the reviewer made an error in mounting a resistor of incorrect value to a switch, and it happened that one of the lugs involved had two additional leads soldered to it. The process of removing the wrong resistor and putting in the right one was greatly facilitated by the fact that the leads were not crimped. A little heat briefly applied to the lug enabled one lead to come right out and the other to slip right in. Even if a lead is not to be soldered immediately, the reviewer avoids crimping it. Instead, he uses just enough solder to hold the lead in place, without filling the lug. When all the other leads are in place, he fills the lug with solder.—*HB*.

E-23

# NEW PRODUCTS

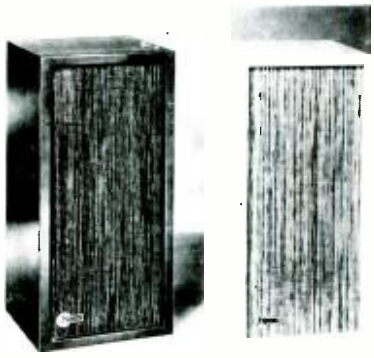
**• CBS-Hytron Preamplifier Tube.** This new tube, designated Type 7247, is a dissimilar-section double triode which combines in a single envelope the first two stages of preamplification for a high-fidelity amplifier. Section one is a hi-mu triode with low hum and noise levels. It is intended as an amplifier for low-level


inputs. Section two is a medium-mu triode having characteristics similar to those of a 6C4. It is suitable for cathode-follower or large-signal phase splitter service. Twin 150-ma heaters may be connected in series or parallel for operation from 12.6 or 6.3 volts. Complete technical data for the 7247, including typical circuit diagrams, can be obtained by writing to CBS-Hytron Advertising Service, Parker Street, Newburyport, Mass., and asking for Bulletin E-317. **E-1**

**• Stereo Record Demonstrator.** Record dealers, as well as others that have use for stereo listening without distraction, will welcome this Permoflux development. Providing as it does binaural auditioning of stereo records, it frees the dealer from such chores as placing speakers, adjusting volume, etc., for each individual listener. The demonstrator consists of a hi-fi stereo amplifier with total output of 12 watts, a transcription-type turntable with 4-pole

motor and pickup arm, diamond-stylus cartridge, and two sets of headphones which may be switched independently from binaural to monophonic listening when desired. The unit can be used to demonstrate monophonic records as well as stereo records, and is equipped with jacks for feeding external speakers. Individual tone controls are incorporated for each channel. Further technical information will be supplied by Permoflux Products Company, 4101 San Fernando Road, Glendale 4, Calif. **E-2**

**• Wharfedale Speaker System.** To meet the demand for a small full-range speaker system, G. A. Briggs has designed the new Model WS/2, a complete two-speaker assembly in a sealed, patented enclosure. It requires no additional speakers to achieve a wide frequency range, and will operate

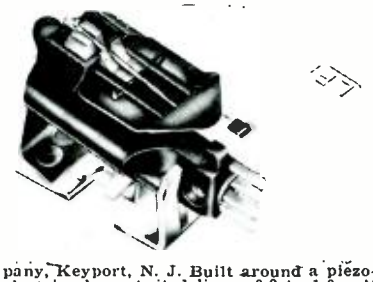


efficiently when driven by an amplifier of only moderate power. Measuring only 11" x 10½" x 24", the WS/2 is finished on all sides and can be used singly or in pairs, horizontally or vertically. It is an ideal unit for adding stereo to any existing high-fidelity speaker system. For full information write to Dept. 50, British Industries Corporation, 80 Shore Road, Port Washington, N. Y. **E-3**

**• Dynaco Triple-Function Amplifier.** The Stereo 70 contains two independent 35-watt amplifiers which can be used for stereophonic or monophonic reproduction, or as a dual-channel unit when desired. Based on the use of patented circuitry and a newly-developed output transformer, the Dynaco A-470, the amplifier provides full rated output from 20 to 20,000 cps at

less than 1.0 per cent total harmonic distortion. Intermodulation ranges from .05 per cent at normal listening levels to 0.5 per cent at rated power. A dual printed-circuit assembly, supplied factory wired, simplifies construction and permits completion of the amplifier in less than five hours under normal circumstances. Detailed information on the Stereo 70 is available from Dynaco Inc., 617 N. 41st St., Philadelphia 4, Pa. **E-4**

**• Stereo Cartridge.** Made in England by Acos Laboratories, this turnover cartridge has been added to the line of phonograph accessories manufactured and merchandised in the U. S. by The Duotone Com-



pany, Keyport, N. J. Built around a piezoelectric element, it delivers 0.8 to 1.0 volt output, and contains built-in RIAA equalization. Frequency response is flat within ± 1.5 db from 40 to 15,000 cps with a roll-off of 10 db at 18,000 cps. Channel separation is said to be better than 25 db at 1000 cps. The special "lok-tite" turnover mechanism is designed to maintain the stylus at a perfect 45-deg. vertical-lateral angle to the record grooves, thus assuring balanced stereo reproduction. **E-5**

**• Bulk Tape Eraser.** More frequently than not, the average tape recordist finds that, after tape erasure, there is enough residual noise remaining on the tape to make itself heard over a new recording. By simply placing a reel of tape on the Robins

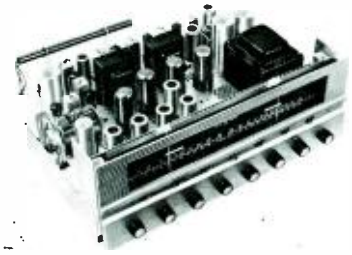

Model 99 bulk eraser, and rotating it a couple of times, complete erasure takes place and background noise level is lowered by as much as six db below that achieved by the average erase head. The device handles reels up to 10 ins. in diameter, and erases tape up to one-half inch in width. It operates on regular 117-volt 60-cycle line voltage. Manufactured by Robins Industries Corp., 36-27 Prince St., Flushing, N. Y. **E-6**

**• Transistorized Power Supply.** The EICO Model 1020 serves ideally as a universal power supply for operating transistor radio receivers, hearing aids, preamplifiers, instruments, and other transistor devices under repair, development, or study. It is also intended for use as a variable bias supply to bias transistors or vacuum tubes in circuit development. Ripple is 0.5 per cent at full load. Two


Type 2N256 power transistors are incorporated in the circuit to permit output voltages up to 30 volts. Output is continuously variable and is monitored by a dual-range voltmeter (0–6, 0–30 volts d.c.). Maximum output current capacity is 150 ma from zero to 12 volts; 200 ma from 12 to 24 volts, and 300 ma from 24 to 30 volts. The 1020 is available in either kit or wired form. Manufactured by Electronic Instrument Company, Inc., 33-00 Northern Blvd., Long Island City 1, N. Y. **E-7**

**• Harman-Kardon Stereo Receiver.** Like its predecessor, the monophonic "Festival," the new H-K stereo "Festival," Model TA230, is a complete electronic center on a single compact chassis. It is supplied with optional copper-finish or hardwood enclosure. Incorporated in the Stereo Festival are separate AM and FM tuners for simulcast reception, dual preamplifiers

with input facility and control for every stereo function including FM multiplex, and a 30-watt dual power amplifier. Features include the new H-K friction-clutch tone controls to adjust bass and treble for each channel separately. Once used to adjust system balance, they may be operated as conventional ganged controls. Preamp filaments are d.c. heated to insure freedom



from hum. Separate electronic tuning bars are provided for FM and AM. Controls include AFC, contour selector, rumble filter, scratch filter, mode switch, and record-tape equalization switch. Two high-gain magnetic inputs are provided for each channel. Ideal for those situations where unsurpassed performance and compact size are of equal importance, the Festival measures but 15-13/16"w x 6⅛"h x 12¾"d, including enclosure. Full technical information will be supplied upon request by Harman-Kardon, Inc., 520 Main St., Westbury, N. Y. **E-8**

● **Silicone Record Spray.** Developed as an effective means of shielding records against dust and grime, Sil-Spray is a new silicone "mist" recently introduced by Jensen Industries, Forest Park, Ill. A


concentrated solution, it comes packed in an aerosol container complete with its own cloth applicator. The silicone mist may be applied directly to the record grooves or sprayed first on the cloth, then rubbed lightly on the disc. Sil-Spray also serves as a static eliminator. **E-9**

● **Program Equalizer.** Developed for use with broadcast, motion-picture, recording, television, and industrial audio equipment, the StudioSound Equalizer has input and output impedances of 600 ohms and an insertion loss of 14 db. It provides up to 16 db attenuation and 12 db boost at 40 and 100 cps, and at 3, 5, 7, 10, and 15 kilo-

cycles. The unit is available on a standard rack panel with all keys, knobs, and jacks; or component parts and dials may be purchased separately. The equalizer is designed for use in individual microphone or program circuits. For further information write Studio Supply Company, 711 S. Victory Blvd., Burbank, Calif. **E-10**

• **Sargent-Rayment Stereo Tuner.** Designed with the fastidious user in mind, the SR-1000 stereo tuner leaves virtually nothing to be desired in its outstanding performance characteristics. Use is made of the Sargent-Rayment-developed 2-tube AM detector which is capable of reproducing AM signals with an absolute minimum of distortion. A specially engineered 10-kc whistle filter allows maximum frequency response, yet provides infinite suppression of inter-station interference. Broad- and sharp-bandwidth AM reception

is switch controlled. The FM channel utilizes an advanced gold-plated frame grid cascode tube, permitting FM sensitivity of 0.85 microvolts for 20 db of quieting. For maximum gain and stability, the SR-1000 uses the new low-voltage i-f tubes, followed by limiters and a fully-balanced broad-band ratio detector. FM audio response is within ± 1.0 db from 18 to 22,000 cps. AM response is flat to 8200 cps in the broad-bandwidth tuning position. Special provisions are incorporated for FM-multiplex operation, including output jacks for adapters and wired-in automatic switching. The SR-1000 is fully described in a new 12-page catalog which is available on request from Sargent-Rayment Company, 4926 E. 12th St., Oakland 1, Calif. **E-11**

• **Stereo Balance Indicator.** The versatility of this instrument promises to make it of distinct interest to every owner of a stereo system. Featuring two separate coils set in a single magnetic field, each stereo channel feeds an individual coil through a full-wave bridge rectifier. When both signals are equal and balanced, the resultant deflection on the meter scale will

read zero. Individual channels may be measured by means of two slide switches. Stable meter action and protection from peak voltages are afforded by damping networks. Maximum meter sensitivity of 120 microamps may be varied by a 7-step range control. By properly positioning this control, the movements may be used as VU meters when connected across a 600-ohm load. Cataloged Model TM-66, this instrument is distributed by Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. **E-12**

• **Fisher Stereo Receiver.** The Model 600 Receiver contains separate FM and AM tuning sections, a stereo audio control with 19 operating controls and switches, and two power amplifiers providing 40 watts continuous power in stereo operation, all on one integrated and compact chassis. Only the addition of speakers is required for the unit to function as a high-fidelity system for the reception of FM-AM stereo programs, as well as for standard FM and AM programs. In addition, associated equipment may be plugged into the 600 to make it a complete sound center utilizing all available program sources, such as records, tape and FM multiplex broadcasts. The r. f. stage in the FM tuner employs an especially-engineered cascode circuit which provides high sensitivity and maximum signal-to-noise ratio. The AM section consists of a high-gain r. f. stage, a pentagrid mixer and oscillator, and an i. f. stage which provides either broad- or sharp-bandwidth

tuning. Frequency range of the dual 20-watt amplifiers is within 1.0 db from 20 to 20,000 cps. A total of 14 input and output jacks is provided, including connections for an FM multiplex adapter. The front panel contains 13 operating controls and switches. Connections for 4-, 8-, and 16-ohm speakers are provided on each channel. For full information, write Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, N. Y. **E-13**

• **"Moodlite."** This is a new concept in decorative home lighting. Essentially a portable lighting fixture, it permits the use of partially colored light in a darkened room to achieve startling effects. It is designed to establish a visual mood in keeping with the type of music one is listening

to. While it is most effective when directed against a plain wall or ceiling, Moodlite may be used in any other manner which suits the momentary mood of the user. It may also be used as a conventional fixture for general room illumination by removing the lens-pattern insert. Manufactured by Moodlite Company, 2145 Griffith Park Blvd., Los Angeles 39, Calif. **E-14**

• **New Precise Line.** Marking its entry into the high fidelity field, Precise Development Corp., Oceanside, N. Y., has just introduced two new stereo amplifiers and a tuner. The Integra, Mark XXIV, incorporates two 20-watt channels, which may be combined for monophonic use. This unit, pictured, accommodates phono, tuner, TV, and tape inputs in an arrangement which permits switching to two tuners, two TV sets, or tuner and TV for certain types of stereo broadcasts. In the phono position it will accommodate mag-

netic, ceramic, and crystal cartridges, and slide switches vary loudness contour, select between four modes of operation, reverse channels, and control a.c. power. The Eclipse Mark XIV amplifier is a highly simplified amplifier of lower power output accommodating tuner and phono inputs. The Perfecta AM-FM tuner employs cathode follower output, and incorporates a tuning meter. The function switch permits connecting a TV set and a ceramic pickup (or a magnetic pickup through a preamplifier) with full front-panel control. Full information will be sent upon request. **E-15**

# NEW LITERATURE

• **General Electric Company,** West Genesee St., Auburn, N. Y., has prepared an entirely enlightening 24-page booklet titled "Fifteen Minutes to Stereo." Directed strictly to the layman, this publication does an excellent job of filling the demand for a succinct statement of just what stereo means to the average home. In all respects it lives up to its subtitle, "A Basic Guide to Stereo Hi-Fi." Available at G-E component dealers for 25 cents.

• **Sargent-Rayment Co.,** 4926 E. 12th St., Oakland 1, Calif., displays its complete line of high quality tuners, amplifiers and audio accessories in a handsome new 12-page catalog which has just been released. Colorfully illustrated and replete with technical specifications of all items discussed, including the new S-R multiplex adapters, this brochure should be read before making final decisions in assembling your stereo music system. It is available on request. **E-16**

• **University Loudspeakers, Inc.,** 80 S. Kensico Ave., White Plains, N. Y., announces a new product catalog containing full information, illustrations and specifications of all new and current University public-address speakers and components. Grouped together are the following main categories of speakers and accessories: Trumpets; Paging and Talk-Back; Submergence-proof speakers; Hi-Fi Weatherproof Dual-range Systems; Super Power Projectors; Portable Soundcasting Systems, and Drivers and Accessories. The final two pages of the catalog contain hi-fi speakers and enclosures suitable for commercial installations. Available free, on written request. **E-17**

• **Amplifier Corp. of America,** 398 Broadway, New York 13, N. Y., is now distributing a six-page brochure describing and illustrating the new line of TransMagnemites, a series of transistorized, battery-operated, spring-motor portable tape recorders designed for professional field applications. Single- and multi-speed models with or without VU meters are available and are listed with their respective recording characteristics tahulated for easy reference. The recorders' operations are concisely explained and complete technical specifications, recommended accessories, and direct factory prices are included. The brochure will be mailed free upon written request. **E-18**

• **French Electronic Directory.** The second issue of the buyer's guide to the French electronics industry has just come off the press. Completely brought up to date and considerably augmented, this directory provides the most comprehensive comparative source of information of every industrial product manufactured by the French Electronics and allied products industries. It contains addresses of all French electronics firms, 600 pages of short-form technical catalogues listing all available products, over 100 pages devoted to manufacturers and sub-contracting firms, as well as a description of the industry itself, its structure, and a complete professional directory.

The directory is in two volumes, solid cover, with 1100 pages, and weighing two pounds. Expensively produced, with some 750 color pages, the two-volume set costs 6100 Fr., (approximately $17.50), and will be found of exceptional value to those who either buy from or sell to the French market. It is the first four-language reference work, (French, English, German, Italian), devoted to a single industry to be compiled specifically on a Common Market basis for the benefit of engineers, procurement departments, and civilian and military users of electronic equipment. The directory may be obtained from Publicité et Editions Techniques, 161, Blvd. St. Germain, Paris VI°, France.

# Sound Talk

*by John K. Hilliard*
Director of Advanced Engineering

**WHAT SPEAKERS FOR STEREO?**

Sound engineers agree that the finest stereo reproduction can be achieved only by two identical speaker systems of exceptional quality. Short of this ideal, however, the premise is muddled by an ever-increasing number of unfounded claims... most of them based on sales philosophy rather than scientific fact.

Actually, the proper selection of stereo speakers is quite clear. Due to certain psycho-acoustic effects, one exceptional speaker system and one of moderate abilities will provide better stereo than matched speakers of intermediate quality. This is only true, however, if the lesser speaker meets certain requisites.

The two speakers must be similar in frequency response and character. In the high end of the spectrum they must have the same limits. At the low end, they must be similar down to 100 cycles. Below that point, the performance of the lesser speaker is relatively unimportant.

If the lesser speaker goes down to only 300 cycles or has major irregularities in its response, a phenomenon called the "orchestral shift" will occur. This shift results from the fact that the sound from any given instrument is reproduced from both speaker systems. The comparative loudness determines the auditory location. If an instrument is "placed" in the lesser speaker and then plays into a frequency range where that speaker is inefficient, it will then be louder in the better system and will appear to shift to that better system.

Speakers that are inefficient below the 300 cycle point will not provide true stereo. This is obvious because the 300 cycle point is above middle C on the piano, 70 cycles above the primary pitch of the female voice and nearly 200 cycles above primary male pitch. For full stereo it is therefore imperative that the lesser speaker efficiently reach at least 100 cycles.

All ALTEC speaker systems are similar in their exceptional smoothness of frequency response, have a high frequency limit of 22,000 cycles, and are efficient below 100 cycles in the lower range. This regularity in response, range, efficiency and quality is the reason why ALTEC speaker systems are noticeably superior for stereo reproduction.

For further information concerning the best elements for stereo, write ALTEC LANSING CORPORATION, Dept. 5A 1515 S. Manchester Ave., Anaheim, Calif., 161 Sixth Ave., New York 13, N. Y. 12-58

# ABOUT MUSIC

## What's in an Audience?

HAROLD LAWRENCE*

NEW YORK CITY offers its inhabitants nearly as many varieties of musical fare as there are flowers in the Botanical Gardens. This abundance of musical activity often makes it impossible to avoid missing some fine concerts, especially when, during the height of the season, the Metropolitan Opera House, Carnegie Hall, and Town Hall each may be presenting important attractions on the same evening. A critic like Irving Kolodin (music editor of *The Saturday Review*) can overcome this hurdle by shuttling between 39th and 57th Streets to see part of each performance—in anticipation of the schedule conflict, he has probably seen a dress rehearsal of the Met's production. But non-editors will have to content themselves with reading the reviews, hoping to catch the missed concert the next time around. However, the likelihood is that only a tiny minority of music lovers will be upset by the duplication for, as any eclectic concertgoer will inform you, the audience overlap between different musical events is lower in quantity than is generally assumed. In fact, for each kind of concert, there is a corresponding audience.

### The Debut Audience

First, let us consider the audience attending the debut of a pianist. The artist in this case is not a protégé of Sol Hurok, has made no recordings, and has won neither the Leventritt Award, the Brussels Competition, nor the Moscow Tchaikovsky Prize. He is merely one of numerous young musicians who plan to mark the beginning of their concert careers in the usual manner—namely, by means of a New York recital. With the proper financial backing, he has rented Town Hall, paid for the printing of tickets and programs, and seen the notice of his forthcoming recital duly listed in the programs-of-the-week page of the Sunday papers. He does not expect to sell many tickets; indeed, his chief concern is to get enough free tickets into the hands of friends and relatives so as to have a respectable-looking, even if "papered," house.

If he comes from a large family, the chances are that a sizeable crowd will be in attendance. On these occasions, the hall takes on the festive atmosphere of a wedding reception, as cousins who have not seen each other in years exchange noisy greetings. There is much hand-waving, cries of recognition and boisterous conversation. Here and there one notices an oasis of silence in the form of a husband, father, or uncle who has been dragged against his wishes to listen to a piano recital when he would prefer to remain home and watch television.

The house lights dim and the audience tears itself away from its animated social activity to focus attention on the stage. It betrays a lack of familiarity with concert decorum by the nature and timing of its applause. From the initial ovation that accompanies the young performer's entrance, to the final round of applause after the last bow, the intensity never varies. It is no exaggeration to say that this audience will clap at the slightest pause, for example, between variations, movements of a sonata, preludes and fugues, and at the deceptive close near the end of *Invitation to the Dance*, while the more knowledgeable members of the audience (probably fellow students) loudly shush their less sophisticated neighbors. By the time the slow movement of the "Pathétique" Sonata has arrived, not a few bored male relatives will have fallen asleep, only to be nudged awake at regular intervals by their indignant spouses.

### The Intellectual Audience

There are no drowsers in the intellectual audience. Intense concentration is the order of the day. Gatherings at intermission time are more subdued than those at debuts; politics, the theatre, art, books, and psychoanalysis are the principal topics of conversation. To be worthy of the intellectual audience, music must provide a sound basis for discussion of ideas. Here is a partial list of the most "verbalized" composers and types of music favored by this audience:

*Stravinsky*—Close association with poets, choreographers, painters (Cocteau, Diaghilev, Picasso, Chagall, Bakst, Nijinsky, Auden, and so on).

*Weill*—Between-the-wars German political and social degeneration a fascinating backdrop for Weill's bitter musical commentary.

*Schöenberg*—Irresistible attraction to intellectual audience due to radical implication of serialization (12-tone system).

*Harpsichord recitals, "musica antiqua," madrigal groups, and so on*—Automatic exclusion of music of the Romantic Era.

*Webern*—A fascinating miniaturist; also called musical counterpart of Paul Klee, Swiss abstract painter.

The above examples do not include *Firebird, Petrouchka*, and *Transfigured Night* because these pieces have become "popular" works in the symphonic repertoire. This is the kiss of death. For when the general public takes a work to its collective bosom, you can be sure that the intellectual audience will abandon it sooner or later.

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

### The Lieder Audience

Coolness gives way to warmth, theorizing to sentiment, in the case of the *lieder* audience. Imported from Europe before World War II, this is one of the most attentive audiences in the world of music. The word "attentive," though, is too weak a description; rapt is better, especially when referring to a Lotte Lehmann recital. The overflow audiences that attended this great artist's performances shortly before her retirement transported Town Hall from 43rd Street to the *Musikverein* in Vienna. The hush that filled the hall was almost palpable, handkerchiefs daubed at misty eyes, and the applause rolled in ardent, emotional waves. The magic of Lehmann and her audience has never quite been duplicated in recent years, though the same audience gives such artists as Dietrich Fischer-Dieskau, Elisabeth Schwarzkopf, and Irmgard Seefried warm receptions.

### The Controversial Audience

The audience drawn by controversy normally contains a large percentage of nonmusical elements. The postwar appearances in New York of politically-tainted German artists turned Carnegie Hall into a political arena, while the arrival of the cream of Russia's musical and terpsichorean talent set New York agog. But after the smoke of controversy has cleared away, and the artists' intrinsic values calmly appraised, the political element diminishes in size and importance.

### Opera Audiences

Although the Metropolitan Opera is a tea room in comparison with some of Italy's boisterous opera houses, the claques, official and otherwise, give Met audiences their special flavor. Everyone is familiar with the more flamboyant bravo-shouter, but there are more subtle examples of the species. For example, take the case of the young lady who attended a performance of *Lucia di Lammermoor* in which her favorite soprano sang the title role. When Lucia dies in the opera's penultimate scene, leaving the stage to the tenor, the fan saw no point in remaining for the rest of the performance, and walked out of the house looking like a "this is where I came in" moviegoer.

### The Folk Song Audience

Youth is the most noticeable ingredient in the folk song audience. Many of its members play guitar or recorder, collect discs by the Weavers, Alan Lomax, and so on, and congregate around the fountain in Washington Square Park to listen informally to bearded modern troubadours.

A comprehensive survey of audiences would have to include the subscription night at the Philharmonic, opening night at the Metropolitan Opera House, benefit audiences, and many others. The next time you attend a concert, look around you and try your hand at audience analysis. AE

# TAPE GUIDE

(*from page 32*)

others fall significantly wide of the mark, usually in the direction of inadequate bass boost, causing the sound to be definitely on the "thin" side.

Therefore if one intends to use his control amplifier for equalizing the signar from a tape head, it is a good idea to have the control amplifier checked out by a technician aganist the NARTB curve. This can be done by playing back a test tape and checking for flat response at the output of the control amplifier, or by feeding signals from an audio oscillator into the tape-head input and checking whether the response at the output of the control amplifier conforms to *Fig.* 3. If response does not deviate more than 3 db from the NARTB curve between 50 and 15,000 cps, it is acceptable.

For those having older control amplifiers without an input for tape head, it is fairly simple to convert one of the phono positions—such as LP or "European"—so that the equalization will instead be NARTB. Thus one can accommodate the signal from a tape head which is fed into the magnetic phono jack. But one must then of course remove the phono plug from the jack. On the other hand, some control amplifiers have two magnetic phono jacks that can be used simultaneously, and in this case one of the jacks can be converted to tape head use. Or, if there is an input jack marked "microphone," this can be converted. *Figure* 4 shows some typical circuits that will produce NARTB playback equalization; parts A and B show losser type equalization, while C shows feedback equalization. If none of these circuits is suitable for the particular control amplifier, information can generally be obtained from the manufacturer of the amplifier in question on modifying the phono equalization circuit to produce NARTB equalization instead.

If no other alternative is available, one can simply feed the signal from the tape head into the magnetic phono input jack. Amplification will usually be sufficient, but because of the difference between the RIAA and NARTB curves frequency response will be as shown in *Fig.* 5; bass will be insufficient, there will be a slight hump in the middle range, and the upper treble frequencies will suffer. Some degree of correction can be achieved by using the bass control for bass boost, but there is still apt to be a significant departure from flat response in this region because it is

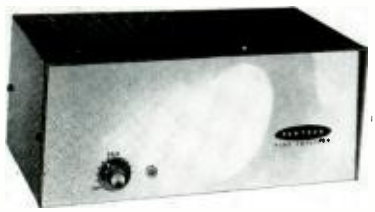


Fig. 6. Tape playback amplifier—Pentron CA-11.

unlikely that the characteristic of the bass control will exactly complement the bass deficiency shown in *Fig.* 5. It is not feasible to compensate the hump in the mid-range, because attenuation by means of the treble control would aggravate the treble deficiency at the high end.

### Recording

Unlike a phonograph, the tape transport is also capable of recording, given suitable electronics. But recording electronics differ significantly from playback electronics in two vital respects:

1. An oscillator is required to furnish high-frequency bias current to the record head, in order to bring distortion

Fig. 7. Another type of tape playback amplifier—Viking PB60.

down to acceptable levels and to increase the amount of signal recorded on the tape. Bias current is also used to energize the erase head, so that the previous signal on the tape will be erased before it reaches the record head. (However, this is not a strictly necessary feature, although it is virtually universal; one could instead use a bulk eraser (a large a.c. electromagnet) to erase the tape, which is often done by those seeking maximum results.)

2. A record level indicator—meter, magic eye tube, or neon lamp—is required to indicate whether the signal being recorded is too great, breeding excessive distortion, or whether it is too small, resulting in a poor signal-to-noise ratio.

These additional requirements mean that it is far from simple to modify the electronics of a control amplifier so that they will be suitable for recording as well as playing a tape. To date, the writer has seen no control amplifier incorporating complete tape electronics, although there is always the possibility that some manufacturer will eventually bring out such a unit.

But as things stand, by purchasing only a transport the audiofan limits himself to playing tapes recorded by others—either commercial tapes (that are considerably more expensive than phono discs of equivalent playing time) or tapes recorded by friends. If one does not own an FM tuner, or if the content and quality of FM programs in one's locality offer no incentive to preserving them on tape, the absence of recording facilities may not be missed. On the other hand, many use their tape recorders extensively for copying discs they have purchased. With proper care of the machine and the tape, the latter can be played thousands of times without suffering blemish (such as scratches, ticks, and pops in the case of discs) and without significantly undergoing change with respect to frequency response and distortion. Hence the disc can be played once in order to record a tape and then be put aside, and the tape can be played as often as wished instead. In the event of misadventure to the tape—loss, accidental erasure, damage to several feet because of a tangle, or the like—the disc can be brought out again for making a new tape.

It is very important that the cable connecting the playback head on the transport to the control amplifier be as short as possible. The head is customarily a high impedance affair, and 200 μμf or less capacitance across it produces a sharp drop in response close to or within the audio range. The greater the capacitance, the lower is the frequency at which treble droop begins. A major factor in this shunt capacitance is that of the cable. Therefore one should use cable of minimum capacitance per foot (about 25 μμf per foot is available) and of minimum length.

Because the signal from the tape head is very small, just a few millivolts, it is subjected to tremendous amplification. Moreover, as shown in *Fig.* 3, a great deal of bass boost is applied to it. Hence any hum picked up by the cable will be amplified to the extent where it is apt to be audible. Accordingly, one must be careful to route the cable from the head to the control amplifier so that it does not encounter magnetic fields produced by motors or transformers.

### Transport and Electronics

Those desiring only the playback

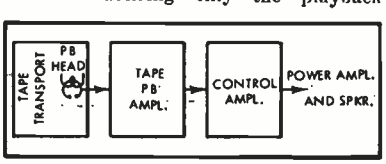



Fig. 8. Use of a separate tape playback amplifier in an audio system.

Fig. 9. Record and playback tape amplifier — Webster Electric.

function, but not owning a control amplifier with proper equalization for a tape head, can purchase a tape playback amplifier separately (*Figs.* 6 and 7) and use it with the transport of one's choice. Thus the signal is fed from the playback head to the tape playback amplifier, and from the latter to the control amplifier, as illustrated in *Fig.* 8. Again, if such a course is followed, one must guard against excessive cable length between the head and the playback amplifier, and one must route the cable to avoid hum pickup.

If one plans to record as well as play tapes, it is possible to purchase a complete tape amplifier separate from the transport, that is, a unit containing both playback and record electronics. (*Figs.* 9 and 10). Or one might build a complete tape amplifier on the basis of an article appearing now and then in the literature. In either case, one must proceed with greater care and caution than when purchasing tape electronics that are integrated with the tape transport. By an integrated unit we do not necessarily mean that the electronics is physically part of the transport; instead we refer to a tape amplifier *specifically designed* for use with a given transport, whether or not they are on one chassis.

An integrated transport and tape amplifier are apt to have the following advantages:

1. Length and routing of the cable will minimize high-frequency losses and hum pickup.

2. The oscillator circuit will be designed to supply the correct amount of bias current required by the particular record and erase heads used on the transport. Requirements for optimum performance differ by at least slight amounts and sometimes by major amounts among heads of different manufacture.

3. The record-level indicator will supply a proper reading. The correct amount of audio recording signal depends not upon the signal (electrical) delivered to the head but upon the signal (magnetic) delivered to the tape. For the same amount of signal fed to two different heads, different amounts of magnetic flux may be applied to the tape, resulting in different levels of recorded signal and therefore different amounts of recorded distortion.

4. Provision for switching from the play mode to the record mode will be at the transport rather than at the tape amplifier, accompanied by an interlock feature to prevent accidentally putting the machine in the record mode and erasing a valued tape. Usually the interlock

Fig. 10. Record and playback tape amplifier—Viking RP61.

consists of an auxiliary button or lever that one must actuate in order to bring the record electronics into use.

5. Equalization will be more specific. Depending upon construction of the head, particularly gap width, high-frequency losses will differ somewhat from one make of head to another. Also, the frequency response at the very low end may vary among heads. In an integrated tape machine, the equalization will probably take into account the deviations of a particular make of head from ideal response, so that over-all frequency response is relatively flat.

The term tape recorder should prop-


Fig. 11. A tape recorder proper—Magnecord S-36B.

Fig. 12. Complete tape recorder, including power amplifier and speaker.

erly be applied to a unit (for example, that in *Fig.* 11) comprising a transport accompanied by record and playback electronics, with the playback electronics limited to delivering a signal voltage capable of driving a control amplifier or power amplifier—about 1 volt on peaks. Many tape machines, however, particularly the so-called "home" units, which are mostly relatively low in price, also include a power amplifier and a speaker, as in *Fig.* 12, so that one does not have to rely on external facilities for playback. Such a machine may be referred to as a self-contained tape recorder. The advantages of a self-contained unit are obvious enough to require no more than a few words of comment. The machine can be taken anywhere—school, church, friends' homes, etc.—and one need not wait until returning to one's high fidelity system to hear the results of a recording session. One can check on the spot whether the recording is satisfactory by playing back the recording. If it is not satisfactory, circumstances frequently permit one to re-record.

However, there *may* be some disadvantages. To offer more functions at the same price or even lower price, there must be a sacrifice in quality somewhere —in the transport mechanism, in the electronics, or both. There is a substantial likelihood that the oscillator will be a single-ended rather than push-pull affair. Typically in a tape machine including a power amplifier, the output stage is a single tube such as a 6V6 or 6AQ5. In the record mode, this tube is switched to serve as an oscillator. However, a single-ended oscillator has more distortion than a push-pull one that uses a tube such as the 12AU7. Minimum waveform distortion of the bias frequency is important inasmuch as this distortion produces noise in recording. It should be added that even in tape machines incorporating a push-pull audio output stage, such as two 6AQ5's, it is general practice to use only one of these tubes as the oscillator when recording. Æ

# DISTORTION STORY

(*from page 26*)

then to find out where it happens and how to stop it. This is following a development or design approach. But what the industry also needs is a means for demonstrating whether these things happen and giving figures to them. For which reason standardized tests, applicable externally to the amplifier, are required.

It is suggested that distortion analysis be based more on the transfer characteristics of the amplifier than on nominal harmonic or intermodulation statements. This is readily possible by a comparatively minor adaptation to the circuitry of a harmonic test meter. A similar but a little more elaborate modification to IM test circuitry will enable exploration of the non-linear effects producing phase and amplitude modulation at extreme high frequencies. This should take care of the high-frequency transient effects as well as various other peculiar forms of distortion that give artificially low readings under more standard measurement conditions.

Further it is suggested that some standardized loading test be devised for applying a load of specific phase angle over a certain frequency range to see the effect of reactive loading on the feedback of an amplifier. This will be more informative than merely ascertaining that the amplifier stays "on the ground" with a variety of reactive loads.

Finally, to take care of the trigger overload effects, it is suggested that some standardized form of data be derived for presenting information on the performance of an amplifier at conditions representing a specific overload. For example, 10 per cent, or maybe 100 per cent beyond the nominal output. It would have to be emphasized that this should be a definite overload beyond the maximum power capabilities of the amplifier and will not be satisfied by merely downgrading the nominal rating of the amplifier.

If an amplifier should give 30 watts undistorted, it would not be a successful method to rate it at 15 watts just so it can have a 100 per cent overload without showing trigger distortion. If it will give 30 watts with acceptable distortion, then the test should apply an input, that should give 60 watts, if the amplifier did not limit at the 30-watt point, and investigate what happens to the amplifier under this condition, giving figures in power and distortion for this input signal. This may seem rather rigorous but it also seems the only way to specify absence of undesirable trigger effects in an amplifier.

Not a little thought is being given by various groups to the problem of how to rate, or specify, amplifier's perform-

ance. Since no one distortion test ever appears likely to be a catch-all for all the things that *can* happen to distort program material, it seems we must settle for a fairly elaborate test procedure that is reasonably exhaustive of the possibilities. Then it would seem to be an opportune time to introduce a standardized distortion-rating figure, that will weight the various possible forms according to their subjective annoyance value, and come up with a performance rating where a higher number means better performance—*less* (audible) distortion.

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### Appendix

The transfer characteristic can be written as a power series,

$$y = A(x + bx^2 + cx^3 + dx^4 + \ldots) \quad (1)$$

where $x$ is the input, $A$ the amplification, or its linear term, and $b$, $c$, $d$, etc., the coefficients of successive order terms introducing distortion.

If the input is a sine wave, it can be written

$$x = V \sin \omega t \quad (2)$$

Substituting this for the various order terms of $x$ in Eq. (*1*), the following substitutions can be made:

$$\sin^2\omega t = \tfrac{1}{2}(1 - \cos 2\omega t) \quad (3)$$

$$\sin^3\omega t = \tfrac{1}{4}(3 \sin \omega t - \sin 3\omega t) \quad (4)$$

$$\sin^4\omega t = \tfrac{1}{8}(3 - 4 \cos 2\omega t + \cos 4\omega t) \quad (5)$$

$$\sin^5\omega t = \tfrac{1}{16}(10 \sin \omega t - 5 \sin 3\omega t + \sin 5\omega t) \quad (6)$$

and so on.

Now assuming the transfer characteristic is, specifically,

$$y = A(x + cx^3 - ex^5) \quad (7)$$

substituting, successively (*2*), (*4*), and (*6*) leads to the expression:

$$y = AV\left[\left(1 + \frac{3cV^2}{4} - \frac{5eV^4}{8}\right)\sin \omega t + \left(\frac{cV^3}{4} - \frac{5eV^4}{16}\right)\sin 3\omega t - \frac{eV^4}{16}\sin 5\omega t\right] \quad (8)$$

At a value of $V$ found by equating the $3\omega t$ term to zero, the third harmonic vanishes. This is

$$V^2 = \frac{4c}{5e} \quad (9)$$

For smaller values of $V$ the third harmonic has a positive coefficient, for larger values it is negative.

Taking the simple case where two successive stages produce only quadratic curvature, if the first-stage transfer response is

$$y = A(x + bx^2) \quad (10)$$

and the second stage

$$z = A'(y - b'y^2) \quad (11)$$

the over-all characteristic is, by substitution,

$$z = AA'[x + (b - Ab')x^2 + 2Abb'x^3 + Ab^2b'x^4] \quad (12)$$

For low level amplification, where the $x^2$ term contributes negligible second, the distortion can be nulled by making

$$b = Ab' \quad (13)$$

But at levels where higher orders become significant, the $x^4$ term also contributes a component of second harmonic, and cancellation will only occur at one level, because the coefficient of second harmonic will contain different powers of $V$.

Assuming the simple push-pull case where two successive stages produce only cubic terms of curvature has responses represented by

$$y = A(x - cx^3) \quad (14)$$

and

$$z = A'(y + c'x^3) \quad (15)$$

this evaluates to

$$z = AA'[x + (A^2c' - c)x^3 - 3A^2cc'x^5 + 3A^2c^2c'x^7 - A^3c^3c'x^9] \quad (16)$$

about which similar remarks apply.

From the geometry of *Fig.* 11, which represents half and quarter wave respectively, of the distorted wave, and the distortion residue, balanced on an average basis the following relationships may be derived, assuming each curve may be approximated by a quadrant of a sine wave, of different periods:

$$b = \cos^{-1}\frac{1}{1+a} \quad (17)$$

$$c = \sin^{-1}\frac{1}{1+a} \quad (18)$$

Writing $b + c = \frac{\pi}{2}$, the areas can be derived.

The up-going "pulse" has an area of

$$A_c = \frac{2ab}{\pi} \quad (19)$$

The down-going quadrant of fundamental component is $f$. Equating these areas, which is the condition obtained by balancing out fundamental in an average-reading distortion meter,

$$f = \frac{2ab}{\pi} \quad (20)$$

As, from the geometry,

$$e + f = a \quad (21)$$

an expression can be derived for $e$

$$e = a\left(1 - \frac{2b}{\pi}\right) \quad (22)$$

Hence approximate area under each part (positive and negative-going) is, using this approximation

$$A_p = \frac{2ab}{\pi}\left(1 - \frac{2b}{\pi}\right) \quad (23)$$

And the indication is the total area divided by the total duration,

$$D_m = \frac{4ab}{\pi}\left(1 - \frac{2b}{\pi}\right) \div \frac{\pi}{2} = a\frac{8b}{\pi^2}\left(1 - \frac{2b}{\pi}\right) \quad (24)$$

As $a$ is the peak basis reading, the remaining factor is the correction, plotted in *Fig.* 11. Æ

# NEGATIVE-SUPPLY OUTBOARD CODAN

(*from page 23*)

volts, commonly lasts more than two years of continuous commercial service, an FP 217.9 (300 volts), or an FP 229.3 (400 volts) can be substituted if a greater margin of safety is wanted. All plug into the same socket.

Wiring, practically all of which is under the chassis, can be done in any workmanlike manner. In the prototype, power leads were cabled, whereas high-frequency leads were run substantially "point to point". Although the high-frequency portion of this device shows no tendency to oscillate, it is just plain good sense to keep the grid and plate circuits of the pentode separated as much as possible.

As only one half of the i. f. transformer is used, the other L C circuit should be opened, to prevent unwanted resonances and adsorption. Construction is simplified by liberal use of tie points, which support minor components, and firm up the wiring, as in *Fig.* 6.

After wiring is completed and checked, and receiver connections provided for, short the "squelch" connection to ground, and measure the d. c. voltage from grid of the a. f. tube to ground. This, which is largely contact potential, usually measures about minus one volt on a 11-megohm-input vtvm.

Now, with the codan connected to the power supply and receiver, and a signal coming in, remove the "squelch" connector short and adjust the "bias" control until the grid-to-ground voltage of the a. f. tube is the same as before. With the signal tuned to exact resonance, adjust the active coil of the i. f. transformer until the a. c. voltage from pentode plate to ground is at a maximum.

Removal of the signal, easily brought about for test purposes by rotating the sensitivity control toward zero, immediately silences the audio system. Detuning the receiver has the same general effect. Due to the relatively higher selectivity of the codan, and to the neon-lamp-produced snap action, signals will tend to snap in and out as the receiver is tuned across the band.

By adjusting the sensitivity of the codan, all signals below a specific level can be eliminated, as well as the prevalent interstation "monkey chatter." Sensitivity of this codan is such that any signal producing more than 0.5 volts rms of i. f. output will activate the audio system at maximum sensitivity setting. This sensitivity is more than adequate for most areas, but it may be increased to about 0.35 volts, rms, by substituting a 6AW8A for the 6U8 here used. This requires a change in socket connections, as the two tubes do not have the same base connections.

Although the constants and components here shown are for an i. f. of nominally 455 kc., a simple change in the pentode plate coil will permit operation at any i. f. up to about 2 mc., and down to or below 50 kc. Operation at 10.7 megacycles is possible, but is not recommended unless the codan can be placed in very close proximity to the last

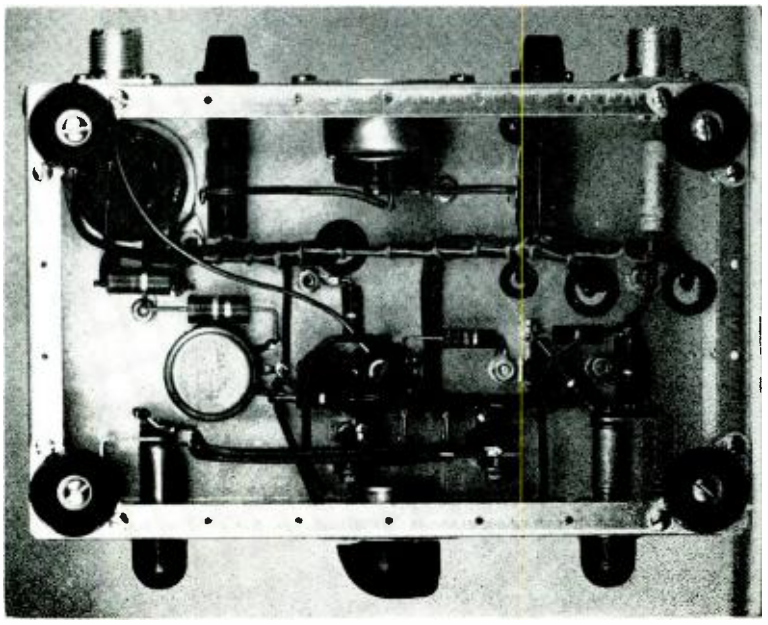

Fig. 6 Under-chassis view of negative supply codan.

i. f. tube. At this frequency, the capacitance of the connecting cable becomes a problem, and one of several alternative codan circuits will work better than the one shown.

By use of ample margins of safety, as is recommended here, life of this codan is substantially infinite, except for the tube, which is nominally rated at 1000 hours, and which will probably last for more than 7500 hours, barring accidents.

Tuning, with a codan of this type, is both simpler and more precise than with the usual method. Only stations above a certain (adjustable) level are heard at all, and these are not heard until they are almost exactly in tune. Considerable use of codan-equipped receivers in all categories from aeronautical radio to supposedly high fidelity broadcast indicates to the writer that a codan is a desirable for convenient listening. Æ

## AUDIO ETC

(*from page 12*)

the fire. It was at this sort of impasse that I gave up and pulled *everything* out, to start all over again!

Then more credit to Dyna, in a difficult situation, for the excellent visual hook-up diagram that comes with the system. It's just a simple picture of the lay-out from the rear, with the cables marked in big, black lines; you follow your nose and plug them all in. Don't have to have any idea as to what they connect. (The labels on these dozens of sockets are, as anybody could guess, something less than communicative. I never could have got to first base if I'd tried to figure them out without any other help. What can Dyna do, though? How can you say everything in monosyllables?)

Once assembled, your Dyna stereo system is ready for business—almost. All you need to do, at this point, is to set a couple of dozen controls in the right positions. You merely flip the two monitor switches on the tape preamps from INPUT to TAPE, move a slide switch at the top of the stereo control box from TAPE to INPUT (this, even though there is no tape to be seen within miles), turn four tone-control knobs, two bass and two treble, to the flat position (I pasted paper over them to keep them out of trouble), set both preamp equalization controls at RIAA, switch the two loudness controls on the preamps to OFF and the *third* loudness control on the control unit from LOUDNESS to VOLUME, set the channel reverse switch to the position marked CHANNEL (that's what it says), turn the two volume controls on the preamps all the way up and the master volume control on the stereo control unit about halfway around, move the BLEND control away from MONO 1 and MONO 2 to STEREO, the BALANCE control to the halfway point between RIGHT and LEFT . . . let's see, have I forgotten anything? Nope; that ought to do it. And now you'll get that lovely, velvety semi-silence that is Dyna's miracle-result and your pride and joy, as you prepare to listen to your first stereo disc. Amazing, I calls it.

### Power Tangle

I seem to have skipped another aspect of the hooking-up department, which accounts for a good part of the macaroni, and that is the power-cable tangle. Unlike

the neatly tailored signal cables, Dyna's power cables are the usual length—full-length—and the cord is high quality, stiff, heavy-duty stuff, too. There seem to be dozens of power cords. Power cords everywhere, and all plugged around and behind and beneath each other. Under the circumstances, every single one is legitimate and necessary. But what a pile of macaroni *these* make!

In our older hi-fi systems, again, power cords were a minor problem. Only one, at first, and then maybe two, when the phono came to be plugged into the system for an over-all switched control. But separate preamps, self-powered, and the other separate units began the march towards the power cord tangle—and stereo has doubled it practically overnight. Separate-unit stereo has, at least.

There isn't a thing you can do in this particular Dyna system (as in others) but plug and plug and plug—in this case, into Dyna's helpful preamp outlets, switched and unswitched, four of them on each unit.

There is one long power cord for each of the two big Mark III amplifiers, one for each of the preamp units and one for the power supply unit, plus, of course, a cord for the radio and still another for the phono—that makes already seveu big, snaky 117-volt lines to run up to the common on-off control center at the two preamps. Tangled in with them are still more power cords—two power-supply cables, one for each preamp—plus the main external signal-carrying cables as well, two from the phono, two from the tuner and two from the preamps out to the main amplifiers.

Looking at it another way, here are the cables that run out from each of my eight units, as I've just counted them:

| | |
|---|---|
| Attached to Preamp A | 6 cables. |
| Preamp B | 9 |
| Stereo Control Unit | 6 |
| Power supply | 4 |
| Phono | 3 |
| Tuner | 3 |
| Main amp. A | 3 |
| Main amp. B | 3. |

You can see what happens when one of these units, or several, are moved by themselves. Impossible! (But, of course, once set up you shouldn't have to.)

Enough said. The moral is clear: if you want the real advantages of this flexible, separate-unit stereo conversion, you must take the cable macaroni along with it, and the multitude of switches too. You'll learn to operate the system readily enough and the only continuing problem is how to cope with other people, young and old, who may also want to play. As usual, I've taken to large taped labels for this, and to taped-over controls that shouldn't be moved. I have a huge arrow pointing to the volume control on preamp B, saying ON-OFF, and another to the stereo master volume control saying MAIN VOLUME. Everything else is pasted over and immovable.

It is quite possible, of course, that as the jealous boss of your household you may want to have your system set up so that only you can make it go. Dyna will oblige.

### Rather Warm for May

I have a couple of reservations concerning this big Dynakit system, over and against its complex but highly workable and praiseworthy nature.

First, I was bothered by a purely external trouble, mechanical hum emanating from the amplifier transformers. It's modest, but you can hear it, persistently, from any part of the room when the music doesn't drown it out. My first Mark III had this trouble but I thought it was just one particular transformer, perhaps with loose plates. Alas, both my present Mark III's make a considerable humming noise and removing the cage (as the company suggested) doesn't do any good. (Not wise, anyway, with those big, hot tubes.) I find this hum musically annoying, even though it remains at the same level regardless of volume setting. I don't like hum—*any* hum.

Well, after many weeks, I finally got my energy up and went about removing those talking amplifiers from hearing range. You can't enclose them—too much heat. And if you want centralized control, the cables involve length problems. I finally moved the big amplifiers clean out of my living room onto a foam-cushioned wood box around the corner in the hall. A pair of very long signal cables came next and I prayed to myself, cathode follower, please. No trouble experienced, so long signal cables *are* feasible. Good!

The main amplifiers are now separately plugged into a nearby wall socket and must be turned on individually—have to do something about that—but at last, I hear not a trace of hum in my living room when the system is turned on, and what an improvement! The Dynakit system really goes to town as it should, now, and I love it dearly.

My second reservation has to do with heat. Speaking generally, I am uneasy about the very heavy current drain in this equipment (and in many another high-power stereo system as well). I don't like the whopping amount of heat that is sent out, mostly from the big power amplifiers. It'll be uncomfortable in hot weather and more than a match for an air conditioner; but I don't find the idea exactly reassuring in any weather, though Dynakit equipment is as safe as it can be under the circumstances.

I can't help feeling that stereo's double channel requirements are going to have to lead to a lot more of the low-drain transistor type of circuitry, such as that in the pair of Vico transistor amplifiers I used last summer and fall for my stereo. These two units, providing between them about 60 watts of rated output, burned up only some 14 watts when at the idle. I left them on most of the time. And the heat production was correspondingly negligible.

If we must have high-output stereo, theu we'll have to begin thinking about power cuts, here and there and maybe everywhere, to bring stereo into reasonable balance with mono hi-fi equipment. Lots of people, I know, won't mind the big current drain of the Dyna type of equipment nor the generated heat; but for home stereo use in general, less current and less heat are definitely in order. After an hour or so, the bottom plates on my two Mark III amplifiers are almost too hot to touch and the soft cushion underneath is likely to begin objecting.

## 2. GLASER-STEERS STEREO

After using the Glaser-Steers mono changer last year, I've exchanged it for the new stereo version and herewith report on same, with some enthusiasm.

The GS-77 is basically the same changer, with the old values, much appreciated on my first try, such as the turntable that stops during the change cycle, allowing the stylus to descend on a stationary disc, then picks up to speed. The operation of the current model is definitely smoother and quieter than my earlier sample, out of the first production. Hardly any overt mechanical noise to annoy, and the treatment of

the stylus is very considerate in the dropping.

How does a stereo-converted changer stack up against separate-arm competition? Are the basic stereo problems well solved?

First, the stereo GS-77 has a redesigned drive, for delicacy of movement and for reduction of rumble. The motor is smaller, the change-cycle slower—and I find this no disadvantage at all. Remember that in the Glaser-Steers changer the change cycle remains the same for all turntable speeds, a basic improvement of real value. Now, in the new model, it is neither too fast, nor too slow, at all record speeds, regardless. I rather dislike a too-quick change cycle, especially since 78 rpm sides are so seldom around to be joined up by the changer's action. A pause is musically a good idea.

As for rumble, the GS-77 is quite good—very good for a changer, I'd say. You can tell the difference clearly enough between mono and stereo playing, but then you can do the same for even the best tables, to some extent. The expensive separate-unit tables still do a better job on rumble than is currently possible in a complete changer, but this changer is easily acceptable for most home stereo. Main likely trouble is perhaps (a) in rumble-exaggerating stereo records such as piano discs and (b) with those speaker systems that have peaks in the lower middle bass, intended or unintended. They are sure to exaggerate any rumble that may be present. (It sounds out less noticeably in a speaker system with true, flat bass.)

The Glaser-Steers arm has been revamped to take stereo and is now, shall we say, a 3¾-wire system. Nominally 4-wire, but the circuits include the arm itself as a short segment of one channel; there are only three contacts at the back end of the cartridge, the fourth going through the arm.

I rather wish it had been possible to use four contacts in the mounting, with the arm grounded at one end. Even that short stretch of exposed arm, connected at *both* ends as part of the circuit, could cause trouble on occasion with hum pickup. Other problems are possible, if I'm right, that may not be so easy to pin down in a given case. For instance, to take one I ran into, there is a mono switch on the changer that parallels the two sides of the cartridge, to eliminate vertical response when playing monophonic records. It does just that—but with my Mark III Dynakit stereo system it sets up a fine ground loop with a hum level that is too high for comfort. Trades rumble for hum. (Note that the Dynakit blend control serves the same function at the other end of the cartridge circuit, without hum.)

I have tried a true 4-wire system under the same circumstances (the arm grounded at the cartridge end and not a part of any circuit) and there is no ground loop, no added hum.

However, note well that most present stereo-converted changers are of the straight three-wire type with a common ground throughout. This evidently works out well enough in many situations. But a 4-wire system is a better idea, any way you look at it. Probably worth the extra cost it may entail.

The arm in the new Glaser-Steers accepts a new type of cartridge mount that plugs upward from below and is fastened by a knurled screw on top. A bit clumsy, but it works, and allows for cartridge change with the advantage of big, positive contacts and easy wiring-up. I'm not overly happy about the arm itself—or *any* present changer arm that I know of, and in particular the still-necessary practice of using an ordinary spring to produce stylus-force adjustment.

Glaser Steers, to be sure, has done nobly with what it has. The changer arm rides freely and as light as a feather when loose from the changer mechanism. It will track well most of the time and with most cartridges at even extremely low stylus forces—two or three grams, as far as I can see. Moreover, the spring, which looks like any old changer-arm spring, actually is part of a quite ingenious double-pivot arrangement at the arm's rear. I didn't even notice it at first, but discovered to my surprise that the arm "weight" did, unexpectedly, remain constant over several inches of up-and-down movement, once it was set. Enough to allow for equal stylus force over a span of eight or ten records on the machine.

But this device loosens or tightens the spring with the conventional small screw wheel, to change the stylus force—and it is here that I find the adjustment still not accurate enough for the ultimate in stereo. Like all such adjustments a turn one way isn't always equivalent to a turn back again; the spring lets go suddenly, or binds a bit, and the "response" to your finger is not linear, so to speak.

Thus in my own use of the changer I found that the GE stereo cartridge worked perfectly, its only trouble being slight hum pickup from the changer motor, near the center. No weight problems. But the Elac (Stereotwin) rode either too light, skittering over grooves and turning fuzzy, or too heavy, the stylus pressing back into and against the protecting shell with a loud chatter. I couldn't adjust the pressure in between, to suit this model. The Shure M7D, *not* designed for changer use (I tried it anyway, just to see what would happen), played generally very well in the Glaser-Steers, partly because its surrounding protective shell is not close to the stylus, which must be moved a long way before hitting it. But an indication that all was not well with this high-compliance cartridge came in a kind of pulsing swish, louder and softer as the record turned, which I can only attribute to a hair too much side-pull on the very compliant stylus. (Shure makes a stiffer cartridge M3D, specifically for changers.)

Considering that these cartridges were running in the Glaser-Steers with stylus forces down to around 2 grams (I tried to find the lightest possible setting) the machine really was doing a good, in its own way. Probably impossible on earlier changers of the pre-stereo era. But stereo is enormously demanding. For top hi-fi, with top cartridges, the changer of the future—if any—must do even better. This one is good for almost, but not quite, anything you can ask of it.

No doubt about it, stereo has brought with it the need for a radically new breed of changer with a new type of arm, more direct in its pressure (minus springs), longer and with more perfect, friction-free bearings. In my opinion, it will have to include as well a further change in the automatic aspect of arm movement, taking advantage of really light arms for lighter and simpler change mechanisms. But all this takes time for development.

Minor beefs: Glaser-Steers might have thought again before situating the stereo-mono switch in an incredibly clumsy place, just under the edge of the record, beneath the arm! To get at it you must unload the machine completely, or stop the record and reach laboriously underneath with your little finger. Can't be switched while the record is turning—which is just the time

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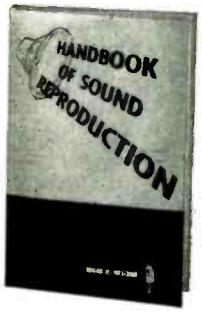


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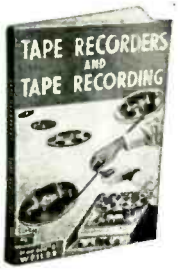


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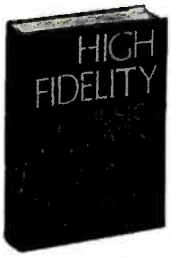



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you'll want to do it; people always forget. Also on this changer (as perhaps on others) there is one position of the controls that is potentially lethal; if you flip REJECT instead of OFF, the arm, when there's no record on the table, or only one, swings out and drops at the 7-inch position. When this happens without a record in place (i.e., when you had meant to turn the table off after using it manually), the delicate stereo stylus hits a series of nasty rubber bumps with tremendous force, relatively speaking. My Shure stylus was ripped right out of the cartridge, mount and all, and deposited harmlessly off in a corner. More power to Shure's foresight and I *was* doing something wrong, of course. But changers ought to be *completely* foolproof!

Well, this one is—almost. A darned good changer, as changers go, and you won't do better, I guess for a good while.

## 3. THOUSAND TIMES NO

Everybody who writes or speaks in public today is an authority, whether he wants to be or not—whether he is or isn't in fact. Either you're infallible, or you just ain't nothing, brother. This drives me crazy, because obviously I'm not infallible, nor is anybody else these days. I don't know *everything*.

If I did know everything, there wouldn't be anything left to learn.

Fellow telephoned be the other day, for instance, long distance from a city a couple of dozen miles out of New York, wanted me to come right over and set up his stereo speakers for him. I said sorry, I couldn't do it just then; he said, how much? and I said, more than you can pay and he came right back, well *how* much? He wanted an expert, and he was darned well going to get one, if it broke him.

He didn't get me because, as I quickly tried to explain to him, it wasn't only a matter of my time (a few other things to do . . .) but a matter of not really feeling I could be of much use to him in his own living room. After all, he has ears and his ears are the ones that, supposedly, are going to be pleased.

Now this sort of answer infuriates these guys. They don't want to do it themselves; they want an "expert"* to set it up right and then everything—of course—is guaranteed to work infallibly. After all, if the expert says so, it must be right.

That sort of thinking has gone a lot too far. OK if you want an expert, say, to do a valve job on your old V-8 engine, which needs it, beyond any doubt. OK if you ask your M.D. to tell you whether you've got pleurisy or only a smoker's hack. Some things, in this doubtful world, can really be determined exactly, precisely. Stereo listening, I maintain, isn't one of them and I'm just as glad.

This particular guy didn't even give me a chance to help him on the phone, for free. I tried. What shape room did he have? and was it live or dead, upholstered or full of hard surfaces? He didn't even listen. I said, it all depends—which it does, and no doubt about it. He kept saying, you're an expert, you just come out and I *know* you can set it all up for me in a couple of minutes. I said listen, do you think I have the magic formula for everybody's stereo? I'd have to do exactly what you'll do, experiment by trial and error, and perhaps I'd get a good stereo sound, maybe I wouldn't. (Or we might disagree as to what's good, and then what?)

Why don't you try so-and-so, I continued, and—by the way—what speakers are you using? I was certain that the one big mistake the fellow could make would be to anchor a pair of massive systems to the frame of his house and *then* go ahead and listen to see whether the placement was OK. At least I might head off that development for him.

Oh, a couple of AR-2 speakers, he said. But I want you to tell me where to put them, so . . . .

*Well!* I almost busted at that. No use trying to advise him that with two mobile speakers he could try every conceivable position in the living room at his leisure and determine by himself which placement suited *him* best—and it might even be enjoyable, as an experiment in listening. Nope, he wanted me to do it and he was obviously disappointed in me, an infallible expert who'd let him down. He sort of hung up as I was trying to tip him off on a good way to start—look for symmetrical locations, within the room, try both the side wall and the end wall before you make up your mind . . . .

I'll bet he called up *High Fidelity* magazine next. Editor John Conly lives a mere 125 miles from the guy and wouldn't he drop down at his earliest convenience? Or maybe *High Fidelity* had already said no, politely—a thousand times no—as our own editor would (60 miles) though both of them have much too kind hearts when it comes to this sort of thing.

Somebody sends me copies of two of my articles, one from this column and one from another magazine with an entirely different readership, suggesting I'm not being consistent. Of course not! The two pieces weren't for the same audience but, more important, I happen to have lived six months longer at the time of the second article—and I'm one of those experts who tries to live and learn. Boy, I learned a lot in those six months, mainly by being aware that there *was* plenty to learn. There still is, there always will be. Æ

* Navy definition, possibly, ED.

# RECORD REVUE

(*from page 53*)

edly, to coax and prod them into attending Mass more often. The tone is fatherly, the sentiments righteous and instructive, the atmosphere suitably subdued; the tenets of Catholicism are, of course, entirely taken for granted and are so preached, without question, and authoritatively. There isn't any question, needless to say, in a situation such as this, where the approved commentary accompanies an actual recording of a Mass in progress, by and for Catholics.

If you are genuinely interested in the significance of the Catholic Mass for music and/or are a Catholic, you'll find this record useful and interesting. Don't listen if you are inclined to argue about doctrine.

**The Music of Guillaume Dufay.** Dessoff Choirs, Leslie Chabay, instrs., Boepple.

**Vanguard BG 582; BGS 5008 stereo**

A record of very old music done with a modern touch but most musically, and an interesting comparison between stereo and mono versions. If I remember well, the mono set-up for this recording was entirely separate from the stereo, with separate mikes, separate tape machine. (I was there, but was busy trying to sing the chorus tenor part.)

Dufay is almost the first of the world's known and individual composers of enduring fame. Before him, only a handful wrote music of their own, under their own names—two stand out still, Perotin and Machault, of the Gothic period, plus an Englishman, John Dunstable; and Dufay adds a fourth, not counting lesser names. Before these times,

music that was other than troubadour or popular stuff, so to speak, was the work of many men, more nearly in the tradition of our folk song. A man may have made up his own new music—but his colleagues and successors took it over as theirs and refashioned it to their own needs.

There are three types of music here. Six short pieces are three-part settings by Dufay of Medieval hymns, out of Gregorian chant, those ancient tunes with rhymed Latin texts that persist and are familiar today in many more recent arrangements. Dufay's 500-year-old versions are strange and lovely for the ear; they are performed with various combinations of instruments and voices here.

A second group is of solo songs, to instrumental accompaniment. The instruments weren't specified in the old days, the playing and singing being left to the performers' judgment; these are done with oboe, viola, bassoon, and cello in some lovely arrangements by the conductor. Chabay is an operatic tenor who is theoretically quite out of style for such music, but his innate musicianship is fine enough so that these songs are beautifully, if anachronistically rendered. Better thus than in dull, though scholarly versions! There are profoundly moving moments in this music.

The third group of works is for the chorus. (The music was intended for solo voices; but they undoubtedly sang in a style unattainable today, perhaps with flat, nasal, non-wobbly tones; the choral tone of our modern singers comes closer to it than the sound of our own trained soloists). Strange harmonies for many ears here—but the music is a kind that easily grows upon you. Witness the singers, most of whom had never heard of Dufay when they came to sing him.

Recording? I enjoyed Vanguard's mono disc but the stereo was a revelation—far more persuasive, more natural, a better conveyor of the music, decidedly.

I tried both on a one-channel blend and found that, as expected, the mono version under that arrangement is technically brighter and more clear, as well as at a slightly higher level. Not a great deal of difference and the sacrifice in level is slight, with good surfaces. But given stereo reproduction—what a difference! No doubt about it, stereo does wonders for all kinds of music and especially that which needs to be put over with dramatic realism.

**Netherlands Chamber Choir—Palestrina-Monteverdi.** Felix de Nobel, conductor.
**Angel 35667**

**Motets for Christmas and Easter.** Philippe Caillard Vocal Ensemble.
**Westminster XWN 18809**

Here are two first rate European choruses, the first Dutch and the second French, singing the classical choral music of the sixteenth century and the newly exciting, instrumental-inclined vocal music of the beginning of that great century of quick changes, the seventeenth. In both of these choirs the musicianship of the singing is outstanding.

I mean by that a whole combination of virtues. Sense of style—understanding of the music and the way it can best be put forth; sense of pitch, extraordinarily good in both groups—to the consequent enjoyment of any listener; sense of rhythm, which leads these choirs to sing the music with that freely flowing sense of the word-rhythm that is essential, avoiding the "beating time" sort of sound that kills the music so quickly; sense of diction, which brings us the words clearly and dramatically—the words are the very basis for the sense of the music itself.

The Dutch singers are buxom, both in physique (see photo in album booklet!) and in their pleasingly fat tones; the French sing sweetly and brilliantly through the nose, as always, with the purity of an ensemble of oboes and flutes. Lovely.

In performances like this, I think any person with a musical ear can be pleased even though his knowledge of the music may be nil. Music speaks its own language, when it is done well. My only complaint here is technical: Westminster's groove cut is very heavy and in the loud passages there is some blasting. Groove-jumping, in some cases, isn't too unlikely. **AE**

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## PROFESSIONAL DIRECTORY



## Industry Notes . . .

**IHFM HEAD DISCUSSES PRICING.** The component high fidelity industry must awaken to the peril of unsound retail pricing practices if it is to maintain and expand its current pattern of profitable operation, Joseph N. Benjamin, president of the **Institute of High Fidelity Manufacturers,** said in a recent address in New York. Speaking before the **Producers of Associated Components for Electronics,** Mr. Benjamin, who is also president of the Bogen-Presto Division of Siegler Corporation, declared that recent discount advertising should be of great concern to manufacturers and dealers alike.

Speaking in behalf of a legitimate profit for all concerned, Mr. Benjamin cited seven important functions which the dealer must perform for his customers. Where discount pricing prevails, one or more of these functions must suffer, and both dealer and customer lose in the long run, Mr. Benjamin stated.

**LING, ALTEC MERGE.** Over 90 per cent of the stockholders of **Altec Companies** have agreed to exchange their stock on a share-for-share basis for **Ling Electronics** stock, thus giving final approval to merger of the two firms. The merger creates an organization with an expected sales volume of 22 to 25 million dollars in 1959. J. J. Ling, board chairman of Ling Electronics, stated that stockholders will be asked to approve a name change to **Ling-Altec,** and that Altec Companies will be operated as a subsidiary.

**FISHER OFFICIAL DECRIES CONFUSION.** James J. Parks, vice-president, Fisher Radio Corporation, speaking in Atlanta before the Southeastern Conference of the National Association of Music Merchants, contended that confusion in the mind of the public is having a serious effect on the sales of hi-fi equipment throughout the country. Mr. Parks' subject was "Understanding and Selling Stereo Hi-Fi." Lack of technical knowledge at sales levels is the industry's greatest problem, he stated. He asserted that, while it isn't necessary for a hi-fi salesman to be an engineer, it is important that he have a good knowledge of the equipment he is handling. Also, he bore heavily on the importance of having a wide assortment of phonograph records available so that demonstrations may cater to every taste.

## Industry People . . .

**Sherman M. Fairchild,** president of Fairchild Recording Equipment Corporation, appointed **Donald J. Plunkett** president in his place effective April 1. Formerly New York director of recording for Capitol Records, Mr. Plunkett is also president of the Audio Engineering Society . . . **Bernard Kardon** will continue with Harman-Kardon, Inc., in a consulting capacity after June when he relinquishes his title of vice-president and general manager. **Sidney Harman,** president, states that Mr. Kardon will also remain as a director of the company . . . **Edward Waldman,** with Telectro Industries Corporation since 1948, has been appointed to the new position of general manager.

**Richard Shahinian,** audio consultant, has opened shop as Festival Hi-Fi & Recording Company at 215–32 Hillside Ave., Queens Village, N. Y. . . . **William E. Johnson** has been named to the new post of dealer sales manager for the Heath Company . . . **R. H. Rogers,** pioneer in electronics advertising, has been appointed advertising and sales promotion manager of National Company . . . **George Sioles,** acoustics engineer formerly with University Loudspeakers, Inc., has joined CBS Laboratories, Inc., as group leader for transducer research.

Recent additions to the sales and merchandising staff of Electro-Voice, Inc., include **James M. Price,** who will act as general manager of the RME division, **Henry Mandler,** who will specialize in high-fidelity products, and **O. K. Ziemba,** who will assist with all activities involving distributor sales. **Arthur S. Robinson, Jr.,** has also joined Electro-Voice as traffic manager . . . **Joel M. Rowley,** formerly advertising manager for the Westclox Division of General Time Corporation, has joined V-M Corporation in a similar capacity . . . New ad and sales promotion manager for Tung-Sol Electric, Inc., is **Neil Uptegrove,** formerly manager of technical advertising for Allen B. Dumont Laboratories, Inc. . . . Appointment of **Robert McCarthy** to the new post of product manager has been announced by Bell Sound Systems. . . . **Stewart Edgerton,** formerly with the Ford Motor Company, is the newly appointed vice-president and controller of Shure Brothers, Inc. Æ

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Johann Gutenberg of Mainz on the Rhine is credited with the invention of movable type, a contribution of immeasurable worth to the arts and sciences. Unmeasured surely, but of great significance, are the contributions to the art-science of high fidelity made by James B. Lansing Sound, Inc.: There is the four-inch voice coil with its attendant high efficiency . . . the acoustical lens . . . the ring radiator . . . Now JBL brings you wide field stereo reproduction through radial refraction. This is the principle on which the magnificent JBL Ranger-Paragon and the more recent JBL Ranger-Metregon are based. Two highly efficient, full range, precision loudspeaker systems are integrated by a curved, refracting panel. You are not confined to one "best" listening spot, but can perceive all the realistic dimensions of stereophonic reproduction at its very best throughout the listening area. The JBL Ranger-Metregon comes within the reach of all true high fidelity enthusiasts. For, no less than seven different speaker systems may be installed within this exquisitely styled, meticulously finished acoustical dual enclosure. You may start with a basic system and progressively improve it. Perhaps some of the JBL loudspeakers you already own may be used. Write for a complete description of the JBL Ranger-Metregon and the name and address of the Authorized JBL Signature Audio Specialist in your community.

JBL

JAMES B. LANSING SOUND, INC., 3249 Casitas Ave., Los Angeles 39, Calif.

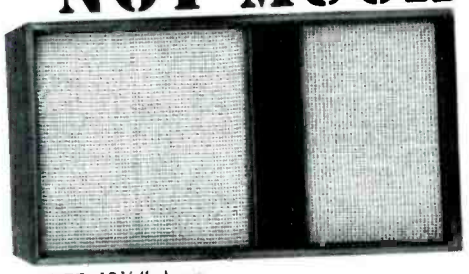
# STEP-UP TO STEREO...ON A BUDGET

*with* Stereo's Standard

STEREO'S STANDARD

IF THIS IS YOUR PRESENT or PROPOSED SPEAKER

## NOT MUCH BIGGER THAN A BREADBOX, BUT...



SIZE: 13½" deep, 14" high, 25" wide

Figure A

**the amazing Electro-Voice Regal gives you bass so low you can feel it— bass sounds you'd expect from a conventional enclosure three times the size.**

"OPTIMIZED BASS" is just one of the many extras in the new E-V Regal integrated speaker system. You get *balanced*, full-range flat response without attenuation or peaks, from bass-you-can-feel to beyond audibility. And, you can drive the Regal systems to concert volume with just 20 watts. (The Regal is more than 2½ times as efficient as other low-efficiency systems.) Now, double your listening area with wide, w-i-d-e dispersion, made possible by E-V's patented *Hoodwin diffraction horn. The Regal's exclusive right-up-front Presence and Brilliance controls (see A) give you infinite adjustment of treble and VHF compression-driver ranges. You will thrill to smooth, high-frequency response *without breakup* due to E-V's patented **Avedon Throat design. ¶The Regal's ultra-compact enclosure is finished on all four sides. You can place it *anywhere*—floor or shelf, vertically or horizontally. ¶Each Regal is a triumph of acoustical engineering . . . made up of the finest components E-V can assemble. Choose either the Regal III with separate 3-way system using precision-built E-V woofer, treble and VHF compression drivers. Just $147.00 net. Or the Regal IA separate 2-way system with E-V woofer and VHF driver. Only $103.00 net. Choose from luxurious tropical mahogany, limed oak or rich contemporary walnut. ¶Know the excitement of the E-V Regal. Compare its sound . . . compare its price at your franchised Electro-Voice high-fidelity showroom. ¶Electro-Voice also makes enclosures of every size, to meet every need, every budget . . . from the ultra-compact Coronet at $35.50 to the luxurious Patrician at $970.

*Patent No. 754,901 ** Des. Patent No. 182,351

*Write Electro-Voice, Dept. AD3, for free illustrated booklet, "Guide to High Fidelity Speakers for Stereo"*

REGAL BY Electro-Voice®

BUCHANAN, MICHIGAN
Superb Products Through Research

Electro-Acoustics · Bridges, High-Fidelity Loudspeakers · Public Address Speakers, Marine Instruments · EVI Professional Electronic Instruments and Military Material.