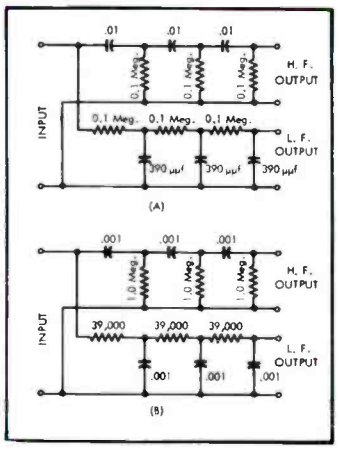
AUDIO

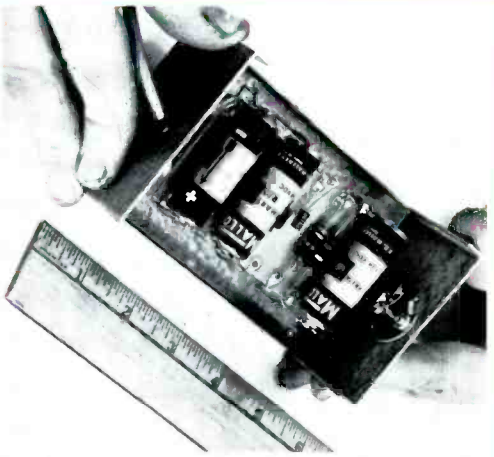
ENGINEERING MUSIC SOUND REPRODUCTION

JULY, 1957

50¢



Readers have shown great interest in electronic crossovers. The author tells their good and bad points. See page 17.



Use this transistor stage instead of a transformer to raise the signal from your low-output moving-coil pickup so it will work properly with conventional preamps. See page 20.

AN ACOUSTIC ILLUSION TELEPHONICALLY ACHIEVED

THE APERIODIC LOUDSPEAKER ENCLOSURE

THE R-C CROSSOVER COMPROMISE

TRANSISTOR PREAMP FOR LOW-OUTPUT PICKUPS

the only fifteen-inch extended range speaker made with a 4" voice coil

the JBL SIGNATURE D130

The four-inch voice coil in the JBL Signature D130 stiffens the speaker cone to form a rigid acoustic piston. Combined with suspension which permits long linear excursion, the D130 produces crisp, accurate bass. • The four-inch dural center dome is attached directly to the voice coil to form a large, effective high frequency radiator. The shallow curvilinear cone permits an excellent distribution of highs. • The large voice coil is made of edge-wound aluminum ribbon so that, with small mass, an unusually large amount of conductor is subjected to the lines of force in the gap of the precision-machined Alnico V magnet. • A pot structure of pure iron provides a low-reluctance return path for the magneto-motive force. Such extremely efficient use is made of the permanent magnet material that stray magnetic fields are virtually non-existent. • Tight electrical coupling and meticulous, close-tolerance workmanship combine to produce the most efficient extended range loudspeaker made anywhere. It is unsurpassed in its handling of transients. Bulletin number SB1002 describing the JBL Signature Model D130 will be sent to you free upon request.

specifications

PHYSICAL DIMENSIONS • Voice coil diameter 4"
Baffle hole diameter 13⅛" • Shipping weight 23 lbs.

ELECTRICAL • Power input 25 Watts • Impedance 16 Ohms
Field—Permanent Alnico V Magnet
Bl factor—1.7 × 10^7 Dynes per Abampere

ACOUSTICAL • Free air-cone resonance 37 cps
Frequency response, usable range, as a direct radiator, enclosed in an adequate baffle 30-17,000 cps

"JBL" means **JAMES B. LANSING SOUND, INC.** *3249 casitas avenue • los angeles 39, california*

THE BRITISH INDUSTRIES

Sounding Board

New! MODEL TPA/10

A Revolutionary Transcription

TONE ARM

by

Garrard

Only $24.50 net

This tone arm, beautifully styled in glistening white and chrome, brilliantly conceived and built with true Garrard precision, is an ingenious combination of functional versatility and shrewd engineering. Though moderate in price, it has been designed and built for long life and superior performance in the finest high fidelity systems. It will operate with complete efficiency in the smallest possible installation (12 inch) . . . yet, it instantly becomes a full length 16" arm where space permits. And . . . it is infinitely variable for any length desired between the two extremes. At any future time, when re-installed under new conditions, this great tone arm will continue to perform perfectly without modification. There will be no need to replace it or alter it.

(over)

The Sounding Board

cut along dotted line and save

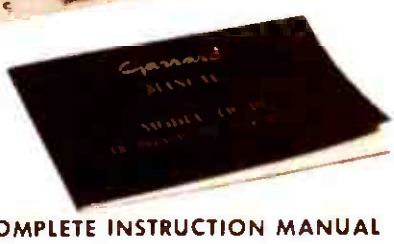
The Sound Board

All the best features of static balance, spring-loading and viscous damping have been combined in this remarkable new arm, to give the maximum vertical freedom. One of its key features is the use of the smallest possible number of pivots, to reduce traversing friction to the absolute minimum, an important factor in record groove protection. This advantage is achieved through spring-loaded cone type ball bearing pivots, similar to those used in shock-proof chronometers! The vertical pivot is a specially designed bearing, combining the features of a ball bearing journal suspended on a single ball thrust. Mounting height is infinitely adjustable — so that the new Garrard arm may be used with any transcription turntable, without shims or other special devices.

TEMPLATE FOR SELECTING HEIGHT AND LENGTH OF ARM

CUTOUT TEMPLATE

ALIGNMENT PROTRACTOR FOR ANGLE OF PICKUP HEAD



COMPLETE INSTRUCTION MANUAL

A Complete Packaged Unit, Ready for Installation!

All the necessary mounting hardware is supplied with the arm. In addition, simplified templates show precisely how to install the arm under any and all conditions. A unique, patented protractor ingeniously enables the user to set the recommended angle of the cartridge at any given radius, to guarantee minimum tracking error and lowest distortion. Since there are various qualified opinions regarding optimum tracking errors at different radii, this adjustment of the new Garrard tone arm will be found invaluable by enthusiasts who would like to experiment and benefit from the most advanced theories.

Styling of the TPA/10 is unusually distinctive . . . a handsome combination of glistening chrome and lustrous white enamel, finished with the greatest care. In appearance and function, it is a perfect mate to the incomparable Garrard 301 turntable . . . but it will grace *any* turntable . . . *any* fine high fidelity installation!

A quality endorsed product of the BIC Group: **Garrard • Leak • Wharfedale R-J • River Edge • Genalex • S. G. Brown • Multicore.**

Dept. GG927

Garrard Sales Corp.
Port Washington, N. Y.

JULY, 1957 VOL. 41, No. 7
Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

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

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

AUDIOCLINIC??

JOSEPH GIOVANELLI*

Transient Response

Q. *I have noticed that in the manufacturers' specifications for various pieces of sound equipment such things as frequency response and distortion are listed with specific numerical values. Transient response is not. If it is mentioned at all, the only statement made is that it is good. Why is it not stated as specifically as the other characteristics, and just what is it? Martin Siegal, Brooklyn, N. Y.*

A. The rate at which sounds reach their peak intensity from a start varies with individual sounds. When a low organ pedal pipe is sounded, it is often possible to hear the pipe build to its full intensity. This is because it has a comparatively long build-up time, or rise time, sometimes as much as half a second. On the other hand, a percussion instrument builds up more quickly, so quickly in fact that it seems to the ear to have been instantaneous. Actually, it has taken a finite amount of time, measured in a few microseconds. Further, there is a sharp peak at the outset of the generation of such a sound which may exceed many times in level the remainder of the sound. Few people seem to have taken into account that the build-up time of sounds, plus rapid peaks in some sounds, which we call transients, do as much to form the quality of a particular musical instrument or other sound as do the relative strength and weakness of harmonics and fundamental. It is obvious, therefore, that all components of a system must, in addition to their low distortion, possess the ability to respond to even the most rapid transients produced by musical instruments. In other words, they must possess good transient response. A loudspeaker, because of its mass, will take a definite time during which its motion will build up once it has been energized. Microphones and phonograph pickups have this same problem. Although electrons seem to travel almost instantaneously, the amplifier and/or preamplifier may also be subject to poor transient response. This is the result of inductive and capacitive reactances. These can combine with resistive components to form time constants which will tend to slow down the amplifier's ability to respond to rapid pulses of sound. If even one of the components in the system lacks good transient response, the result will be sound that lacks presence, even when all the other components are as perfect as the state of the art permits.

Distortion

Q. *Would you give me some information concerning distortion, its aural effects and the means for detecting it? Martin R. Kramer, Brooklyn, N. Y.*

A. Distortion is the name we use to cover a multitude of evils which can be unpleasant to listen to, without regard to some of the program material currently available. Distortion takes the form of departures from the waveforms presented to the input of a device. Every piece of equipment is subject to distortion to some degree.

One form is known as frequency distortion. When we talk about flat frequency response, we mean that a piece of equipment is capable of reproducing all audio frequencies with equal ease. If, however, there is attenuation in the lows, we are aware of a lack of bass, depending upon the amount of attenuation. Clearly, this is a departure from the original signal. This holds true for both boosts and attenuations. Sometimes, we purposely introduce frequency distortion in the form of bass and treble controls. The purist sets them in the flat position and leaves them there, although that setting is likely to cause poor sound reproduction when poor program sources or room acoustics are encountered. We have found that some amplifiers are not flat when the controls are set in the position so marked, but must be adjusted somewhat to produce this response.

A sound consists of a fundamental frequency and harmonics which give the tone a color and provide a means for distinguishing one instrument from another. These harmonics should be passed with the fundamental frequency. However, the components of a home music system may add harmonics generated within themselves. They color the music or speech, altering the over-all quality. The highs may sound brittle. In general, harmonics fall into musical relationship to the tone being played by the instrument, so that a considerable amount of this type of distortion may be present without being noticed. Actually, the harmonics generated within the system are not nearly so closely related to the fundamental as one might at first expect. The third harmonic is one octave plus one fifth interval higher than its fundamental. If the fundamental tone were F below middle C, the third harmonic would be the C above middle C. This might not be too bad if an F major chord were played, since that chord might well contain the C represented by the third harmonic. Let us assume, instead, that a D-flat chord were played. The F is a part of that chord but the C is not, but it would be present artificially and would clash with the D-flat in the chord. Another fact which deserves particular attention is this: when an instrument such as a piano or an organ is tuned properly, the fifth intervals are purposely made flat with respect to the lower note of the interval. Thus, in our F-major chord, the C generated by the equipment would be slightly sharp with respect to the C played by the musician, leading again to beating and clashing. To measure this kind of distortion, we use an oscillator whose output is as pure a fundamental tone as it is possible to obtain. It is fed into the system under test. By means of a device known as a wave analyzer, the fundamental is filtered out, with the assumption that all excess output is generated within the unit and output is compared with that of the fundamental and this ratio is expressed as

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

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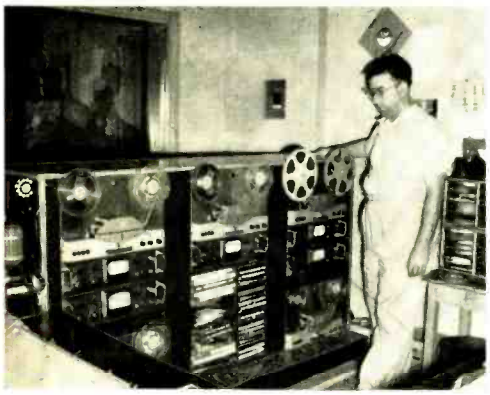
Top quality delivers the greatest economy!



Used where demands are the greatest

Gerry Van Caster, studio engineer at Station WBAY, Green Bay Wisconsin, operating a panel of five Magnecord M-90 tape recorders, which are in operation 8 hours daily. Two other Magnecords give the station equally dependable performance—one being used for pre-taping to save time, and the other for the station's mobile unit.

From coast to coast, in every state in the union Magnecord has been and is the choice of professionals. In a recent survey (copy available if you'd care to see it) four out of every five radio and TV stations in the greater Chicago area said in effect, "we depend on our Magnecord M90's. They're the workhorses in our daily operations. Don't know what we'd do without them."

Now we're happy to tell you that the M90 is better than ever and will deliver top performance with a positive minimum of service. You bet—the top quality you get in the Magnecord M90 is not cheap but you'll enjoy the greatest long run economy from this equipment.

FEATURES:

- Interlocking push-button controls.
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- Separate record and playback amplifiers permit simultaneous monitoring from tape.
- 15" and 7½" tape speeds with switch selection.
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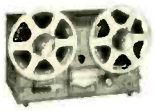
- Instantaneous start and stop less than 1/10 sec.
- High speed cueing control.
- Record interlock.
- Full remote control.



P-63 (above). NEW compatible tape transport instantly converts your present Magnecord equipment to the industry's highest standard.

P-60 Stereo (at left). The answer to the professional's request.

PT-6-6. The workhorse in tape recording—new—better than ever! Ideal for both studio and field work. Write for data.

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MAGNECORD DIVISION, MIDWESTERN INSTRUMENTS, INC., 1101 S. KILBOURN, CHICAGO, ILL.

per cent harmonic distortion. We can put up with perhaps two or three per cent harmonic distortion without being unduly disturbed, although one per cent is generally considered a good upper limit.

Where harmonic distortion exists, intermodulation distortion is generally present also, and one per cent of IM distortion is enough to be noticed, with the maximum permissible limit being about two per cent. This type of distortion tends to make the equipment sound fuzzy, muddy, and blurred and is very fatiguing to the listener. In any nonlinear device, beating or heterodyning takes place between various frequencies introduced into it. We want this beating in the super-heterodyne receivers but we do not want it in amplifiers, since it causes additional frequencies to be produced other than those we introduced by means of recordings, tuners, etc. It follows, then, that we want our amplifiers and other devices to be as linear as possible. Let us assume that we have two frequencies introduced into the amplifier, one at 50 cps and the other at 6000 cps. The two tones will combine to form their sum and difference, 6050 cps and 5950 cps respectively. These new frequencies also are now free to combine in various combinations, as are the harmonics of the fundamental tones and of the beats of the fundamental tones. Of course, some of these frequencies are weak in amplitude and are not discernible by ear. This type of distortion is probably the most objectionable we have, since the products of it are not related musically to much of anything. When a complex wave is introduced, such as the output of a large orchestra, many frequencies are available to beat to form many additional tones which can really muddy the waters.

No standards have as yet been devised for accurately measuring this type of distortion. One method commonly used is that developed by the Society of Motion Picture and Television Engineers, and is therefore known as the SMPTE method. It makes use of two tones, one of low frequency, the other of moderately high frequency, both introduced at the input of the system under test, with the lower frequency tone being adjusted to have four times the amplitude of the upper one, since this is likely to be the case when actually reproducing sounds. The low frequency is removed by filtering and the modulation of the high-frequency tone by the low frequency is compared to the output of the high frequency tone and is expressed as a percentage. The actual mathematics are not very complicated, but because of space limitations, cannot be presented here. In another method, two tones are introduced whose frequency differs between 30 cps and 400 cps. The sum terms are generally ignored, as they fall outside the audible range, while the difference terms are noted and, again, expressed as a percentage with the difference tones being compared to the sum of the amplitudes of the two test tones.

Some of the problems involved in distortion and its analysis are too detailed to go into here. We have devoted much space to this subject because, while we have all heard that much distortion is bad, we are not always aware of the nature of it and, more important, why it is so objectionable. It is for this reason that we have taken this opportunity to explore distortion and its relation to music.

COMING EVENTS

August 20–23—WESCON (Western Electronic Show and Convention) sponsored by the 7th Region of I.R.E. and the West Coast Electronic Manufacturers Association. Cow Palace and Fairmount Hotel. San Francisco, Calif.

Aug. 28–Sept. 7—National Radio & Television Exhibition, Earls Court, London, England.

Sept. 12–15—Portland Hi Fidelity Music Show, sponsored by Portland High Fidelity Music Dealers Association. New Heathman Hotel, Portland, Oregon.

Sept. 18–21—Chicago High Fidelity Show, presented by the Institute of High Fidelity Manufacturers. Morrison Hotel, Chicago, Ill.

Oct. 9–12—New York High Fidelity Show, presented by the Institute of High Fidelity Manufacturers. N. Y. Trade Show Bldg., New York City.

Oct. 25–27—Third Mexican High Fidelity Fair, Mexico City, Mexico.

Oct. 31, Nov. 1, 3—Fourth Cuban High Fidelity Show, Habana, Cuba.

Nov. 8–10—Puerto Rico Hi-Fi Show, Normandie Hotel, San Juan, P. R. For information about exhibiting, write Puerto Rico Hi-Fi, P. O. Box 25, San Juan, P. R.

LETTERS

Another Last Word

SIR:

I would like to see the Briggs 10-watter controversy appropriately buried with the following few last words:

If Brother Briggs were qualifiedly right rather than just "satisfied," we would all pay top prices for the seats in "peanut heaven" at the concert and opera.

We can take a passable audio system that cuts off at 6000 cps or less and, as we raise the volume, the music becomes more and more brilliant. At fairly high level, plus a pronounced peak between 3000 and 4000 cps, we can also produce "presence" that will satisfy the uninitiated as fidelity. The explanation lies within the human ear. It is an established fact that just two tones, at fairly high level, will produce some 240 sum and difference products in the inner ear. We "hear" all of these resulting products. As the sound level is decreased, the number of products above the threshold of nerve response is decreased. Our music becomes dull.

Consider then that the tonal quality of any instrument is composed of many individual tones of various amplitude and phase relationships.

Through habit, and probably nothing more, we seek a preferred distance from a performance and utilize such information as is available to us at that distance to establish our criterion of fidelity.

One forceful proof of this explanation is the reaction of the musician to high fidelity systems. The one instrument that he has never heard reproduced to his satisfaction is the instrument that he plays. My conclusion is that, as close as he is to his violin, he hears elements of information to which even the microphone does not respond. While he complains of the volume, he still contends that the violin sounds more nearly correct the louder you make it.

Add to all this the preponderance of abnormal ears and ignorance becomes bliss for all concerned.

H. W. WHITBY, SR.,
25 South Main Building,
Dayton 2, Ohio.

On "Test Reports"

SIR:

Your editorial "Test Reports" in the April issue is, without question, the finest editorial to appear in your publication for the last two (if not ten) years. Our congratulations to you for giving public notice to the audio fraternity of this blight on the publishing business.

Many of us have fumed and stormed when reading the reports that you mention, but have not had the opportunity to express our feelings to as wide an audience as you. This you have done for us in magnificent fashion.

We also have come to the same conclusion as you—that if the authors of the report in question don't know what they are talking about in a field in which we are familiar, then their reports of articles outside our intimate knowledge must be seriously questioned if not altogether discarded.

Thank you for this service towards a more informed public.

ROBERT L. LEBON
HARRY W. SHADLE
GEORGE R. RAPP, JR.
JOHN P. THOMAS
KARL C. THOMAS
State College, Pennsylvania

Make yours a HEATHKIT®

It's Easy (and fun) to Plan Your Own Hi-Fi Installation
By Choosing the Heathkit Components
That Best Suit Your Particular Needs.

As the world's largest manufacturer of electronic equipment in kit form, Heath Company can provide you with a maximum variety of units from which to choose. You can select just the amplifier you need from five different models, ranging in power from 7 watts to 25 watts, some with preamplifiers, and some requiring a separate preamplifier. You can pick your speaker system from four outstanding high fidelity units ranging in price from only $39.95 to $345.00. You can even select a fine Heathkit FM or AM Tuner! Should there be a question in your mind about the requirements of an audio system, or about planning your particular hi-fi installation, don't hesitate to contact us. We will be pleased to assist you.

MATCHING CABINETS . . .
The Heath AM Tuner, FM Tuner and Preamplifier are housed in matching satin-gold finished cabinets to blend with any room decorating scheme. Can be stacked one over the other to create a central control unit for the complete high fidelity system.


MODEL FM-3A

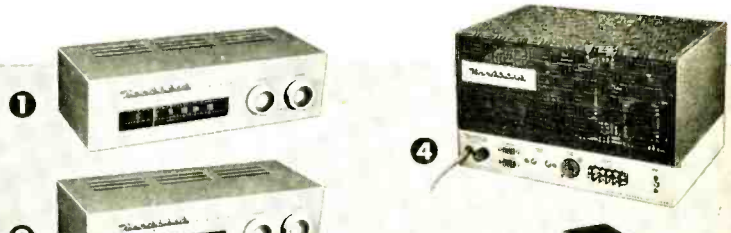

MODEL BC-1


MODEL WA-P2

PRE-ALIGNED TUNERS . . .
A unique feature of the Heathkit AM and FM Tuners is the fact that both units are prealigned. A signal generator is not necessary! IF and ratio transformers are pretuned at the factory, and some front-end components are preassembled and pretuned. Another "extra" to assure you of easy kit assembly.

HEATH COMPANY
A Subsidiary of Daystrom, Inc.
BENTON HARBOR 25, MICHIGAN

EASY TIME PAYMENTS . . . We invite you to take advantage of the Heath Time Payment Plan on any order amounting to $90.00 or more. Just 10% down and the balance in twelve monthly payments. WRITE FOR COMPLETE DETAILS.



HIGH FIDELITY SYSTEM

1 HEATHKIT HIGH FIDELITY FM TUNER KIT Features AGC and stabilized, temperature-compensated oscillator. Sensitivity is 10 microvolts for 20 db of quieting. Modern circuit covers standard FM band from 88 to 108 mc. Employs ratio detector for efficient hi-fi performance. Power supply is built in. Illuminated slide rule dial for easy tuning. Housed in compact satin-gold enamel cabinet. Features prealigned transformers and front end tuning unit. Shpg. Wt. 7 lbs.

MODEL FM-3A Incl. Excise Tax (with cab.) **$25.95**
$2.60 dwn., $2.18 mo.

2 HEATHKIT BROADBAND AM TUNER KIT This fine AM Tuner was designed especially for use in high fidelity applications, and features broad bandwidth, high sensitivity and good selectivity. Employs special detector circuit using crystal diodes for minimum signal distortion, even at high levels. Covers 550 to 1600 kc. RF and IF coils are prealigned. Power supply is built in. Housed in attractive satin-gold enamel cabinet. Shpg. Wt. 8 lbs.

MODEL BC-1 Incl. Excise Tax (with cab.) **$25.95**
$2.60 dwn., $2.18 mo.

3 HEATHKIT HIGH FIDELITY PREAMPLIFIER KIT This preamplifier meets or exceeds specifications for even the most rigorous high fidelity applications. It provides a total of 5 inputs, each with individual level controls. Hum and noise are extremely low, with special balance control for absolute minimum hum level. Tone controls provide 18 db boost and 12 db cut at 50 cps, and 15 db boost and 20 db cut at 15,000 cps. Four-position turnover and four-position rolloff controls for "LP", "RIAA", "AES", and "early 78" equalization. Derives power from main amplifier, requiring only 6.3 VAC at 1A and 300 VDC at 10MA. Beautiful satin-gold enamel finish. Shpg. Wt. 7 lbs.

MODEL WA-P2 (with cab.) **$19.75**
$1.98 dwn., $1.66 mo.

4 HEATHKIT ADVANCED-DESIGN HI-FI AMPLIFIER KIT This fine 25-watt high fidelity amplifier employs KT66 output tubes by Genalex and a Peerless output transformer for top performance. Frequency response ± 1 db from 5 to 160,000 cps at 1 watt. Harmonic distortion less than 1% at 25 watts, an IM distortion less than 1% at 20 watts. Hum and noise are 99 db below 25 watts. Output impedance is 4, 8 or 16 ohms. Extremely stable circuit with "extra" features.

MODEL W-5: Consists of W-5M *plus* WA-P2 Preamplifier
Shpg. Wt. 38 lbs. Express only **$79.50** $7.95 dwn. $6.68 mo.

MODEL W-5M
$59.75 $5.98 dwn. $5.02 mo.
Shpg. Wt. 31 lbs. Express only

5 HEATHKIT DUAL-CHASSIS HI-FI AMPLIFIER KIT This 20-watt Williamson-type amplifier employs the famous Acrosound model TO-300 output transformer, and uses 5881 tubes. Frequency response is ± 1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion less than 1% at 21 watts, and IM distortion less than 1.3% at 20 watts. Output impedance is 4, 8 or 16 ohms. Hum and noise are 88 db below 20 watts.

MODEL W-3: Consists of W-3M *plus* WA-P2 Preamplifier
Shpg. Wt. 37 lbs. Express only **$69.50** $6.95 dwn. $5.84 mo.

MODEL W-3M
$49.75 $4.98 dwn. $4.18 mo.
Shpg. Wt. 29 lbs. Express only

6 HEATHKIT SINGLE-CHASSIS HI-FI AMPLIFIER KIT This 20-watt Williamson-type amplifier combines high performance with economy. Employs Chicago-Standard output transformer and 5881 tubes. Frequency response ± 1 db from 10 cps to 100 kc at 1 watt. Harmonic distortion less than 1.5% and IM distortion less than 2.7% at full output. Output 4, 8 or 16 ohms. Hum and noise—95 db below 20 watts.

MODEL W-4A: Consists of W-4AM *plus* WA-P2 Preamplifier
Shpg. Wt. 35 lbs. Express only **$59.50** $5.95 dwn. $5.00 mo.

MODEL W-4AM
$39.75 $3.98 dwn. $3.34 mo.
Shpg. Wt. 28 lbs. Express only

7 HEATHKIT 20-WATT HIGH FIDELITY AMPLIFIER KIT Features full 20 watt output using push-pull 6L6 tubes. Built-in preamplifier provides four separate inputs. Separate bass and treble controls. Output transformer tapped at 4, 8, 16 and 500 ohms. Designed for home use, but also fine for public address work. Response is ± 1 db from 20 to 20,000 cps. Harmonic distortion less than 1% at 3 db below rated output. Shpg. Wt. 23 lbs.

MODEL A-9B **$35.50**
$3.55 dwn., $2.98 mo.

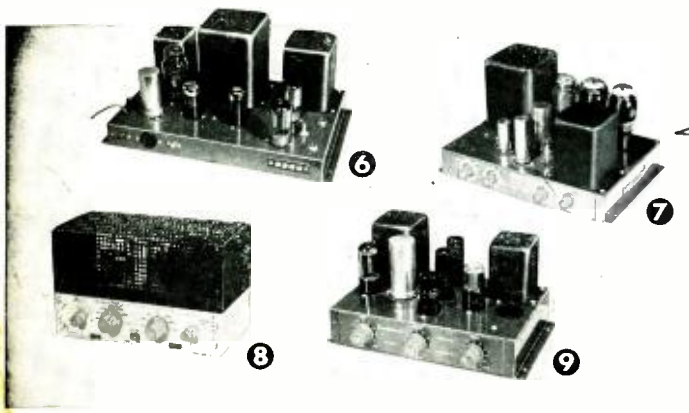
8 HEATHKIT ELECTRONIC CROSS-OVER KIT This device separates high and low frequencies electronically, so they may be fed through two separate amplifiers driving separate speakers. Eliminates the need for conventional cross-over. Selectable cross-over frequencies are 100, 200, 400, 700, 1200, 2000 and 3500 cps. Separate level controls for high and low frequency channels. Attenuation 12 db per octave. Shpg. Wt. 6 lbs.

MODEL XO-1 **$18.95** $1.90 dwn., $1.59 mo.

9 HEATHKIT 7-WATT ECONOMY AMPLIFIER KIT Qualifies for high fidelity even though more limited in power than other Heathkit models. Frequency response is ± 1½ db from 20 to 20,000 cps. Push-pull output and separate bass and treble tone controls. Good high fidelity at minimum cost. Uses special tapped-screen output transformer.

MODEL A-7E: Same as A-7D except one more tube added for extra preamplification. Two inputs, RIAA compensation and extra gain.
Shpg. Wt. 10 lbs. Incl. Excise Tax **$19.95** $2.00 dwn. $1.68 mo.

MODEL A-7D
$17.95 $1.80 dwn. $1.51 mo.
Incl. Excise Tax
Shpg. Wt. 10 lbs.



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HOW TO ORDER
Just identify kit by model number and send order to address below. Write for further details if you wish to budget your purchase on the HEATH TIME PAYMENT PLAN.

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BENTON HARBOR 25, MICHIGAN
Please send Free HEATHKIT catalog.

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Address_____
City & Zone_____ State_____

EDITOR'S REVIEW

THE COMING SHOW SEASON

ONE OF THE FASCINATING THINGS of hi-fi is the show season—and those in the industry who participate deserve a considerable amount of praise for their efforts toward acquainting more and more people with the advantages of properly reproduced music. Looking backward, we must recognize the fact that the many annual hi-fi shows have been the instrument by which countless thousands have heard of component hi-fi for the first time—and component hi-fi is well recognized as the only true high fidelity equipment on the market—and while manufacturers have a commercial interest in selling equipment through the shows, they are also bringing the means for real enjoyment of music into the homes of everyone.

The cost of exhibiting at a hi-fi show is not inconsiderable, as will be recognized by anyone who takes the time and trouble of adding up the expenses. The cost of exhibit space is only the beginning—to this must be added the traveling and living expenses of those in attendance, their time, and the cost of shipping equipment and exhibit material around the country.

By and large, however, this is a more economical means of presenting the component hi-fi story to the public than any other because of the fact that only those that have a potential interest will go to the shows. Newspaper and consumer-magazine advertising may be seen by a greater number of people at a lower cost per person, but not all of them have any real interest to start with. Furthermore, people have already learned that large and showy advertisements extolling the ultra-super-hi-fi so-and-so unit do not always present the true facts about the quality of reproduction, and everyone knows by now that not everything labeled "Hi-Fi" is actually that. If not actual misrepresentation, such glowing description had better be taken with a grain of salt—and it usually is. There is only one way to make sure—listen to it. True, current models of big name console "hi-fi" equipment are much better than phonograph combinations were in 1947, but most of them are far short of the high quality available from component high fidelity equipment.

And so, looking to the shows to introduce real high fidelity—component high fidelity—to the music lover, we look forward to a full show season for the coming fall. Aside from the many shows in the United States—Chicago, New York, Cincinnati, Miami, Portland, Seattle, and St. Louis have already been announced—there is a series of three shows "south of the border" that take place on three consecutive weekends. The third Mexican Feria de Alta Fidelidad—that means High Fidelity Fair—is scheduled for October 25–27 in Mexico City; the fourth Cuban show is scheduled for October 31, November 1, and November 3 (November 2 is a local holiday) in Habana, Cuba; and the first Puerto Rico High Fidelity Show is scheduled for November 8–10 at the Normandie Hotel in San Juan, P. R.

Since we know that many exhibitors will want to attend one or more of these shows, we have, with the help of Paramount Travel Service, set up the first

MEXI CARIB HI FI TOUR

which originates in New York, Chicago, and Los Angeles, takes in the three shows, and allows for a three-day rest at Montego Bay in Jamaica.

It may seem strange to some that anyone would want to attend three hi-fi shows on three consecutive weekends, but those of us who are dedicated to this industry find it exciting and exhilarating. This observer made the same trip last year following the Mexican show, but primarily as a vacation—although there were many opportunities to talk hi-fi wherever we went. Now that we have found—and helped create—an opportunity of making the same trip again, we ourselves plan to go.

In the belief that many readers would find such a trip interesting, entertaining, and possibly profitable—as well as providing a marvelous vacation tour—the Mexi Carib Hi Fi Tour is open to anyone who wishes to go. It is a complete prearranged trip, with air travel, hotel accommodations, and a minimum amount of planned sightseeing all included. Those who go will have an opportunity of seeing an afternoon of bullfighting in Mexico, an evening at the fabulous Tropicana night club in Habana, three days of swimming in the superb water at Montego Bay, and a chance to explore an historically interesting area with which relatively few residents of the U. S. are familiar—Puerto Rico.

Travel from the New York terminus is by way of Air France, Cubana, and Pan American; from Chicago via American, Cubana, and Pan American; and from Los Angeles via Mexicana, Cubana, Pan American, and a choice of return routes. Full information may be obtained from Frank Hostage, Paramount Travel Service, 145 East 52nd Street, New York 22, N. Y.

The trip starts on October 23 and returns on November 11, although any desired variations in itinerary before or after these dates may be arranged to suit anyone's desires. Here's hoping we'll see you there. Having made the trip once, we are quite certain that it will be an enjoyable one.

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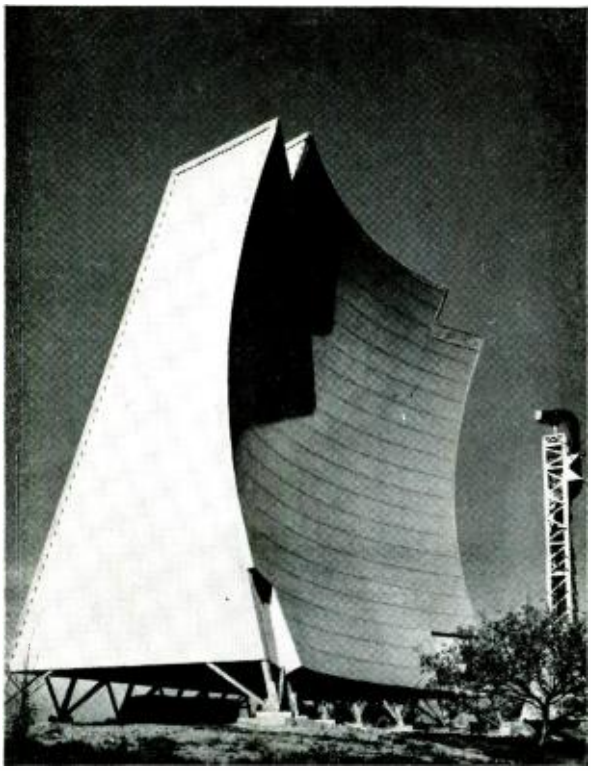

Giant over-the-horizon antenna designed by Bell Telephone Laboratories for "White Alice," Air Force Alaskan defense communications network.

How UHF radio got seven-league boots

THE huge antenna systems which project ultra-high frequency radio communications beyond the horizon began when a Bell Telephone Laboratories engineer became intrigued with a strange phenomenon. Although these radio waves were supposed to be useful only over line-of-sight distances, the waves displayed a mysterious tendency to take off in a giant stride to antennas beyond the horizon.

This phenomenon had been studied both here and abroad, but no practical use was seen until the engineer became interested and thoroughly sifted the experimental data. He came up with the stimulating conclusion that over-the-horizon transmission is far stronger and much more dependable than was generally supposed. Further he predicted that it could be utilized to supply dependable broadband communications. He and his associates at Bell Laboratories confirmed the prediction experimentally, then drew up requirements for the first over-the-horizon UHF transmission system.

This pioneer work at Bell Telephone Laboratories has greatly increased the usefulness of UHF communications. For example, over-the-horizon transmission now provides critically important communications between remote military outposts in the Arctic and in the far north.

For the Bell System it can provide important new links for telephone conversations and television.

Kenneth Bullington, B.S.E.E., University of New Mexico; M.S., Massachusetts Institute of Technology; recipient of the 1956 Morris Liebmann Memorial Prize and the 1956 Stuart Ballantine Medal for his contributions in the field of over-the-horizon ultra-high frequency radio transmission.

Experimental antenna used in early over-the-horizon UHF radio transmission research. Research extended transmission from 30 miles line-of-sight to 200 miles.

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The Aperiodic Loudspeaker Enclosure

E. de BOER*

The author analyzes the requirements of a resonance-free woofer enclosure and then proceeds to design a practical cabinet that fulfills these requirements to a maximum degree.

THE REALIZATION of adequate reproduction of low frequencies is a well-known trouble of high fidelity. This difficulty is mainly due to the low radiation efficiency of cone-type loudspeakers at these frequencies. More specifically, when the dimensions of the radiating member are small compared to the wavelength of the emitted sound, a poor match exists to the air load. This not only causes trouble in obtaining a flat frequency response but a severe limit is imposed upon the maximum power as well.

The only way to meet both design objectives is to increase the radiating area. Since this is not feasible beyond a certain limit, the loudspeaker enclosure is designed to improve the match between diaphragm and air load. It can be stated quite generally that an improved match over a large frequency range can only be attained by a system occupying a large volume. In a small-sized cabinet, where resonance is used to reinforce the bass end, the improvement is present over only a very narrow frequency range.

One can conclude from this that for a given maximum volume one has to concentrate either upon obtaining flat frequency response with limited power capability or upon an improved power match resulting in a jagged frequency response curve. Many solutions are actually situated midway between these extremes. The only one of these extremes which can be called satisfactory is the first one. The author believes that there may be interest in an enclosure which has been designed to obtain a smooth frequency response, the power requirements being completely put aside.

It has recently been shown[1] that under certain circumstances a small enclosure is theoretically capable of a flat frequency response toward some 20 cps. Provided with a large-diameter loudspeaker such a system can produce sufficient power for normal listening conditions. A similar type of reasoning has led to the Acoustical Suspension System.[2] These systems have in common that they demand a rather critical choice of parameters of the loudspeaker as well as of the enclosure.

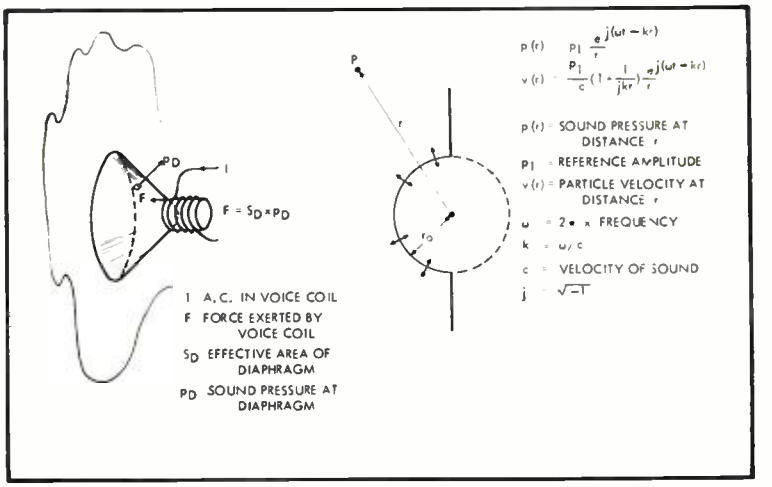

Fig. 1. Hypothetical loudspeaker in an infinite wall.

The author has developed a small-sized enclosure which can be used with a normal type of loudspeaker and is not critical. The design objective has been to approximate the behaviour of the loudspeaker in an infinite baffle with the requirement that the fundamental resonance be critically damped. This has been realized by adding two adjustable parameters to a system resembling a bass-reflex system.

Electrical Analogue of a Loudspeaker

Let us discuss first the performance of a loudspeaker on an infinite baffle. For reasons of simplicity we first assume that the diaphragm has no mass and is freely suspended. When a constant current I passes through the voice coil, a force F is exerted on the diaphragm. This force can be balanced only by acoustic forces, so the sound pressure p_D on the diaphragm is constant with frequency.

For low frequencies, the radiating system can be converted into a pulsating sphere radiating into the left half-space without introducing too large an error,[3] as shown in *Fig.* 1. From the given formulas for the sound field it can be seen that the amplitude of the sound pressure is inversely proportional to the distance. Hence our hypothetical loudspeaker (fed by a constant current I) has the property that the pressure response at a given point in the radiation space is independent of frequency.

This simplified theory shows why an actual loudspeaker may have a reasonably flat pressure response even when

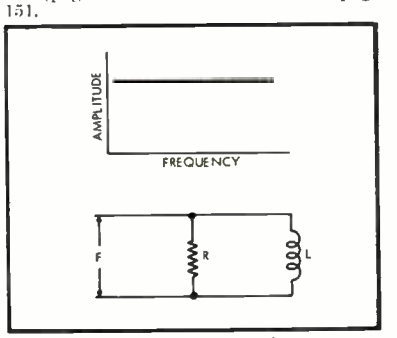

Fig. 2. Electrical analogue of the system of Fig. 1.

* *O. R. L. Clinic, Wilhelmina Hospital, Amsterdam, Netherlands.*

[1] E. J. Jordan, "Loudspeaker enclosure design" *Wireless World*, Jan. and Feb., 1956.

[2] E. M. Villchur, "Revolutionary loudspeaker and enclosure" AUDIO, Oct., 1954, and July, 1955.

[3] F. V. Hunt, "*Electroacoustics.*" Fig. 5.7 (page 158) and related text on page 151.

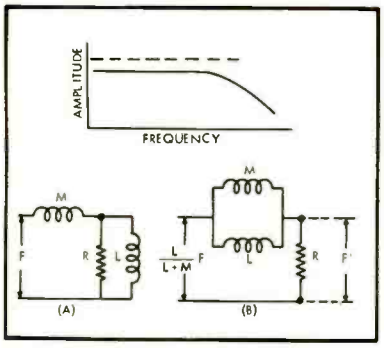

Fig. 3. Loudspeaker with mass (M) reaction included.

the dimensions are smaller than the wavelength.

For a discussion of the power capability we are interested in the amplitude A of the diaphragm excussions. The diaphragm velocity $v_D = j\omega A$ is related to the force F by the concept of mechanical impedance z_M defined as

$$z_M = \frac{F}{v_D}$$

From the formulas given in *Fig.* 1 it follows that

$$z_M = S_D \rho c \frac{kr_o}{kr_o - j} \text{ where } k = \omega/c \quad (1)$$

For low frequencies z_M is nearly proportional to frequency; hence the amplitude A is nearly inversely proportional to the square of frequency in order to maintain a constant sound pressure. This is the reason sound power at low frequencies is severely limited.

In order to visualize more clearly the operating conditions of actual loudspeakers we will refer to an electrical analogue of the mechanical system. Any mechanical force will be represented by an electric voltage, and a velocity by a current. A mechanical impedance is then transformed into an electrical impedance, which may be numerically equal to it.

As can be verified easily, impedance[1] can be represented by the electrical impedance of a resistance and an inductance connected in parallel as in *Fig.* 2.

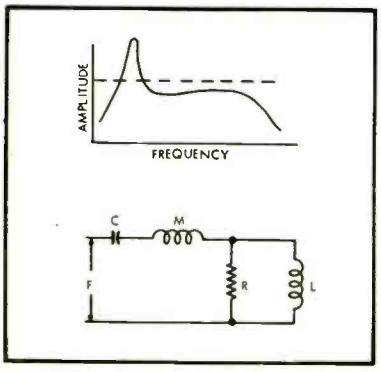

Fig. 4. Loudspeaker with effect of finite compliance (C) included

We refer to this impedance as the radiation impedance of a circular orifice. In the case of our hypothetical loudspeaker this impedance is connected directly to a voltage source representing the constant force F. The voltage across the configuration of *Fig.* 2 now represents also the sound pressure on the diaphragm.

For the spherically symmetrical radiator of *Fig.* 1 it represents the sound pressure at a given point in the radiation space as well. So from our electrical analogue it is easily verified that the pressure response of the loudspeaker will be flat. The radiated power is represented by the dissipation in R. The inductance L represents a certain mass of air vibrating in the neighborhood of the diaphragm without dissipation (radiation mass).

We have now acquired the skill to study the performance of actual loudspeakers from the electrical analogue. The mass, stiffness, and so on of the diaphragm are added to the analogue and the pressure response will still be given by the voltage across the radiation impedance of *Fig.* 1. The addition of these extra, though unavoidable, elements cause the frequency response to deviate from the ideal one.

First we assume that the diaphragm has a non-vanishing mass but still infinite compliance. Since the force F has to be divided between mass and air load the mass reactance appears in series in the electrical circuit. See (A) in *Fig.* 3. By way of the equivalent configuration of (B), the pressure response is easily calculated. Here F represents the mechanical force and F' the part of it that is effective in radiation. One can see that the introduction of mass reduces the efficiency and causes the higher frequencies to be reduced in strength.

Now we add the feature of a finite compliance. This appears in *Fig.* 4 as a capacitor (proportional to the compliance), again in series with the radiation impedance. The resulting configuration gives rise to a series resonance which actually lies in a frequency region where the damping by R is very small. This means that this fundamental resonance will not be materially damped by acoustic radiation.

The damping arises mainly from mechanical friction and from the electromagnetic coupling to the driving amplifier. The friction can simply be represented as a series resistor. The electromagnetic damping can also be studied from the electrical analogue but the derivation is somewhat more involved. Suppose for a moment that the voice-coil resistance is zero and that the amplifier is a pure voltage source. The motion of the diaphragm will then be such that the induction voltage developed in the voice coil just balances the impressed voltage. The diaphragm velocity

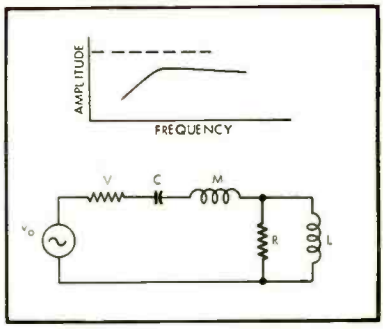

Fig. 5. Velocity-controlled loudspeaker.

is completely controlled by the amplifier and the driving system is represented in the electrical analogue *Fig.* 5, by a pure current source. From this it is apparent that the low-frequency response drops 6 db per octave. This is a well known property of high-efficiency speakers driven by an amplifier with low internal impedance. The actual situation will be somewhere between those pictured in *Figs.* 4 and 5. Since amplifiers are frequently designed so as to deliver a nearly constant output voltage, the driving system is preferably depicted as in *Fig.* 6, consisting of a current source v_o shunted by a resistor Q. The velocity v_o is the velocity attained by the diaphragm when the total ohmic resistance would be zero. The current consumption by Q is a measure of the actual voltage drop over the internal resistance of the amplifier and the voice-coil resistance, r. Hence the numerical value of Q is inversely proportional to this total resistance. From *Fig.* 6 it is apparent that the damping is largest when Q is large, that is, when the total resistance in the voice-coil circuit is low.

Loudspeaker in Enclosure

The electrical analogue serves as an important tool toward understanding the action of more complicated systems. When a loudspeaker is placed in an enclosure the diaphragm has to exert additional forces. Hence the elements due to the enclosure appear in series with the diaphragm impedance of *Fig.* 4.

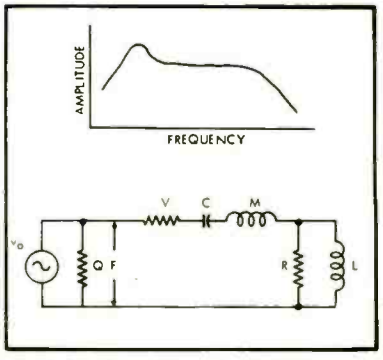

Fig. 6. Loudspeaker with electromagnetic damping.

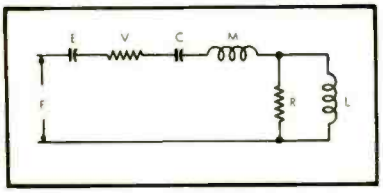

Fig. 7. Loudspeaker in completely closed box (E represents stiffness of enclosed volume of air).

Because of the finite compressibility of air a completely closed box acts as a stiffness, at least for low frequencies. The analogous capacitor E appears in series with the diaphragm stiffness C, thus increasing the resonance frequency (*Fig.* 7.) When the enclosure is provided with a port, the situation becomes much more complicated. Under the assumption that the port radiates without interaction with the diaphragm, its impedance is again represented by an inductance L' and a resistance R' in parallel. In order to find the proper places of this impedance and the enclosure's stiffness we note that the air flux issuing from the rear side of the diaphragm can choose between two ways. Part of the flux leaves the enclosure via the port, the rest is effective in building up sound pressure inside the box. This two-way choice can be represented by a parallel connection of the capacitor E and the port's radiation impedance as is illustrated in *Fig.* 8. The parallel configuration can be defended as well by noting that the pressure inside the box must be the same on all places. Thus the port is driven by the same sound pressure as the enclosure's stiffness. In the electrical analogue both impedances must then be connected across the same voltage, hence they must be connected in parallel.

The circuit of *Fig.* 8 gives the generally accepted electrical analogue of what is easily recognized as a bass-reflex system. In two respects, however, the circuit is deficient. First, the interaction between diaphragm and port is neglected. Proper introduction of this effect makes the circuit much more complicated. In the second place the radiation of the rear side of the diaphragm is 180 deg. out of phase with that of the front side. In our qualitative discussion we assume that both effects do not have a large effect on the various pressures and velocities appearing in the circuit. For the acoustical response, however, we may state that the sound pressure at large distance is approximately represented by the difference of the voltages across L and L'.

The performance of the bass-reflex system will be analyzed only briefly. At the free-air resonance frequency of the loudspeaker nearly the whole force F appears across the parallel section. When this section resonates at the same frequency, full radiation is retained while at the same time a large mechanical impedance is presented to the diaphragm. This advantageous situation is only present over a small frequency range, however.

At lower frequencies the parallel section becomes inductive and the series section capacitive, so that a series resonance develops. At frequencies higher than the parallel resonance, the parallel section becomes capacitive and the series section inductive so that a second series resonance of the whole circuit appears. At these two resonances the diaphragm velocity becomes maximal. The resulting maxima of the induction voltage developed in the voice coil cause the well known double hump of the voice-coil impedance which is specific to the bass-reflex system. The opposite polarities of front and rear waves cause the lower resonance to be reduced in amplitude. A typical theoretical response is shown in *Fig.* 8.

Damped Enclosures

The bass-reflex system provides us with an easily realizable configuration of mechanical impedances due to the enclosure. Over a restricted frequency range an improved match between diaphragm and air load is obtained by way of the port radiation. This occurs, however, at the expense of the response at other frequencies.

In our design we will stick to this type of configuration, though the requirements are completely different. The impedance of the enclosure will be used solely to control the diaphragm's motion. The port will not be used as an alternative radiator of sound. This is obtained by making the port area exceptionally low. We will try to modify the system so that smooth frequency response is obtained from the radiation of the diaphragm. The unavoidable resonances can only be attacked by the application of damping.

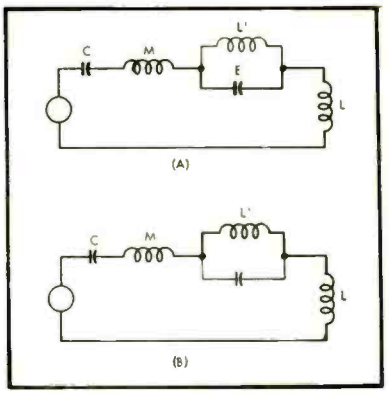

Fig. 9. Origin of main resonances.

It has been shown[1] that under certain conditions a very small value of the resistance R' can serve this purpose effectively. Such a value can be realized by introducing a port provided with a thick though porous resistive cloth. The resulting enclosure is claimed to have a flat response towards some 20 cps.

Due to the fact that one resistance is used to damp two resonances and one anti-resonance, the system is quite critical, however. In addition, the residual radiation of the damped orifice tends to impair the lower frequency. For these reasons the present author has tried to find a solution which does not suffer from these disadvantages.

Let us focus attention to one of the series resonances of a typical bass-reflex enclosure (provided with a port that is too small). At the frequency of the upper resonance the mass-like impedance of the diaphragm resonates with the stiffness-like impedance of the enclosure. The latter is given almost exclusively by the stiffness of the enclosed volume of air. This series resonance is indicated schematically by the thick line in (A) of *Fig.* 9. This resonance can be

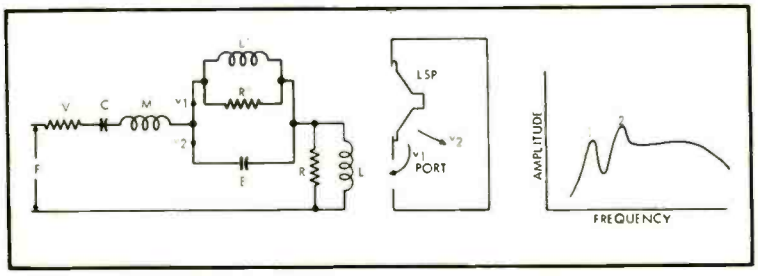

Fig. 8. Loudspeaker in box provided with additional orifice.

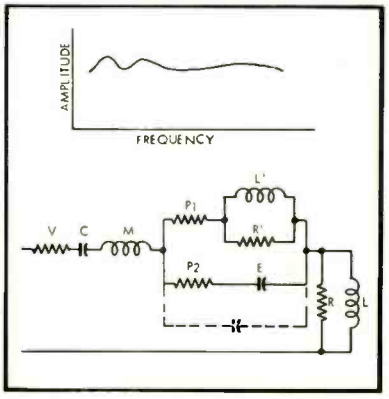

Fig. 10. Loudspeaker in "aperiodic" enclosure.

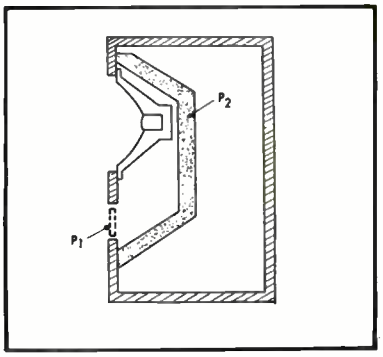

Fig. 11. The operiodic enclosure.

damped by a series resistor inserted anywhere in the indicated path.

The other series resonance is due to the stiffness of the diaphragm impedance at low frequencies being balanced by the mass-like character of the enclosure. The current path of this resonance is indicated at (B) in *Fig.* 9. Both resonances can be damped nearly independently by inserting two resistors, one in series with E, the other in series with L' (see *Fig.* 10).

At intermediate frequencies the resonance of the parallel section is met. This resonance tends to cause a dip in the frequency response. It is, however, damped by the two resistances P_1 and P_2. With a proper choice of parameters, correct adjustment of P_1 and P_2 automatically reduces this anti-resonance to the wanted degree.

These parameters have been determined experimentally by way of the electrical analogue. It appeared that the choice of the parameters L' and E is not critical so that a rather low value of E can be chosen. This results in a very low enclosure volume which is, of course, a very attractive feature of this system.

There remains the question whether the obtained system can be realized acoustically. The electrical analogue shows that the resistors P_1 and P_2 have to be inserted in series with L' and E. As regards P_1, the acoustic air flux has to pass through P_1 before developing sound pressure across the port impedance. Referring to *Figs.* 8 and 10 it follows that an acoustic resistance has to be placed in the port.

The placement of the element corresponding to P_2 is somewhat less obvious. The air flux r_1 toward the port (*Fig.* 8) must not be hindered, whereas the flux r_2 has to pass through a resistance.

This situation can be realized by stretching a resistive cloth over the rear of the loudspeaker, so that both the loudspeaker and the port are isolated from the main volume. The obtained enclosure is shown schematically in *Fig.* 11. It has been checked experimentally that this enclosure operates as expected and that the small cavity behind the loudspeaker (see the dotted capacitor in *Fig.* 10) does not introduce a noticeable extra resonance.

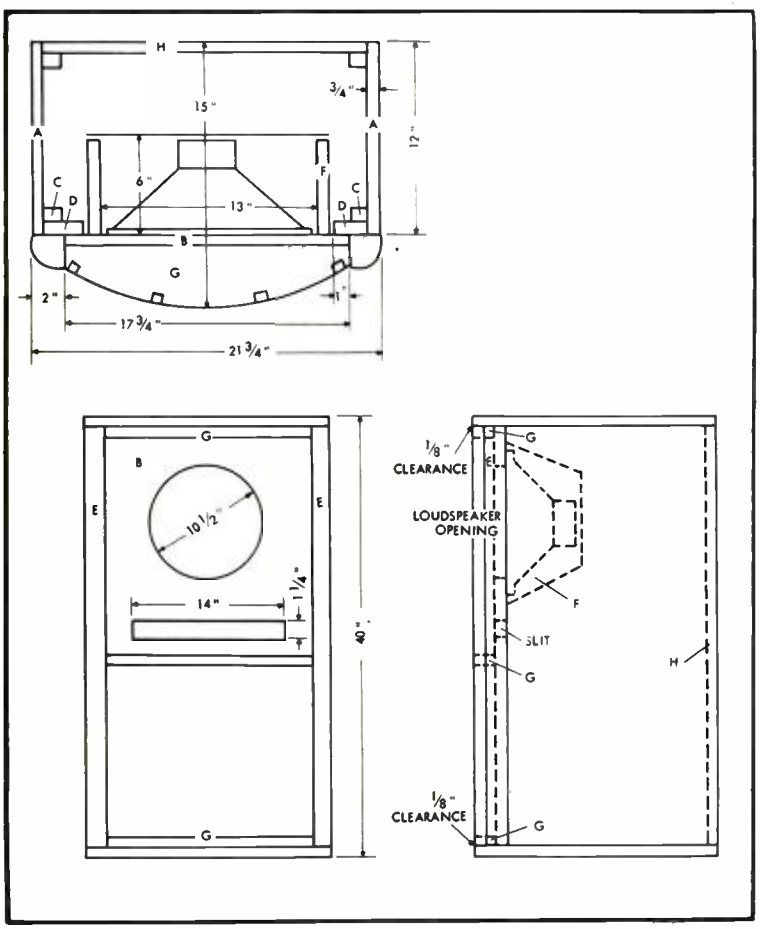

Fig. 12. Constructional data for operiodic enclosure.

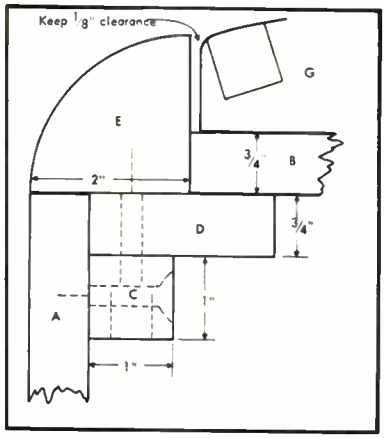

Fig. 13. Detail of front corner construction.

Construction of the Enclosure

The external appearance of the enclosure is much like that of a bass-reflex system. The dimensions are chosen quite differently, however. The volume is less than one half the normal value, and the port area is much smaller than the diaphragm. By way of a resistive cloth the interior volume has been divided into two parts (*Fig.* 11). The smaller cavity contains the loudspeaker and opens into the port, the larger one consists of the remaining part of the volume. This dividing member serves to reduce the upper resonance, thus eliminating the most objectionable cause of boom.

The port, here having the form of a narrow slit, is covered by a thin layer of similar material, in order to damp out the lower resonance.

The damping of the resonances can be adjusted by changing the thicknesses of the layers. This adjustment being one of the major stages in the construction, the construction must be such that the interior of the enclosure is easily accessible. When properly adjusted, the system is capable of a smooth frequency response extending to one half octave below the speaker's free-air resonance. The lowest frequencies are somewhat attenuated because of the cancelling action of the residual sound radiated by the

(*Continued on page 51*)

The RC Crossover Compromise

NORMAN H. CROWHURST*

A thorough discussion of the advantages and disadvantages of the high-impedance crossover network, with numerical and graphical presentation of phase shift and the flatness of over-all response.

ALL CROSSOVER DESIGN seems in some measure to be a compromise. At first sight, the requirement of delivering only frequencies below crossover to one unit and frequencies above crossover to the other unit, would seem to dictate as sharp as possible a rolloff beyond crossover.

This runs us into the difficulty that sharp rolloffs normally produce: problems with transient response. Use of a simpler network, giving a more gradual rolloff, results in frequencies beyond the crossover being delivered to both units.

It would seem, basically, that the constant-resistance type, of a suitable slope choice, gives the best over-all performance, because it provides for constant total energy distribution between the two units.[1] This means that, after making adjustments for differences in efficiency, the over-all response should be flat. It also provides a constant phase difference between the energy delivered to the two units, so that, by appropriate acoustic adjustment of phase relationship, close integration takes place between the acoustic output from both units.

Any true constant resistance network, however, involves the use of both inductances and capacitances. The use of inductances leads to practical problems in the choice of suitable inductance components.

Some prefer to use air cores because they can introduce no distortion. But they are also considerably less efficient and contribute an appreciable resistance component to the network, for which reason they are not suited to the steeper slope type of constant-resistance crossover, because the resistance they contribute invalidates the constant resistance parameter of the network.

As a whole, iron-cored components yield a better efficiency as inductances and, if well designed, can produce extremely little distortion—less than other components in the chain usually do. However, the fact that it is possible for iron-cored components to introduce distortion makes many of the purists steer clear.

A modern trend is to advance the position of the crossover from the output of the power amplifier to a position preceding power amplification so that separate power amplifiers feed the separate loudspeaker units. This means that the crossover does not have to handle power, but operates at a relatively low level.

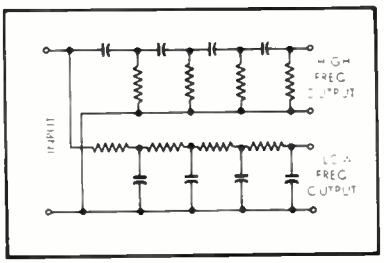

Fig. 1. General arrangement of RC crossover filter networks. The number of components and the values used are the subject discussed in this article.

This introduces a further reason for avoiding the use of inductances: the fact that any inductance working at low level is susceptible to hum pickup and needs careful shielding.

It is possible, as has been shown in earlier articles,[1,2] to simulate the constant-resistance characteristics with resistance capacitance networks *and feedback*. However, this arrangement results in a comparatively involved circuit, so many are turning to the use of a resistance/capacitance network for the crossover, ahead of the power amplifiers, without the use of feedback to obtain the constant resistance characteristics. The purpose of this article is to investigate the properties of these circuits.

Possible Choices of Values

Each arm of the crossover can consist of any number of resistance and capacitance elements as shown in *Fig.* 1. The values of resistance and capacitance can be chosen in almost an infinite variety of combinations. However, the interaction concept[3] enables us to select certain limits in the possibility of performance variation.

Maximum interaction occurs when all the resistances and capacitances have the same value. A minimum can be achieved by making each successive resistance-capacitance combination of higher impedance value, so as not to shunt the preceding one appreciably. An ideal separation, producing zero interaction, would be achieved by placing a buffer stage between each resistance-capacitance combination.

So, for the purpose of analysis, we shall consider these two extremes to see which gives the best possibility of producing a good compromise as regards the various features of response required.

Any network using a consistent pattern of time constants, whether maximum or minimum interaction is used (or something in between), will have a phase shift characteristic that is approximately symmetrical about a point where the phase shift is half its ultimate value[4]. The non-interacting cases conform exactly with this relationship.

Constant Phase Difference

Also, setting all the time constants the same, without interaction, results in the half-maximum-slope point coinciding with the half-ultimate-phase-shift point. With identical components the deviation is fractional. On this basis it would at first seem logical to make the crossover

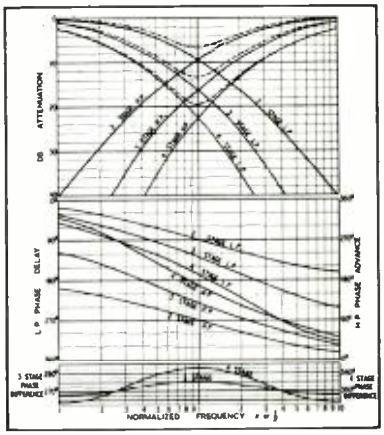

Fig. 2. Responses achieved when sequences of identical values are employed in the circuit of Fig. 1, using 2, 3, or 4 pairs of elements in each filter. The dotted curves in the top part show the response of the total energy supplied to the combined circuits. At the bottom is shown the phase difference between the two outputs for the 3- and 4-stage networks; the 2-stage network maintains a constant difference of 180 deg.

* *150–47 14th Road, Whitestone 57, N.Y.*

[1] Norman H. Crowhurst, "Basic design of constant resistance crossovers," AUDIO ENGINEERING, Oct. 1953, p. 21.

[2] Norman H. Crowhurst, "Feedback filters for two-channel amplifiers," AUDIO, Oct. 1954, p. 32.

[3] Norman H. Crowhurst, "The interaction concept in feedback design," AUDIO, Oct.–Nov. 1956.

[4] Norman H. Crowhurst, "Unique relationships," *Audio*, Oct. 1955, p. 62.

at this point on the rolloff characteristic.

A set of characteristics for two-, three-, and four-stage networks, using the identical component construction and also using the non-interaction arrangement, are shown in *Figs.* 2 and 3. Here we can see the reason why this selection of crossover is not suitable.

Although the condition of constant phase difference is met with this arrangement there is a dip in the total power curve at the crossover point.

Using identical components in cascade, this dip is 6.5 db for the two-stage configuration, 13 db for three-stages, and almost 20 db for four stages.

Using the non-interacting case—which is considerably harder to construct because it requires buffer stages to reach the ideal and an extremely wide variety of resistance and capacitance values even to approach the ideal—the loss at crossover is not quite so serious. For the two-stage case, the total energy shows a 3-db dip, the three-stage gives a 6-db dip and the four-stage a 9-db dip.

Approaching Constant Total Power

The next thing to consider is whether pushing the two responses together so that the total power is the same at crossover point will produce a reasonable approximation to constant total power throughout the frequency spectrum in this region. To do this we need to find the half-power point and shift both curves to make crossover occur here.

Examining the characteristics so produced, shown at *Figs.* 4 and 5, shows that, however many stages are used and whichever choice of values is adopted, the arrangement now approximates the performance of the single-stage network in varying degree. In the single-stage network, the half-phase-shift and half-power points coincide at the frequency where the reactance is equal to the resistance. This simple arrangement gives a constant phase difference, between the energy delivered to the two circuits, of 90 deg. and a constant-total-power condition.

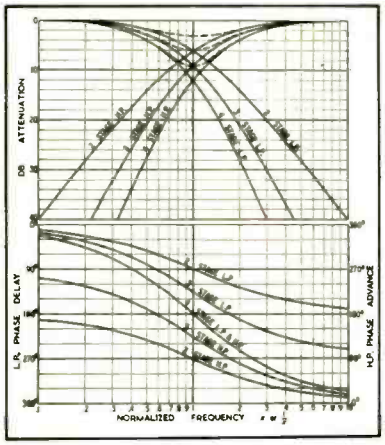

Fig. 3. Responses achieved when interaction is entirely eliminated between successive "stages." The only practical way to achieve this limiting case would be to employ buffer stages between each pair of elements. However this limit indicates the form that can be approached by using elements of successively higher impedance, to reduce interaction. In the limiting case, shown here, the phase difference is constant—180 deg. for 2 stages, 270 deg. for 3 stages, 360 deg. for 4 stages.

Identical Component Cascade

Using identical components in cascade, the two-stage network gives a minimum phase difference, at the new crossover point, of 105 deg., rising to a maximum of 180 deg. The three-stage case gives a minimum of 110.7 deg., rising to

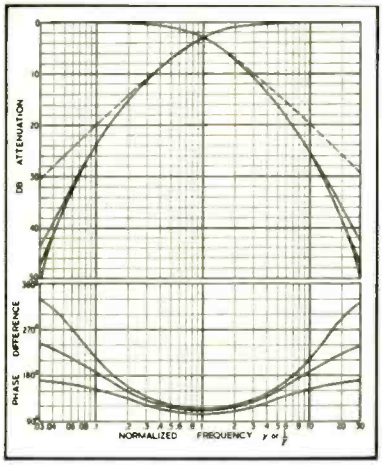

Fig. 4. Moving the responses of Fig. 2 over to approach constant total power produces these results. The dotted curves indicate the responses of single reactance networks for comparison.

a maximum of 270 deg. The four-stage case gives a minimum of 112 deg. rising to a maximum of 360 deg.

As regards constancy of power delivered to the combined arrangement, these circuits are extremely good, all of them giving an approximation of better than 0.1 db at all points.

What may appear to be a disadvantage in using more stages—that of producing a great deviation in phase—may be considered to be compensated in the greater ultimate slope of cutoff beyond the crossover frequency. However the half-slope point (towards this ultimate maximum slope) is not reached until 2.7 times crossover frequency in the two-stage case, 5.1 times the crossover in the three-stage case, and 8.5 times crossover frequency in the four-stage case.

This means that, for example in the four-stage case, a slope of 21 db per octave, of the rated maximum of 24 db per octave, is not reached until a ratio of 72:1 beyond crossover frequency. A slope of 12 db per octave is reached at

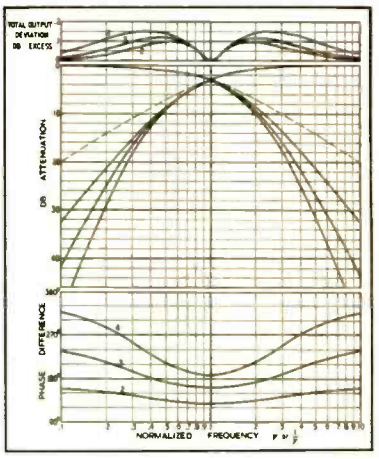

Fig. 5. Moving the responses of Fig. 3 over to approach constant total power produces these results. Here the deviation from total constant power is measurable, shown at the top.

8.5 times crossover, but with an attenuation of 23.78 db. At this point there is not much difference in the attenuation given by each network.

From this it is seen that the use of identical components in cascade, after making the necessary adjustments to crossover frequency to achieve approximately constant total power, closely approaches the response of the single-stage arrangement (shown dotted) until the attenuation gets quite large.

The phase difference is always slightly larger than the 90 deg. constant value associated with a single-stage arrangement, but does not become excessively larger until there is a considerable amount of attenuation in one of the outputs.

Reduced Interaction

Use of networks with less interaction than identical components give will result in a response that does not hold quite so closely to level nor is the phase deviation kept so close to the 90 deg. figure. This is shown by the other set of cases given in the appendix, where non-interaction networks are considered. In practice a network somewhere between the extremes might also be used, but the figures given show the extreme possibilities.

Using non-interacting networks the two stage case shows a minimum phase difference of 131 deg. with a maximum of 180 deg. and the rolloff beyond the crossover is more rapid. However the deviation from constant total power is a little larger too, as shown in *Fig.* 5, reaching a maximum of 0.1 db.

The three-stage case results in a minimum phase difference of 162.1 deg. and slightly more deviation from total constant power. The four-stage case achieves a minimum phase difference of 188 deg.

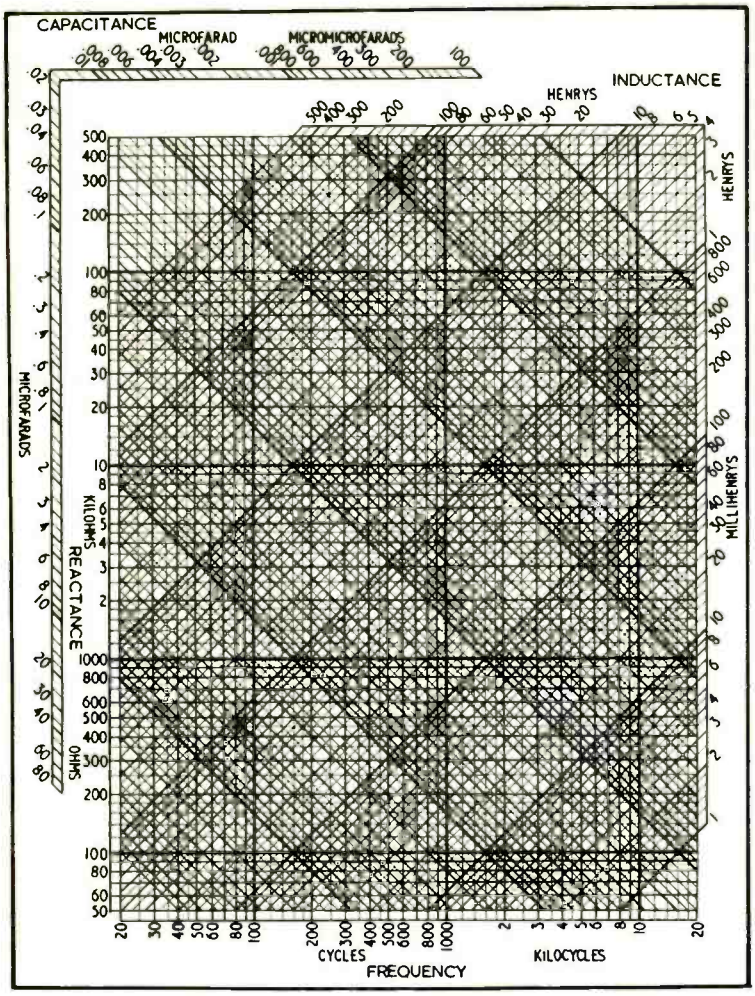

Fig. 6. Reactance chart for aiding calculations: (use chart from June 1956 issue, p. 27)

with even more deviation from constant total power.

Practical Compromise

All of these arrangements achieve fairly close to the constant total power condition, however, and probably the more serious audible effect will be the phase deviation—the fact that the phase between the energy from the different units in the vicinity of crossover is rapidly changing.

This consideration favors the networks with the lower number of stages and probably the single-stage arrangement is really ideal, provided it does not deliver too much energy at frequencies well beyond crossover to the wrong unit.

If this happens use of two or more stages may be warranted to achieve a greater slope beyond the crossover frequency, *but this increased slope cannot be achieved at crossover frequency,* with a resistance-capacitance type of circuit, *without introducing a dip in the total power response.*

The only way to achieve a sharper slope at the crossover frequency itself, and in the region *immediately* beyond it, is to employ an arrangement that produces a constant-resistance *characteristic* by using resistance-capacitance networks with appropriate feedback controlled to achieve the correct over-all response. This was discussed in detail in the article on Feedback Channel Separators.[2]

Design Procedure

For the benefit of those who want to utilize these results to produce a *simple* compromise in RC crossover design, the procedure can be outlined in the form of simple factors: any reactance chart such as the one at *Fig.* 6 will give the relationship between capacitance, frequency, and reactance. First the desired crossover frequency is multiplied by the design factor for the number of stages used to give the design frequency for the low-frequency filter, and divided by the same factor to give the design frequency for the high-frequency filter.

Number of Stages	Design Factor
2	2.68
3	5.1
4	8.5

For example, if a three-stage filter is contemplated, the factor is 5.1. The design frequency for the low-frequency filter is multiplied by 5.1: if the desired crossover frequency is 800 cps, the design frequency is 4080 cps. The design frequency for the high-frequency filter is 800 divided by 5.1, or 157 cps.

Now we use the reactance chart: assume the resistors will all be 0.1 megohm; for the low-frequency filter, the capacitors will be 390 μμf. and for the high-frequency filter they will be .01 μf. An alternative design might use the same value of capacitor throughout say .001 μf, and change the resistor; then the resistors for the low frequency filter will be 39,000 ohms, and for the high frequency filter will be 1.0 meg. These alternative designs are shown at *Fig.* 7.

Appendix

Two-stage networks, using identical components in cascade:

$$A = 1 - x^2 + j3x \qquad (1)$$

where $x = \omega CR$ or $1/\omega CR$ for low pass and high pass respectively.

$$\phi = \tan^{-1} \frac{3x}{1 - x^2} \qquad (2)$$

$$db = 10 \log_{10} [1 + 7x^2 + x^4] \qquad (3)$$

Loss at half ultimate phase shift, 90°, $x = 1$:

$$db = 10 \log_{10} 9 = 9.542 \text{ db.} \qquad (3a)$$

Half-power point (3-db loss) given by

$$1 + 7x^2 + x^4 = 2; \quad x = .374 \qquad (4)$$

Phase at half-power point:

$$\phi = \tan^{-1} \frac{1.122}{.86} = 52.5° \qquad (2a)$$

(*Continued on page 53*)

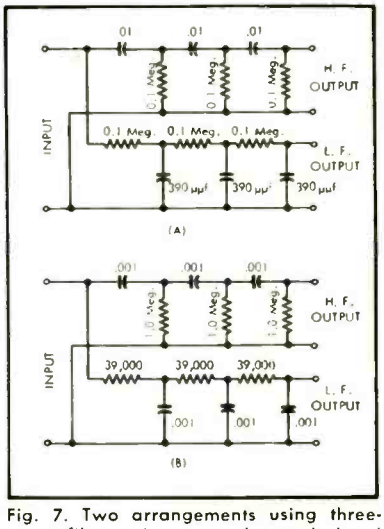

Fig. 7. Two arrangements using three-stage filters, showing values calculated in text.

Transistor Preamp for Low-Output Pickups

ANTON SCHMITT*

A low noise, transistorized preamp for flat amplification of pickup signal affords greater fidelity in sound reproduction, and can be built with assurance of successful operation

IN RECENT YEARS the quest for better sound reproduction has led to the development of a number of improved types of phonograph pickups. One such high-quality electromechanical transducer now enjoying a widening use is the moving-coil pickup, in which the coil is arranged either to rotate in the magnetic field like a d'Arsonval meter, or simply to move within the field. Its advantages include (1) low effective mass and a high compliance, (2) a resonant frequency above audibility, (3) low impedance to minimize hum pickup difficulties and (4) a highly linear response—all of which are important factors in the production of clear, "quality" voice and music signals.

One drawback to the moving-coil pickup is the low output signal it generates, usually of the order of 0.5 to 5 millivolts. This is appreciably lower than the 15- to 20-millivolt output of the usual magnetic or variable reluctance pickups. The higher voltage levels ordinarily are required at the high gain inputs of most preamplifiers. For this reason, most moving-coil pickups are designed to work into a matching step-up transformer, which makes possible the signal voltage output of 15 to 20 millivolts needed to override hum and noise in the preamplifier input stage.

While presently available input transformers are markedly improved over earlier versions, the writer's observation has been that even the best of these units fails to satisfy the stern requirements of the "no compromise" school of audio-fans. To deficiencies in the input transformer may be traced such disappointing phenomena as hum pick-up, peaked high end response, "spread" or inadequate bass (comparable to that resulting from improperly damped speakers) and an unnatural coloration of program material.

An obvious approach to the problem would be through the elimination of the input transformer. While producing greater fidelity, such a solution unfortunately entails the employment of maximum or near-maximum settings of the gain control of the preamplifier—a practice likely to produce an undesirable noise level in even the best modern preamplifier.

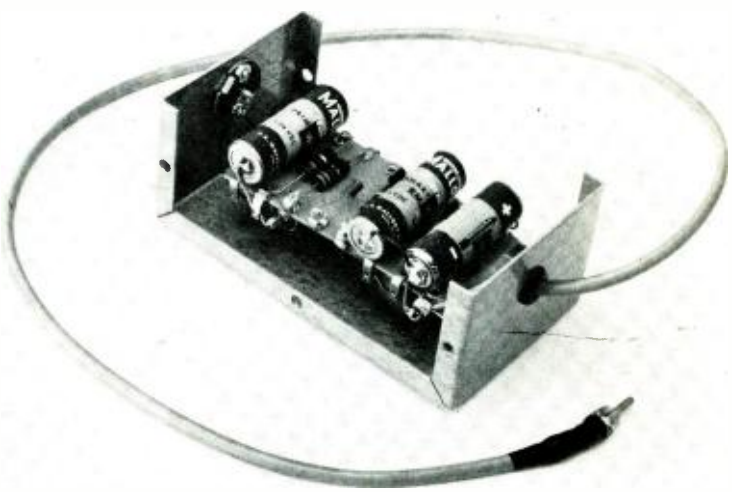

Fig. 1. Simple transistor preamp provides gain necessary to permit connecting low-output pickups to normal preamplifier which incorporates suitable equalization curves.

Why not, then, substitute for the input transformer a cascode-stage preamplifier? Offhand, would not the 6BQ7 so used appear to offer possibilities? After a number of experiments, the writer found that the cascode amplifier was not very satisfactory for this particular application. The limitations of the cascode circuit for use in phono preamplifiers have been pointed out by Marshall.[1]

Transistor instead of Transformer

An approach recently made by the writer entailed the development of a simple and basic low-noise, high-gain transistorized preamplifier, designed to replace the input transformer usually used with low-output moving-coil pickups. It can be built in a few hours, and costs even less than a top-quality input transformer. The results of both instrument and ear tests of this unit have been most gratifying.

Prior to the development of the device it was decided that the finished product, to merit attention, would have to satisfy the following requirements:

1. The gain must equal or exceed that of readily available commercial input transformers.
2. No noise level above that of "negligible" could be tolerated.
3. Hum level must also be negligible—if not eliminated.
4. Sound reproduction quality, by subjective listening tests, must be superior to that obtainable by the use of an input transformer.
5. Frequency response must be linear from 10 to 40,000 cps.
6. High-end response must be clean and smooth, neither "peaked" nor "wiry"; low-end response must be "tight" and clean.
7. Circuitry must be simple. Components needed—especially the designated transistors—must be readily obtainable and low or moderate in cost.

The transistor preamp described here successfully meets these criteria. A number of units are now in use, and have been commended by seasoned and highly critical listeners.

Construction

This preamp requires only a few parts and the circuit, *Fig.* 2, is simple. Since direct coupling is used between cartridge and transistor, the limiting factor for

*Harvey Radio Corp., Inc., 103 W. 43rd Street, New York 36, N. Y.

[1] Joseph Marshall, "The grounded ear," *Audiocraft*, Dec. 1955.

bass response is the input resistance of the regular preamplifier. With the 47,000-ohm load generally used for the more common magnetic cartridges as the input resistance, low-frequency response will be down less than 2 db at 10 cps. High-frequency response will be down less than 2 db at 75,000 cps.

Resistor R_1 and capacitor C_1, in conjunction with the battery in the emitter branch, automatically provide proper operating potential between the collector and the emitter. The degenerative action of unbypassed resistor R_2 in the emitter circuit reduces distortion, smooths overall frequency response and increases input resistance. An input resistance of about 5000 ohms is suitable for such cartridges as the Electrosonic and the Fairchild. An increase in the value of the resistor R_2 raises the input resistance, but lowers the gain.

The collector load resistor R_3 affects both the gain and the amount of thermal noise. The collector current is constant at 200 microamperes for values of R_3 from zero through 8200 ohms. Beyond 10,000 ohms, the base current increases from a low of 10 microamperes, and the collector potential becomes too low. In this condition, there is a loss of gain and an increase in distortion. With a load of 6800 ohms, gain is 20 db and noise is barely audible. Increasing the load to 8200 ohms increases the gain but also increases thermal noise.

Three mercury batteries are used: one is in the emitter, and two are used in series to supply the collector potential. In *Fig.* 1, they are shown soldered in place, since at the time of construction the battery holders currently available were not on the market. With a measured drain of 200 microamperes (with pickup plugged in), battery life in continuous service is estimated at over one year. Battery life could be extended if an off-on switch were installed, or the pickup removed from the arm when not in use. Several units have been in continuous operation for a year without battery replacement.

Despite battery operation, difficulty with induced hum may be experienced unless proximity to power transformers and turntable motors is avoided. Returning all grounds to a point at the input to the shield will minimize any induction hum problem.

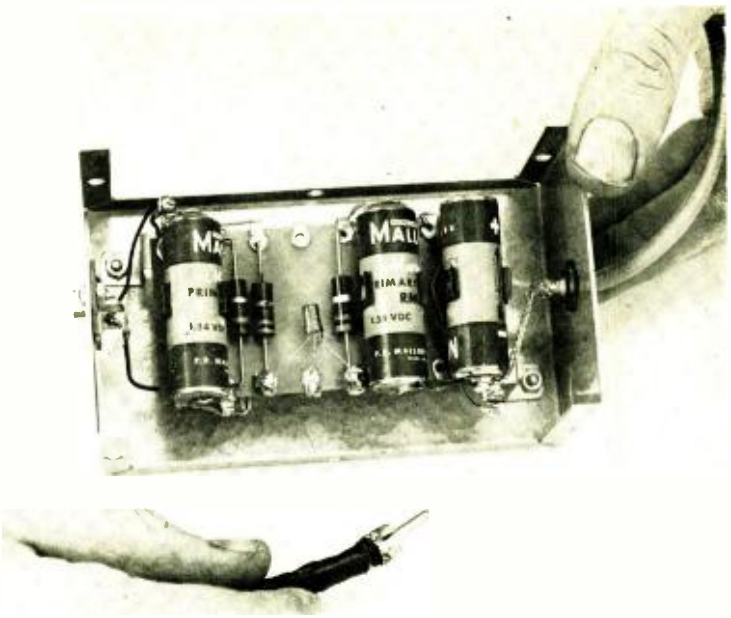

Fig. 3. Close-up of internal construction. Battery clips specified in parts list eliminate need for soldering batteries in place.

All of the low-noise transistors currently available have functioned satisfactorily in this circuit, although occasional individual units have been excessively noisy. It is recommended that a transistor be checked for noise before clipping the leads and soldering in place. In soldering, pre-tinning the leads and lugs and brief applications of heat should permit making satisfactory connections without risking damage to the transistor. Reversed battery polarities can be ruinous to transistors and caution should be practised—although in the experiments accompanying the development of the present circuit, polarities were reversed on a number of occasions without apparent damage to the transistor, probably because of the low potentials present.

Among the transistors the writer found satisfactory in this application were the Raytheon 2N133, and the RCA 2N77, 2N109, and 2N105. In the preamp shown, the Raytheon 2N133 was used. The transistor is soldered in place with the red dot facing the batteries which supply potential to the collector—the lead soldered on the terminal lug nearest the two batteries in series is the collector lead.

The preamp was built in a 3" × 2⅛" × 5¼" gray hammertone aluminum box. The resistor strip is a Miller 450. A two-foot, single conductor shielded microphone cable serves as the output lead, entering the box through a grommet. Component values are given in the accompanying parts list. *Figures* 3 and 4 show two additional views of the completed preamp.

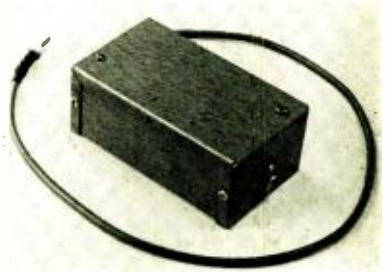

Fig. 4. External view of completed preamp.

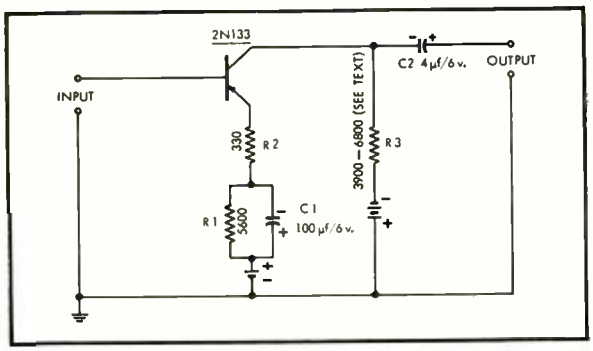

Fig. 2. Schematic of the transistor preamp.

PARTS LIST

C_1	100 µf, 6 volts, electrolytic
C_2	4 µf, 6-volts, electrolytic
R_1	5600 ohms, 1 watt
R_2	330 ohms, ½ watt
R_3	3900 to 6800 ohms, 1 watt (see text)
1	Transistor—Raytheon 2N133, RCA 2N77, 2N105, or 2N109
1	Acme Battery Holder, #153
1	Aluminum box, 2⅛ × 3 × 5¼
1	Miller #450 Resistor Mounting Strip
3	Mallory RM-12R mercury batteries

From the Archives of Bell Telephone Laboratories

An Acoustic Illusion Telephonically Achieved

HARVEY FLETCHER*

A description of one of the first studies of binaural illusion and its effect upon those who first participated in the tests. The second in this series of reprints of Bell Laboratories' papers on sound, hearing, and acoustics.

DURING the Winter and Spring of last year (1932) a strange figure inhabited the American Academy of Music in Philadelphia. Looking him full in the face, one met unblinking eyes, and a slight smile, fixed and unfading; and this evidence of inhumanity was confirmed by looking at him in profile, for just in front of his ears, microphones were set into his cheek bones, as seen in *Fig.* 1. Thus Oscar, the tailor's dummy, though less than human in appearance, was given one capacity that was more than human: that of instantly communicating to others exactly what he heard, exactly as he heard it. To listen through the receivers connected to Oscar's microphones was to put oneself in Oscar's place. This capacity of Oscar's gave him an important position in the tests of musical reproduction conducted by the Laboratories in cooperation with Dr. Leopold Stokowski and the Philadelphia Symphony Orchestra.

(Reprinted by permission from Bell Laboratories Record, Vol. 11, No. 10, June, 1933)

* Acoustical Research Director, Bell Telephone Laboratories (1933).

Fig. 1. Into Oscar's head two microphones are set, one on each side.

Oscar on stage with one of his "coaches."

When one hears a sound, one can usually locate approximately its point of origin—its distance and direction. The mechanism by which this location is accomplished is not altogether understood, but the interaction of the two ears seems to have much to do with it, for stopping up one ear destroys the ability almost completely. In listening to an orchestra under the two conditions, the difference in effect is quite similar to that between a view seen in full perspective with both eyes and in flat panorama with only one.

It is to be expected that any two sound-apprehending devices could double for the ears. Two microphones, placed the same distance apart as human ears, could be independently connected to two receivers. A person putting the receivers to his two ears would be acoustically transported to the location of the microphones, no matter at what distance from them he might actually be, hearing all sounds as he would if his ears were in the positions of the microphones. Oscar duplicates the conditions of normal hearing as nearly as possible, not only by supporting the microphones the proper distance apart but by modifying the sound field near them as a human head modifies it near the ear.

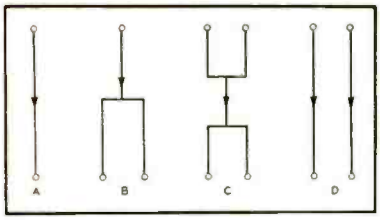

Fig. 2. Systems of transmission can be divided roughly into four classes: monaural (A), diotic (B), mixed (C), and binaural (D).

In the extent to which they approach the conditions of normal hearing, systems for transmitting sound can be roughly divided into four classes, as diagrammed in *Fig.* 2. In "monaural" systems, such as the commercial telephone, a single transmitter is connected to a single receiver. "Diotic" systems, in which the transmitter is connected to two receivers, one for each ear, are familiar to those who have used double head-receivers on telephone lines and the like. "Mixed" reception is found in the similar use of double receivers to monitor a loud-speaking public address system, in which two microphones are used to pick up the program and their outputs are mixed. Of "binaural" systems, in which the outputs of two microphones are separately conducted to the two receivers, only a few experimental examples such as that used in Philadelphia have been built.

From the familiar monaural condition, the change to the diotic produces mainly the effect of an increase in the loudness and fullness of the sound, and of a shift of its apparent source to the center of head. Changing to the mixed condition adds a roughness to the sound but leaves its loudness and apparent source as they were when reception was diotic. With the final change to the binaural condition, the apparent sources of sound move to approximately their proper locations in space, and the apparent reverberation is greatly reduced.

To provide, for the experiments in Philadelphia, a binaural system which would reproduce speech and music faithfully in all respects, microphones, amplifiers and receivers of the highest quality were used in the two channels, transmitting extremely wide ranges of frequency and volume. Since the response of a receiver depends upon the person's ear upon which it is placed, perfect reproduction requires a different equalization for each person. In these experiments, however, only a single equalizer was used, which was an average for a group of listeners. By its use the frequency characteristics of the system were corrected so that all observers agreed that the reproduction was exceptionally faithful.

Striking evidence of the naturalness which can be secured with such a binaural system was obtained at several formal demonstrations in Philadelphia. When the guests had put to their ears the receivers connected to Oscar, who was in another room, someone would say confidentially in Oscar's ear, "Please move over." A surprisingly large number of the guests would start to obey the command before realizing that it came from the receivers. Afterwards someone would whisper in first one and then the other of Oscar's ears, and would tear paper, jingle keys, or thump a tambourine to illustrate the fidelity of the system to sounds of high frequency. Finally Oscar would be brought out and set in the midst of the audience so that they could compare direct with transmitted sounds.

Experiment showed that the advantage of using Oscar, instead of two microphones less dramatically mounted, was confined to cases in which the sounds originated quite near the microphones. For tests of the reproduction of music, therefore, two microphones were hung from a bar. It was found that, when the localization effect of the system is disregarded, the best place for the microphones is relatively near the orchestra, where the tones are brilliant because absorption has not diminished the high-frequency components as it has by the time the sounds reach remote parts of the hall. The localization is such, however, that observers sitting at the rear of the hall where they can see the orchestra prefer to have the microphones near them, even at the expense of tonal brilliance, for otherwise they find themselves discomforted by being acoustically in one place and visually in another. This effort has even been noticed by observers in another room where a screen placed the source of sound at a certain apparent visual distance.

Fig. 4. The amplifiers and equalizers for the binaural system were adapted for use at the Century of Progress Exposition by L. B. Cooke.

In comparisons of binaural with loudspeaker reproduction, even the inconvenience of wearing head receivers does not prevent most observers from preferring the binaural system. In an attempt to rate the worth of the binaural system, observers were asked to note their preference between monaural reproduction of the full frequency range and binaural reproduction of various limited frequency ranges. Even when all frequencies over about 2800 cps were suppressed in the binaural system, more than a third of the observers preferred it.

To give a wider public the unique experience of being put in the other man's place by a trick of the ear, a binaural system (*Fig.* 3) was installed at the Century of Progress Exposition in Chicago. Here Oscar II appeared in a glass booth somewhat similar to that shown in the headpiece, and observers who hold to their ears one of the sets of receivers on a nearby balcony, will feel as if transported to his position, there to be addressed by Oscar's companion. The system will furnish to those who use it dramatic proof that there is no longer any limitation, except expense, to the acoustic fidelity which electrical transmission systems can achieve. ●

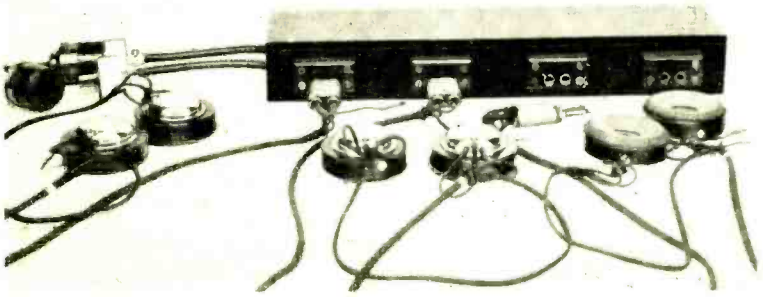

Fig. 3. Arrangement by which several pairs of receivers were multiply connected to Oscar for binaural observation by several persons at once.

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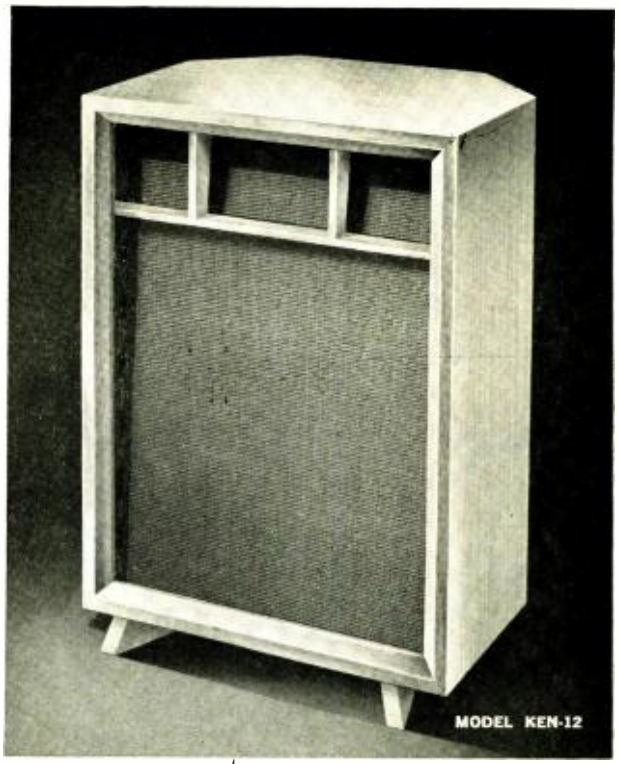
MODEL KEN-12

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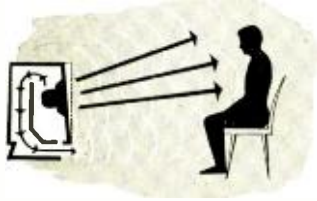

KwiKit acoustic design and tilted baffle combine direct speaker radiation and compensated rear horn loading in a way that blends bass, middle and treble ranges perfectly . . . for *uniform* response throughout the listening areas of a room.

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Heavy ¾" first grade, fully cured lumber for top, bottom, sides and back . . . *not* flimsy ½" wood commonly used in "kits." Bigger, sturdier—*as much as 30% heavier* than others in the same price class. Eliminates spurious resonances so detrimental to achieving richer, cleaner bass reproduction.

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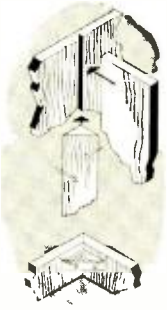

Exterior and interior elements, even the cleats, fit snugly within close tolerance "rabbeted" grooves. Gluing and screwing of each piece results in reliably air-tight, permanent joints. No nails used. No pencil markings necessary. Mitering and plenty of glue blocks and bracing for truly rigid construction.

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Underside view shows how advanced design, self-contained folded horn extends to the *front* of the cabinet, projecting low frequencies out into the room . . . not back into a corner, splashed against the walls. Small slot in base is resistively controlled vent which equalizes woofer diaphragm excursions in compression chamber. KwiKits are therefore independent of room furnishings, shape or placement and can be used against a flat wall, in a corner . . . even up in the air!

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EQUIPMENT REVIEW

Tech-Master 60-watt Amplifier Kit
Bogen Stereophonic Tape Adapter-Amplifier
Garrard Model T "Mark II" Record Player

WE CAN WELL REMEMBER the day when we would not have recommended the use of a 60-watt amplifier for the home system because there were none available then. But we have long campaigned for more than 10 watts—which we consider the absolute minimum for a monaural system—with the upper limit gradually moving from 20 to 30 to 40 and so on. We also remember being told about 200-watt amplifiers, and our comment was, "That's all right, plenty of people will buy them for their home systems."

In general, while the actual power *requirements* have not risen, we have become more conscious of the peak demands on our systems, and consequently we have found that those loud notes come through with much less cringing on our part when we have sufficient power to handle them. 60 watts does not represent a great increase over 30—only 3 db—but if it helps to eliminate the distortion on the loud notes, even 3 db is worth while.

The Tech-Master Model 19K amplifier kit comprises both the power amplifier and a satisfactory preamplifier with all the necessary switching, tone, and volume controls at a price that is most attractive—you actually save approximately $50 by building it yourself. It is also available in factory completed form as Model 19. Suffice to say that the amplifier lives up to its specifications. Intermodulation distortion measured only 0.85 per cent at 60 watts, using 60 and 7000 cps, and the output was 65 watts at 2 per cent IM. Response was within ±2 db from 10 to 50,000 cps, and square wave response was satisfactory up to 7000 cps, with only a slight rounding at 10,000.

The amplifier is easy to build, with instructions which should make it possible for the beginner to complete the unit with no trouble at all. We would like to see a little more space between some of the sockets and the associated terminal strips so that resistor leads might be slightly longer, but with a little care the construction can be followed with ease.

The tube complement consists of a 12AX7 as preamplifier, a 12AU7 as tone control amplifier, a 6AN8 as phase splitter and driver, and a pair of 6550's in the output stage, with a 5U4GB as rectifier. The selector switch, with ten positions, provides the on-off switch, phono positions with RIAA, AES, NAB, LP and 78 equalization, and high level inputs from PIEZO pickup and from TUNER, TV, and TAPE. In addition, the unit is equipped with a TAPE FEED jack which is connected ahead of the tone controls (but *after* the volume control).

The amplifier is 14¼ in. wide, 10¾ in. deep, and 5¼ in. high, and may be fitted into an accessory metal cabinet if desired for table-top use, but if to be installed in a cabinet there is sufficient shaft length so it may be used with a ¼-in. wood panel. The unit is furnished with a two-tone black and gold panel with all designations, and this panel would normally be mounted on the front of any wood panel with which it is used.

Among the attractive features of this amplifier are: very low hum output, good tone-control action, hum-balancing potentiometer, variable pickup load calibrated directly in ohms, two a.c. outlets—one switched and one "hot,"—and 4-, 8-, and 16-ohm speaker outputs.

Listening quality is all that could be desired and rather more than would be expected from a complete unit at this price. On the whole, we were pleasantly surprised at the performance of this unit and we consider it an excellent value.

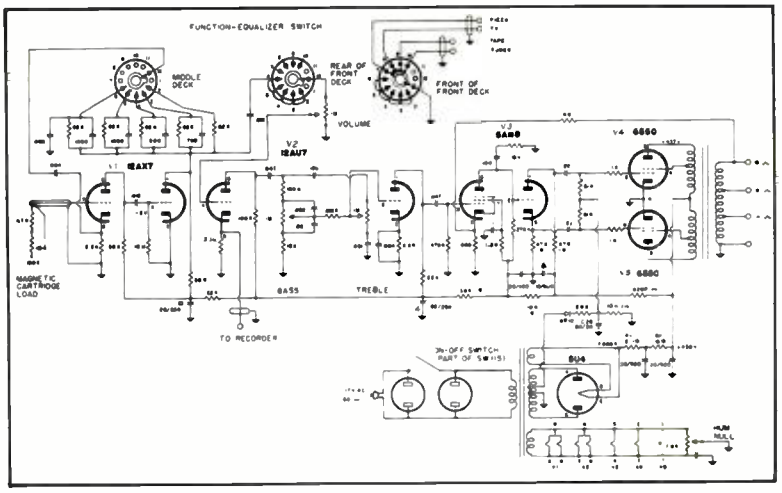


Fig. 1. Schematic of Tech-Master Model 19K Amplifier Kit.

EQUIPMENT REVIEW (Cont'd)

BOGEN ST-10 STEREOPHONIC TAPE ADAPTER-AMPLIFIER

One of the problems of converting a hi-fi system to stereo is that it requires an additional amplifier (and speaker, of course) in addition to the stereo playback head itself and the tape preamplifier. If a conventional tape recorder is converted to stereo, it is possible that the preamp may have been added at the same time, but with such an adaptation as provided by the Dactron stereo adapter kit, for example, no internal changes need be made in the recorder—the stereo head is simply attached outside the regular tape playing mechanism. In any case, two head outputs are available from any stereo recorder, and the ST-10 permits both to be fed to similar preamps, with the output of one channel being fed to the remainder of one's system, while the ST-10 also furnishes a small power amplifier for the second channel.

This amplifier would serve especially well for any of the playback—only tape decks that are available, or for any which did not provide any electronic circuitry. Furthermore, because of the flexibility of the ST-10, it would be a simple matter to convert any ordinary tape recorder to stereo by simply changing the head and adding this adapter-amplifier. Thus, with the change of the head, and the consequent connection of the top track section to the tape recorder amplifier in just the same way as the half-track head had been, and the direct connection of the bottom-track head to the ST-10 amplifier and on additional speaker, the system would be complete.

In other words, whatever your problem with respect to a conversion of an existing recorder to stereo, or with respect to providing amplification for a tape deck which had none at all, this adapter-amplifier should answer it.

This amplifier, shown in *Fig.* 2, consists of two channels—both with the same type of tape preamplifier, equalized for direct connection to the leads from the playback head—and with one channel terminating in a 10-watt push-pull amplifier, while the other terminates in a cathode follower normally intended to feed an existing hi-fi system at some unused high-level input. The preamplifiers are 12AD7's, with feedback equalization. Channel 1 continues with volume and tone controls, a 6U8 as voltage amplifier and phase splitter-driver, with two 6AQ5's in the output stage, with provision for 4-, 8-, and 16-ohm speaker loads. In Channel 2, the preamplifier is followed by a volume control and a 6C4 cathode follower. The volume controls are ganged, and the tone control is actually a treble control on Channel 1. Adjustment of balance between the two channels can be made by means of the volume control of the auxiliary amplifier used with Channel 2.

The ST-10 is quite compact—measuring only 5⅜ in. wide by 12 in. deep and 6½ in. high with its protective cage and the legs shown. For installing in an existing cabinet, the over-all height is about 5 in. Two short "patch-cords" are used to connect the preamplifiers to their following circuits, thus making it possible to reverse the channels readily to make the connections without any internal connections in the amplifier itself. This is a distinct convenience to most users of tape recorders, especially those to whom a soldering iron and long-nose pliers represent an insurmountable hazard.

Performance will be found quite satisfactory on most stereo tapes—those that are, in themselves, good. Gain is adequate, and equalization conforms to the NARTB standard tape playback curve within 2 db from 20 to 20,000 cps, although it is doubtful if any tape recorder will put out an appreciable signal at 20,000 cps at a speed of 7½ ips. The 10-watt output is perfectly adequate for the average installation on *stereo*, but we would recommend that for monaural tapes the conventional system amplifier should have rather more than 10 watts for completely satisfactory use. However, as a means of changing from monaural to binaural playback, this Bogen amplifier offers a simple and reliable—as well as fairly economical—answer.

GARRARD MODEL T "MARK II" RECORD PLAYER

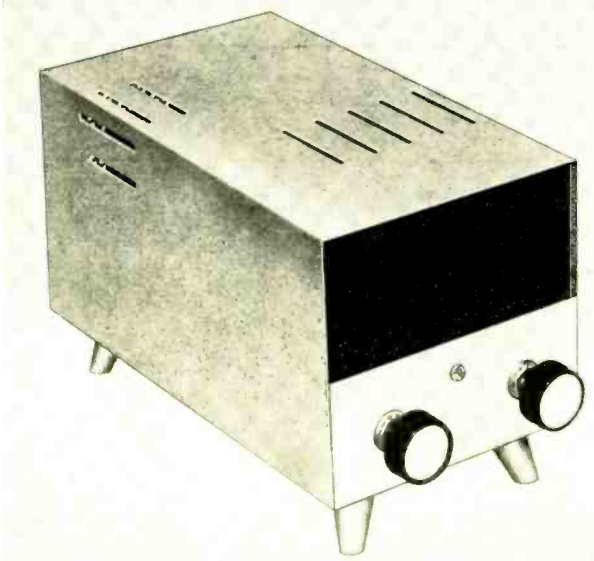
Like the Model T Ford, the Model T Garrard changer has undergone some great changes, although—unlike the earlier bearer of this famous name—the Garrard is still called a Model T, but with a "Mark II" added to distinguish it from its predecessor, the original Model T.

Actually, however, the new Model T is a great improvement over the earlier ones, and it is much more like the well known Garrard changer line in mechanical construction—with only the changing mechanism omitted. The new model provides four speeds—the usual "all three" plus 16⅔ rpm. While we will never agree that the 16⅔ speed will be at all useful in high fidelity reproduction of music, there are some users who have need for it because of talking books and similar uses. Be that as it may, most people demand the fourth speed, even though they haven't the slightest idea of what they are going to use it for after they get it.

The motor on the Model T is mounted on live rubber vibration absorbers, with the entire base plate isolated from the mounting board by "snap mount" spring assemblies which permit instant mounting and levelling from the top of the unit after it is installed. All four speeds operate from a single turret on the shaft of the dynamically balanced motor, and no belts are used. When the unit is shut off, the idler disengages from contact with motor shaft so as to avoid the possible formation of flat spots which might result in thumps and wow.

In operation the Model T Mark II is exceptionally satisfactory. The motor is started by moving the tone arm, and at the end of the record it is shut off automatically. There was no detectable wow or flutter in listening, using piano records for the former and violin for the latter. Speed was noted as being about 3 per cent fast, but this was with pickup stylus force of only 4 grams—with greater stylus force it could be brought to normal speed. The speed remained constant down to 90 volts input, and dropped off gradually to 65 volts, where it was 5 per cent slow. Below 65 volts the speed dropped off sharply, with insufficient torque to turn the record against the stylus drag. However, since most associated equipment would be inoperative at 65 volts, this was not considered of any importance.

The new Model T is compact, requiring only 14¾ by 12½ in. for mounting (practically the minimum possible for a 12-inch record) and clearances of 3 and 2-1/16 in., respectively, above and below the motor board.



Left: Fig. 2. The Bogen Model ST-10 Amplifier.

Below: Fig. 3. Garrard Model T "Mark II" 4-speed record player.

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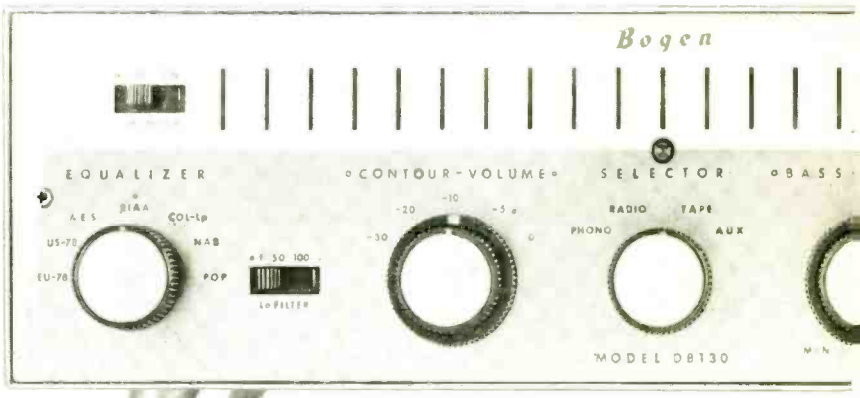

DB130 35 WATT AMPLIFIER

Glance at the "specifications and controls" or at the control panel in the photo. It's obvious that our engineering department (largest in the high-fidelity industry) hasn't spared itself on the DB130. Many experts consider this the finest "full-control" amplifier ever built. Spin those knobs and flick those switches at your nearest Bogen Sound Salon. You'll get the hi-fi thrill of your life.

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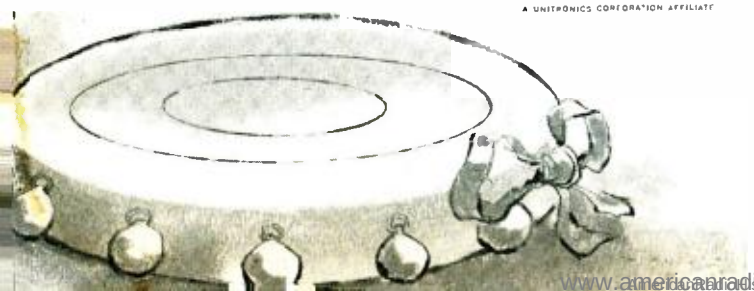

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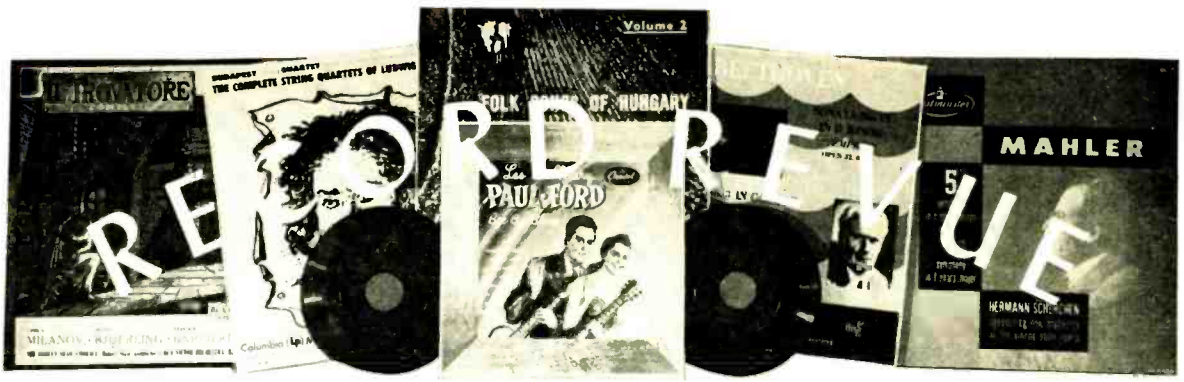

EDWARD TATNALL CANBY*

JUST YESTERDAY

Orff: Die Kluge. (Story of the King and the Wise Woman). Philharmonia Opera Co., Sawallisch. **Angel 3551 B/L (3).**

This is really rattling good entertainment—though whether it is music, speech, opera or something in-between is hard to say. A hilarious-serious folk tale, Grimm-style, it is set to an odd combination of lively German lowbrow speech and a species of music that is all rhythm and hardly any harmony except D minor—a typical Orff proceedure, as those who have heard his two "Carmina" works will know. The lighthearted way in which speech becomes music and music slides off into speech here is enough to make your mouth fall open; it's so natural, you don't so much as notice it half the time.

Orff, the distinguished German modern, seems long ago to have solved the musical problem of the age, what to do instead of old-fashioned harmony and keys. He just uses D minor, or just D itself and A (2nd harmonic). But the permutations and variety built around that eternal D is remarkable. And oh, so easy to understand! Nothing a bit tough about *this*, except perhaps the double-talk German, not all of which, I suspect, is 100 per cent translated into revealing English.

The production is flawless, marvellous, superb. Nothing more can be said! Sprightly, lively, imaginative, marvellously musical, every bit of it is a delight to follow, and notably the leading parts, the King (Marcel Cordes) and the Wise Woman—Die Kluge herself (Elizabeth Schwartzkopf), who wraps King and all around her little finger; the three roguish vagabonds—what a crew!—and the sorrowful Donkeyman, whom the Wise Woman alone protects. There are outlandishly, unbelievably alive drinking scenes, roars of laughter, uproarious plotting; there is hypnotic persuasion on the lady's part, when she subdues her grandly furious King-husband who has lost his temper in a way to make your hair curl. . . . Just get out the booklet with complete text in German and English (you'll have to follow it word for word) and enjoy a really strange and titillating experience in dramatic stage stuff.

Some of the finest recording I ever hope to hear, and on ghostly-noiseless surfaces.

Cimarosa: Il Matrimonio Segreto (The Secret Marriage). Piccolo Scala production. Soloists, La Scala Orch. Milan, Sanzogno. **Angel 3549 C/L (3)**

Here's another flawlessly perfect Angel production, via the famous La Scala Opera. This one inaugurated a new, small La Scala theatre, in Milan.

This is for Mozart fiends and also for those who relish hearing Rossini and Verdi already in the making. The music, by one of the big opera men of Mozart's day—the late seventeen hundreds—will astonish those who know Mozart's "The Marriage of Figaro" or "Don Giovanni," for here is just about every musical trick that Mozart knew. Even the plot is "Mozartish"—here is another Suzanna and a Figaro, and here is the usual elegent horse-play between ingenious and uppity servants and their masters of the upper crust. But even more, here is the Mozart style of music to a T.

Or almost a T, and don't start saying it's Mozart but not quite as good. To be sure, Mozart cuts deeper and wider, his tunes stick better and are more lasting. But it was Mozart who did the borrowing, not Cimarosa. Cimarosa's music actually is pure, indigenous Italian opera on its own home ground and borrowing from practically nobody. Mozart's opera, then, as this will show you, is outwardly just about 95 per cent borrowed from Italy, over and above the Italian language Mozart used. (Put aside "The Magic Flute" and his other more Germanic operas. In German.)

It was the 5 per cent German additive of lyric eloquence, of softness and humanity, of structure and architecture (this last, in its own area, a lot more than 5 per cent) that made Mozart even better.

There just couldn't be a more lively, active, well-acted, beautifully sung performance than this one. As you listen, you'll begin to sense the true Italian in it, the strong fore-taste of Rossini, the sharper, cooler, more brittle quality as compared to Mozart. Also, the pure line of Italian vocal showmanship, glorying in itself, that was tempered in Mozart, but which blew itself straight up into "Aida" and "Il Trovatore" in Italy, within the next century.

As always, complete texts and story, plenty of interesting illustrated background material for the eye. These Angel productions are each a masterpiece of engrossing entertainment, to keep you busy as a bee for hours at a time. Wish I could keep up with all of them.

Kurt Weill: The Seven Deadly Sins (1933). Lotte Lenya et al., Orch. W. Brückner-Rüggeberg. **Columbia KL 5175.**

Well, I'm "converted." Before this, I hadn't been overly excited by Kurt Weill's famous stage pieces, but "The Seven Deadly Sins" suddenly hits the spot. It's an unusually persuasive, beautifully constructed piece, a kind of classic that sums up in concentrated form the best of Weill's assets, without compromise.

The work, from 1933 and Germany, was a sort of ballet with singing, set in a hypothetical America that, however, is much more like the between-wars Germany that was Weill's home country. It is surprisingly "modern" for a piece already so old—the story is about two sisters both named Anna who, as in a number of fashionable psychological plots of our own day, are actually two aspects of the same person.

The practical Anna (Lotte Lenya) does the singing, telling the story of herself and the other Anna, the flaming, impulsive, beautiful one, as they travel the hot spots from Los Angeles to Boston to Baltimore (the piece is sung in German!) making cash and fortune as they (she) can. Anna I is always trying to keep Anna II on the straight and narrow route to virtue.

At home, in Louisiana (!), the Family is here represented by a grim barbershop quartet that sings implacable music, self-satisfied, greedy, smug, about how well Anna is doing, how virtuous she is and how much money she'll be sending home, to build them a new house. An impressive and gruesome way of expressing a family's utter lack of understanding of its offspring—enough to make you shiver.

And as the sisters travel, each new episode, each new city, represents one of the Deadly Sins—Sloth, Pride, Anger and so on. Each is a complete unit, a movement, a scene in the whole. Each has its own shape and plot, the story sung by the practical Anna in Lotte Lenya's small, wonderfully human and pathetic voice. Best of all, the orchestra in each number has a different full, intense life of its own, very active but, as in the whole work, curiously static, playing the same high-tension musical figures straight through each episode for a curiously effective building-up of emotional force. And all of this is set unsically in that bitter-sweet, semi-blues style that made Weill famous in his American-made works of a later time and in the "Threepenny Opera" revival.

The curious thing about this piece is that it is wholly classic in the highest sense, almost a work of Greek drama. It is block-like, stylized, rigidly economical, without a trace of extraneous matter; the entire musical action is carried on by (a) Lotte Lenya's singing, (b) the Family, those lugubrious male voices and (c) the active backdrop of the orchestra. Each episode sticks to its own pattern of expression as rigidly as any movement by Bach himself, building tension by monotony. The Family acts as a sort of Greek chorus, and, indeed, it reminds me strongly of much in Stravinsky's Greek-inspired works of this same period, the Twenties and Thirties.

Popular? Well, the music is Weill all right and no doubt about it. But the formal shaping of this piece is so taut, so carefully worked out, that there is little question of "compromise" with the demands of a popular style. My respect for Weill has gone up immensely and I recommend this to classical doubters, as well as those who like the composer anyhow.

A fine recording in general, the orchestra fat and tubby, Lotte Lenya very close and alive, the Family of male voices oddly set off in a strange sort of filtered space. To my ear there's some distortion here, but not of any great importance.

Leon Kirchner: Piano Concerto. Kirchner; N. Y. Philharmonic, Mitropoulos.
Wm. Schuman: Credendum (Article of Faith). Phila. Orch., Ormandy.
Columbia ML 5185.

This imposing disc of two large commissioned American works is typical of a remarkable number now being issued, thanks to foundation money.

I'm the first to hail a contemporary music, but I just can't get a happy feeling about the continuing existence of large-scale symphonic writing of this sort, that depends wholly on a special type of patronage which removes it almost fully from the active life of our present world!

It's not the patronage (the composers not only get performances but, aside from the inevitable teaching they usually do, practically

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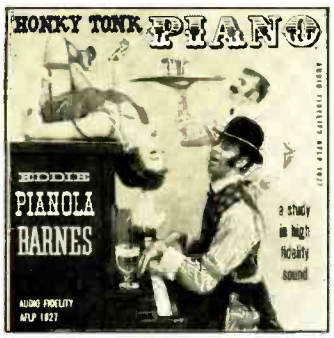

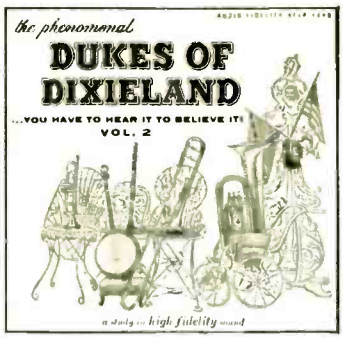

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WRITE FOR *FREE* CATALOGUE

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live and work by prize-winning, fellowships, awards, scholarships and the like. Patronage is an old stand-by for art, since the beginning of time. What bothers me is the fact that *this* patronage simply allows composers to compose for themselves, for no audience that can hope to come near them in understanding, for an expensive, uneconomical and unrealistically large medium that automatically precludes *any* sort of general hearing, from the word go.

This sort of foundation money just asks composers to write themselves straight out of this world into a composers' ivory tower, and hang the public, or even an appreciative audience of musicians!

What am I saying . . . ? Well, these remarks refer not only to this particular disc but to many dozens of others which, I suspect, are not being listened to. Frankly I can't see any of our readers going out to buy this music and I don't see why they should. It's not written for them. I doubt if its written for their grandchildren, either, though *that* one never knows.

—By which I do *not* mean it is necessarily poor music or less than good music. Just professional music. My reactions are as follows, if you're curious. The Kirchner Piano Concerto is an enormously complex, thick, dissonant, ultra-serious work which, frankly, made not one trace of plain musical sense to me from beginning to end, on a first hearing. That is, there are no easy melodic lines, keys, harmonies, no quickly graspable rhythmic motives, no "themes,"—and a very large amount of activity. It has a twelve-tonish sound to me, but not in any graspable manner, as do many other works for me.

Which means, simply, that I do not yet understand this man's language—not one word. And, as I say, I'm reasonably hep on modern idioms. He is probably making a lot of sense. But then again, for all I know, he may make no discernible sense whatsoever, to anyone but himself. Possible, in these days of fuzzy values, though not probable.

To judge this piece honestly, then, I would have to hear it through a half dozen times minimum and preferably more, at decent intervals. Mind you, that in itself is *not* a criticism of the piece, though it is a bit tough on reviewers who have a million other pieces to hear also. But, somehow, I feel that even the musicians of the N. Y. Philharmonic are floundering in considerable incomprehensibility as they play it. Indeed, the composer himself plays muddily—even he. But then—Beethoven's music had the same effect on its first hearers.

And so, *maybe*, this is a very important work. Just maybe. It won two major prizes and a fullscale recording with top talent all around. That might mean something, but again, it might not. Not to my ear—yet. So it goes with modern music these days. . . .

As for the other item, William Schuman, his square, spare, energetic American style is simplicity itself in contrast—no trouble at all in getting the gist of his tribute to UNESCO. It's full of strong rhythms, percussion, ordinary chords hurled dissonantly at each other (an old Schuman trick) and has an expressive slow movement and an elegant scherzo-like section between its dress-parade opening and closing. I don't think you'd mind this one a bit.

IN THE PAST

Locatelli: Twelve Concerti Grossi, Op. 1. I Musici Virtuosi di Milano, Dean Eckertsen. Vox DL 333 (3)

Why such monumental editions of composers whose names aren't usually on concert programs? A lot of music, all of a kind here—and none of it is Bach or Mozart in quality—but, on the other hand, every bit is worthwhile, solid, interesting. And, I say, there's no reason why if you like a bit of this you shouldn't like more and more, given time and leisure. Why not twelve concerti, or as many more as you please?

Nobody was expected to play all of these works consecutively without a break, as published, and nobody in his senses will play them all here one after another for six sides. If you aren't too lazy to get up and change a record yourself, every so often, you'll sample these at leisure, for a long-time extension of pleasure.

I see no reason why any amateur, if he enjoys a bit of Locatelli, or Joe Doaks or whomhave-you, shouldn't collect as much of the same as he wants.

Locatelli was one of the famous Italian violin player-composers of the 18th century and his music, on the conservative side for his time, is very close to that of the older Corelli. No experiments, no bursts of strange chords and no sudden dramatic changes, as in Vivaldi; this man just writes good music, craftsmanlike. It is enjoyable on that basis, on the excellence and consistency of its style.

The Milan Virtuosi play in a fairly bouncy manner, with plenty of energy and less smoothness than the German orchestras that have recorded this kind of music. Dean Eckertsen hails from Utah, one of those touring American maestros who now so often conduct European ensembles in American-commissioned recordings. A good enough combination here and, come to think of it, probably better for the music than the temperamental Italians themselves might do with a conductor of their own.

The usual comprehensive booklet of background analysis is included and I found the detailed study of Locatelli good reading and interesting. If you're going to sample this kind of music you might as well do a job of it.

Vivaldi: Eighteen Concerti for Flute. Gastone Tassinari, fl.; I Musici Virtuosi di Milano. Vox DL 353 (3)

Same reasonings apply, more or less, to this vast collection, but here things are carried to an extreme. Vivaldi, to be sure, is a resourceful and important composer. But the flute is the flute, and I found that about two of these exhausted my own flute-tolerance powers for any given listening hour! The flute parts are quite remarkable, full of variety, replete with both melody and much fancy ornamentation—but this only makes the music the more like a flute practice session, after the first two or three concerti. Tough on the ears.

This one, then, is for those with special flute interests and/or those with tolerance and patience when it comes to a lot of one sort of sound. Or for those who collect Vivaldiana, the more complete the better.

Bach: Partitas and Sonatas for Unaccompanied Violin. Nathan Milstein. Capitol PCR 8370 (3).

These six works, one to a side, have been recorded by everybody and his brother who is a fiddler. I'd suggest that this set makes them more accessible as music than any so far, and for good reasons.

Worth a bit of going-into. The age of Bach, the end of the Baroque period in the early 18th century, was famous for its fascination with the transferring of one artistic medium into another, for sleight-of-hand, for trick perspective effects, for "false" fronts, frames, backgrounds and the like in art, for artificial "ruins," fake grottos, carved shrubbery in landscaping. Always one medium into another.

In music the same thing applied. If the walls of Baroque interiors had simulated windows and landscapes on them, musicians tended to transcribe orchestral music for keyboard, violin music for chorus and so on. Hence the many different versions of works of Bach's day—and hence these super-works for a single violin by itself.

For, you see, this was a *real* trick—to write a whole "symphonic" piece for one violin, sketching out and suggesting music that is, of course, only skeletonized in the actual notes as played. But don't think that this isn't big music. These same pieces could be written out, from the skeleton, for a stageful of performers and, indeed, Bach did actually use some of the music in radically different and much larger forms, as movements in cantatas for example.

The rest of this can be said quickly enough. The six sonatas and partitas (not much difference between the two types for the average listener) are suggested, sketched, by the violin and can be filled out by the ear. It takes two for this job. (1) The performer and (2) the listener. Alas, too many per-

formers simply do not "hear" the big piece that is skeletonized for their instrument. They just play the notes, as though really for violin alone. Result: No sense. All you hear is a lot of fiddle scraping.

But other performers do hear the whole and when they play, you too can hear.

Milstein is one of the finest, most accurate, most intelligent fiddlers going. This recording is not only accurate and clear in both pitch and rhythm, so you can get the drift of the musical sense, but he has a consummate understanding of the big music behind the notes. You'll hear it—the big, full-scale pieces that are sketched out—instead of a lot of fiddle noise. No more need be said.

Concertos for Two Pianos (Bach in C, Mozart in E Flat, K. 365). Clara Haskil, Geza Anda; Philharmonia Orch., Galliera **Angel 35380**

Ha! Is this a trap for an unwary reviewer. Here are two pianists inextricably mixed together on one record (the label doesn't say which plays "first" and which "second" and in both works the two pianos are virtually equal in any case)—and I am on record as having lavishly praised one and politely damned the other! Clara Haskil I have called the "first lady of Mozart," the best of 'em all, and I ran down Anda's solo Beethoven piano sonatas as something less than understandingly musical.

Well, harrumph, spit . . . as Major Hoople says, I *think* I can tell which is which here but I'm not saying, at least in print. I *think* I spot the lovely tone of Haskil in the Mozart and I *think* the other, somewhat louder and more percussive piano is Anda. I must admit some very fine teamwork and I can only, wishfully, credit it to the great Clara, who does have the Mozart know-how. The two pianos really carry the burden of the music and they do it beautifully here—the best version of the Mozart I can remember, out of many. (All the two-piano teams play this as a matter of course.)

The Bach Concerto, originally for two harpsichords, is even more a piano duet, with occasional backing by the string orchestra. It's much too thick a piece for two pianos and so the texture must inevitably be highlighted by "pounding out" themes here and there so they'll get through. These pianists do it, but with restraint. In the slow movement, pianos alone, they don't bang a bit.

It's plain impossible to distinguish which piano is which in this Bach—they are completely intermeshed. The team work, again, is excellent and the enmeshing such that the performance is entirely unified and very musical. On any pair of pianos this Bach is cluttery and thick sounding, but these two do it as well as it can be done, all things considered, and the vigor of rhythm, harmonic progression, and strong themes gets over and will no doubt please you no end.

A modest, well-played orchestral backing for both works, not particularly forceful but plenty adequate for the music. And a superb piano sound.

Mozart: Symphonies #38, #39. Pro Musica Symphony of Vienna, Horenstein. **Vox PL 9970.**

I should have got to this sooner—it's a superb record. Horenstein is a lg. flamboyant, romantically-inclined conductor with a good flair for the dramatic. He gives Mozart the best kind of Romantic treatment—not sentimental nor overblown, but simply a musical approach that allows the music to sound big, serious, eloquent.

He plays Mozart on the slow side, impressively, making the slow introductions as ominous as Beethoven. The quick finales are lively but sensibly paced, so that the tunes get through. There are many passages that, under his treatment, remind us of Schubert or Weber. These things are in the music, and no doubt about it.

Oddly enough, most of the older big Romantic-style conductors have treated Mozart as a miniaturist. Even the best tend to make his symphonies sound light and fragile. They surely didn't in Mozart's own day.

But more important than all this is Horenstein's fine musicianship with this orchestra.

The music is given every chance to speak for itself. Each idea, each phrase, each line is carried through, given its full place and shape within the dynamic whole . . . why spread out more words to get over an idea that is strictly musical. I'll merely say that these are among the best and most interesting playings of the two symphonies I've heard, which means their power to please should be correspondingly h'gh for any listener.

Mozart: Clarinet Concerto, K. 622; Clarinet Quintet, K. 581. Benny Goodman, Boston Symphony, Munch; Boston Symphony String Quartet.
RCA Victor LM 2073.

The first time Benny Goodman played Mozart in public—a long while back—people almost died. Nowadays everybody does it (that is, crosses the line between jazz and "classical") and so this recording is up for judgment on its merits.

Goodman, then, is still a serious, rather stiff and somewhat formal classical clarinetist. This, I think, is not at all a criticism of him—indeed, just the opposite. The great schism in our day is that between the musicians who play only other people's written-down notes and those who improvise or compose their own. Benny has always been an improviser. Just as a "classical" player finds himself very uncomfortable when asked to improvise a few chords or a cadenza—"unaccustomed as I am . . . "—so, a trained improviser is just as positively ill at ease when faced with the rigid requirements of the written notes, from which by custom he's not allowed to depart for an instant.

Just let's keep in mind that in the old days, in Mozart's own days too, improvisation was still very much a part of "classical" music. Even in these hallowed works of classic repertory, I'd venture to guess, Ornamentation, extra flourishes, cadenzas and the like, were added *ad lib* to a great deal of music in those times.

But present-day tradition says we must keep to the straight and narrow, and that is that. Besides, Benny's style of improvision is, quite correctly not that of yesterday but of today. He can no more "talk" in improvised Mozart language than you and I can converse in good Shakespearean.

So, you'll find these two renderings very good ones, but not entirely poetic, not really free on Goodman's part. A bit stiff. The orchestra and quartet do very well.

The recording is ultra-hi-fi and rather interesting with regard to the clarinet. Goodman's instrument is picked up close-to and with a super-realistic and almost hoarse sound that I find oddly attractive though it is not the sound Mozart would have expected for his listeners, who were at a greater distance whether for quartet or concerto. Still —I like it. Gives guts to the clarinet which sometimes in Mozart playing can be just too, too ethereal.

Mozart: Missa Brevis in D, K.194; "Credo" Mass in C, K.257. Soloists, Mozarteums Kammerchor, Camerata Academica des Salzburgur Mozarteums, Paumgartner
Epic LC 3323

Two characteristic early Mozart Masses, sung with spirit and bounce in the typical Austrian manner of today, the choral sound rich and wobbly and not too precise, the solo voices similarly cast. This chorus has a habit of pounding its weak terminal syllables to the detriment of rhythm, but its singing is musical and very earnest and attentive. So, too, with the quartet of solos. Dr. Paumgartner's orchestral accompaniment is as always, excellent—he is best in that department.

The earlier Mass, K.194, is routine—for Mozart, which is to say well composed, light and joyful (quite regardless of the text) and thoroughly musical. The later one, only two years afterward (1776) gets its title from the great intensity of the Credo movement and its Credo theme; this is a far bigger and more important work, much more dramatic and with a strong feeling for the text itself as well as a tremendous urge towards big architecture—motives that persist, sonata-like structures, dramatic changes. An exciting piece.

Mozart: Quartet #17 in B Flat, K. 458 ("The Hunt"). Schubert: Quartet #2 in C. Quartetto Italiano.
Angel 35351

Angel has one of the world's best quartets in this group; this record shows that "best" can mean simply "most communicative" for many a listener. This is as communicative, listenable quartet record as you can hope to find.

The Mozart, one of his most accessible and mature works, is as expressively played here as it was by the Budapest Quartet in an early RCA 78—a strong statement. The Schubert is a piece he tossed off at fifteen, not a great work but one that will remind you of the early Schubert symphonies in some of its material. In both of these the recording is tops for quartet—big, close, round, in a moderate liveness that doesn't get in the way of clarity yet adds persuasiveness and body to the sound. You can't go wrong here.

See also a dozen-odd other Angels by the same group, if you enjoy this one.

Brahms: Sonatas #1 in G, Op. 78, #2 in A, Op. 100 for Piano and Violin. Leonid Kogan, vl., Andrei Mitnik, pf.
Angel 35332

Part of Angel's Russian harvest from the visiting Russian musicians who came to London, these Brahms sonatas have that peculiarly sweet, almost old-fashioned sound that we've come to realize is characteristic of Russian music-making today. Romantic—yes. But Romantic in a special smooth, velvety way that is quite interesting—and more and more unlike any present Western techniques of playing, as you get to know it. Rather objective, on the whole, and even just a wee bit lacking in warmth though not in sincerity.

Gorgeous recording, though the piano is somewhat less prominent than the violin. That, too, is old-fashioned, though pleasantly so.

Mahler: Symphony #6 ("Tragic"). Rotterdam Philharmonic, Eduard Flipse (Holland Festival, 1955). **Epic SC 6021 (2).**

Now here, my friends, is the big-orchestra hi-fi piece to end 'em all and it is wonderfully played, remarkably well recorded too, considering that the orchestra and conductor are not world-famous and the job itself was done at an actual performance.

Well, every so often a performance-recording does work out beautifully. Maybe it was good planning, maybe a freak, but this one is a success. I think I caught one cough in the whole—if there were others I missed them for the music. And the mammoth orchestra, the huge bass drum, the kettledrums, the flutes and piccolos and the vast brassiness, even the cowbells (a special feature!) are captured with a gorgeous effect. I've already used this as a demonstration record for good hi-fi in a very large orchestra with lots of big, rolling bass.

The best of it all is that Mahler, always a difficult man to play in these monster symphonies, is performed with as fine a sensitivity as I remember hearing—famous conductor or no. The music glows, it marches, it is personal, romantic, stern, lovingly lyric, flaming, as it should be. Four whole sides of it and you won't want to miss a bit.

Debussy: Preludes, Book 1. Guiomar Novaes, piano.
Vox PL 10.180

Novaes has been recording for Vox for a long time; these Preludes add consistently to my earlier feeling about her—a pianist whose outward technique and virtuosity are fine but who somehow is cold and, in a deeper emotional and projection sense, unmusical. These preludes are in a way themselves a bit chilly, in spite of their famous "sensuous" quality. In this version they leave me unmoved, even bored. The lady just does nothing with them, emotionally or in the subtlety of phrasing and color that can make the music startling.

Gorgeous Vox piano recording, as usual. That aspect could scarcely be better handled.

TRADITIONS

Music of Bali. Gamelan Orch. from Pliatan, Indonesia. **Westminster XWN 2209 (2).**

Four whole sides of gamelan music—that's a lot, as Pepsi used to say. In the last year or so we've had single records of the music of Bali and of another exotic traditional music, the Raga of India; now in both areas there are whole albums, including this one.

First (but not foremost), the fi in this set is superb and the music is wonderfully suited to hi-fi sound, with its variety of bell-like and percussion sounds. Almost any quarter-inch on any of these sides will give you fine "demonstration material."

Secondly, it is obviously more faithful to the original music-dance material to present longer examples such as this. After all, in Western music we don't ship out "samples," little bits of a Beethoven Symphony, excerpted, for the sake of the general sound. This recording has the advantage of relative completeness and it is bolstered in effect by a booklet full of pictures and an explanation in great detail by Colin McPhee, who ought to know, he being the top American expert in the field.

And so I only put forth one question—who is to buy this sort of album? Not the hi-fi man, who isn't likely to want more than a side of this sound to play around with. Not the general listener who thinks he can just sit back and absorb it. For it will all sound pretty much the same and—let's face it—the music, though exotic and sensuous in general effect, is not going to make real sense to us any more than a wholly unknown speech would, on casual listening.

And so I suggest that those who are ready to sit down and study the booklet thoroughly, who will listen to each piece for itself along with the explanation, are the people who will find two whole LP's of Balinese worth the cash. Also, of course, all field workers, dancers, professionals in music or anthropology who have special reasons for interest.

Oh yes—it makes swell exotic background music at a very low and discreet volume level. That way, you can take it on all four sides—maybe.

Classic Scots Ballads. Ewan MacColl, Peggy Seeger. **Tradition TLP 1015.**

For folksy people, this is an interesting "marriage" between Scots and American music. The songs are sung by the Scotsman with an assist from Peggy Seeger, who is a sister of the well known Pete Seeger (daughter of Charles Seeger) and the Seeger accompaniments are on American-style banjo and guitar.

Tradition records has the know-how to include here a book with the complete texts, (written out as well as possible considering the Scots language) for those who, inevitably, will want to try the songs for themselves. This is not exactly a "primitive," back-country documentation of untouched folk stuff; but on the other hand it is far from a radio TV desecration. I enjoyed the music and found both singers musical as well as communicative.

The fi is only so-so, seems lacking in the higher range. No problem, unless you are out for hi-fi sound and nothing else.

Smoky Mountain Ballads. Harry and Jeanie West. **Esoteric ES-545.**

I don't know how the folk purists will like this one but I'll guarantee it isn't TV mood music! Real, old-fashioned hill-billy sort of stuff, but perhaps a bit nearer to genuine hill-country entertainment than a lot of the billy. Strong rhythms, lots of jangle and twang from guitars and mandolins, and the lady's voice is one of those 12-year-old yawps, without a trace of wobble or culture, that just delights my soul—though maybe you'll think she's crude!

As to hi-fi, it's true corn, by which I mean the fi is superb and makes the music jump. The label says "stereo fidelity," which is a pardonable way of indicating that the stuff was taken down on Ampex stereo equipment, though the present LP version is, natch, something less than stereo. You c'n buy it on real stereo tape too, I'd guess. ●

AUDIO ETC.

Edward Tatnall Canby

1. STEREO VICTROLA

I've just got a new Victrola and I hasten to report on it as a matter of general interest. It's funny to see that ancient and honorable name on the newest of the new, a stereo home tape phonograph system (the RCA Victor Victrola Stereotape Player, to be exact) but it's significant too, as well you may imagine—for this machine makes it official: home-style stereo sound is here, with all the old-fashioned trimmings, including the furniture.

By which I mean, simply, that the name Victrola traditionally stands for a real home machine, neither engineer's equipment nor a gadgeteer's concoction. This sort of machine, as they used to day, is for milady, or the Little Woman; it's that Dream Come True, it's the Ultimate in Gracious Living, it's togetherness . . . whoa; what I mean is it's a home machine. 100 per cent. That's something.

Uh-uh, I know what you're thinking, and that is exactly why I'm writing about this Victrola. Yes, it is a "table model", (or two of them) though they stand on legs. Yes, it has a fine hi-fi speaker about the size of my spread-out hand, and the enclosure is of indeterminate smallness. No fifteen-inch horn-loaded woofer here. Yes, there is an amplifier (dual) of indeterminate wattage and of, perhaps, average distortion for this home type of machine. I wouldn't want to line it up against a 65-watt power job, on a test.

There's even a tone control, on the back, though as a concession to modernity it is labelled TREBLE and has a NORMAL position halfway around. There are push-buttons, of the simplest, and the complications are absolutely minimum. As minimum as you can get, and perhaps a bit more. Just set it up and push the button—RCA does the rest. Almost. You still have to thread the tape and rewind it.

Perhaps that gives you an idea of how very "home-style" this player is. There isn't even any provision for attaching outside speakers, though you can push two buttons marked SINGLE and STEREO to play the two present types of tapes. There are only two units—not three—and the cabinetry of the two is identical. Where the tape player is in one unit there is a tape storage space in the other. Both have Victrola-style lift-lids, like 50 years ago, with the familiar side support that breaks and folds down; both have speakers built into the front section. (I should add that the furniture is modern, vaguely like one of those new office buildings turned on its side, with fancy gold-brass tapered metal legs on transparent feet. Nowadays even a Victrola must be modern.)

Well, there you have it. I can't help remembering, a couple of years ago, the stereo tape sent me by a wealthy gadgeteer who had just installed an Ampex stereo professional model in his home—along with two amplifier-speaker systems that probably cost $1000 each. Mikes, too; condensers of course. Maybe $6000 total. The gent had to go out and shut off the refrigerator in the (distant) kitchen, so there would be no noise in his vast living room while he recorded a stereo message for me. ("Now I'm standing in front of the right-hand mike . . . and now I'm walking over to the left. . . .") That was Home Stereo in its early stages! And, indeed, the idea that one should have a super-hi-fi mammoth speaker system, a pair of them, persisted right up until very recently. Many a gadget stereo installation is as big as a house. Two houses. Only the best—for stereo.

Now I pointed out, in a still small voice back around 1952, that stereo or "loudspeaker binaural" as it was often called, actually requires *less* fancy equipment than standard reproduction for a given effectiveness. The ear gets more of what it wants, more realistic spatial distribution of the sound, and it reacts with a big "yes"—it seems to hear better sound quality.

The same principle operates in a well-known manner upon ordinary single-channel equipment: good acoustics, good speaker placement, and your small machine sounds fine—but even the fanciest hi-fi system in a poor listening place will seem to develop all sorts of distressing distortion.

Because stereo speakers (a) spread out the sound over a wide area, as the ear demands and, (b) offer definite side-to-side spatial clues and a heightened sense of natural liveness due to the two separate channels of sound, the stereo effect makes stereo speakers and amplifiers sound relatively "better" than they are. As a tiny portable radio in the right location can sometimes sound like a big system and fool you before your very ears, so a stereo system with inexpensive audio equipment can sound remarkably like a big outfit as you listen to stereo music upon it.

A Lot for a Little

And so you can imagine what I'm about to say regarding the Stereo Victrola, and about home stereo, speaking generally.

As outlined above, the Stereo Vic would seem to be just the kind of outfit any self-respecting audio bug would avoid like ye

plague. A home machine, pure and simple: two pieces of furniture with a tiny amplifier (dual) and two puny speakers—same old home squawk box only double.

Well yes, in some respects. But let me point out that the stereo Victrola, double and for tape, costs retail with everything included and ready to play in the neighborhood of $350. Less for the suitcase model. That's with speakers, cabinet, wires—no extras whatsoever to buy.

A lot? Well, people used to pay more than that for some of the old Orthophonics and their successors, which didn't have the relatively expensive tape mechanism, let alone everything doubled. And this looks like a good tape transport, this one, equipped with the highly desirable stacked (in-line) stereo head and a constant-turning capstan, like the Ampex, that allows for instant starts, plus interlocking controls for safety. Quite a bit of value, as I think you'll realize when you begin to figure. A good "plain" tape player costs not so very much less, with one cabinet and one channel. (Note that this Vic is a player, not a recorder. No danger of erasing by accident!)

Still—is this a machine of any listening interest to the audiophile? Maybe not if you're a real hi-fi stickler. That's strictly up to you and your pocket book. My business is to describe what this machine will do in listening terms, granted its strictly home-orientated design. It'll do a surprisingly good job on good tapes.

Do not ever forget that the basic task of any stereo reproducer is to bring you two channels of stereo sound correctly aligned and phased, through two speaker systems. This is the essential—and it is even more important than the quality specifications of the two systems themselves. (That's why I'm all against staggered-head stereo which, it seems to me, almost guarantees faulty, inaccurate, out-of-step stereo sound in any budget-priced machine. The RCA Victrola, again, uses stacked heads.) Any system that can deliver two stereo tracks to your ears in the proper relationship has already achieved a whale of a lot as far as the listening musical ear is concerned. Take two 3-inch speakers and feed them a good stereo signal—even without baffles, held loose in the hand—and they'll give you the stereo effect and some of the stereo advantage of extra realism and immediacy.

With stereo delivery rightly accomplished, the ear (stationed in the proper listening spot) will do wonders with reproduced sound. Two years or so ago I marvelled at the sound of the then new stereo Ampex 612, with two small suitcase-sized speaker systems. (Each costs almost as much as the entire RCA outfit.) I continued to be amazed, until one day I casually switched my regular big-speaker phono over to *one* of the Ampex units for an AB comparison. I was even more amazed, for by itself and in direct comparison to bigger, bulkier hi-fi equipment the Ampex speaker unit showed up realistically as less than perfect. I could hardly believe that the gorgeous stereo sound I'd been having had come from this relative pipsqueak.

Now, the same principle applies to the pair of pieayune RCA Victrola stereo sys-

The "King of Instruments"—an Aeolian-Skinner organ installation.

The sound of the organ is one of the most difficult to reproduce, because of its wide tonal and dynamic range, and because of the large amount of fundamental energy that appears at extreme bass frequencies.

At a recent public demonstration, staged by the Audio League at St. Mark's Church, Mt. Kisco, N. Y., the recorded sound of an Aeolian-Skinner organ (from stereo tape) was instantaneously alternated with that of the "live" instrument. The reproducing equipment selected included four AR-1 speaker systems. Here is some of the press comment on the event:

The Saturday Review *(David Hebb)*

"Competent listeners, with trained professional ears, were fooled into thinking that the live portions were recorded, and vice versa. . . . The extreme low notes were felt, rather than heard, without any 'loudspeaker' sound . . ."

AUDIO *(Julian D. Hirsch)*

"Even where differences were detectable at changeover, it was usually not possible to determine which sound was live and which was recorded, without assistance from the signal lights. . . . facsimile recording and reproduction of the pipe organ in its original environment has been accomplished."

audiocraft

"It was such a negligible difference *(between live and recorded sound)* that, even when it was discerned, it was impossible to tell whether the organ or the sound system was playing!"

The price of an AR-1 two-way speaker system, including cabinet, is $185.00 in mahogany or birch. Descriptive literature is available on request.

ACOUSTIC RESEARCH, INC. 24 Thorndike St., Cambridge 41, Mass.

tems, but moved another step down the cost ladder.

I will not try to pretend that the sound on these units is perfect, nor superhi-fi. It could not be at the home price. Even in stereo listening, my somewhat practiced ear could detect an absence of low bass, an occasional boom-bass resonance, and a certain amount of uncleanliness in the upper highs. Yes, my trained faculties kept reminding me, this is a home phonograph like many another today; it boasts better bass and a lot more highs than in the old days—it is certainly enormously improved—but it still has, shall we say, its limitations. Taken for granted.

But that, you see, is when I force myself to be analytical, to ignore the musical effect in favor of the sound itself.

Now this is not most people's habit and it isn't mine when I'm listening to music—which is most of the time. Normally I just listen, and the over-all effect of the music itself is what hits me, for better or worse. Actual distortion in the sound is merely one factor and often by no means the most important, what with recording, performance, playback acoustics and so on.

And so I have already found that even with my rather experienced and luxury-loving ears I am enjoying stereo on the RCA Victrola with very few reservations of *musical* importance. Yes, I dislike the "boom bass," an effect that many people will never notice though I'm too well trained to overlook it. Yes, though I notice no conscious absence of musical bass, I did remark once that the lowest note in an organ piece simply didn't come through at all. Just vanished. But that was merely one note; low kettle drums and bass drums are so realistic via stereo that the missing bottom is unimportant. Yes, I notice, occasionally, a somewhat edgy string tone in the highs and I am aware of the relatively greater cleanness of my larger and more costly hi-fi system—when I happen to think of it. And I notice that maximum volume isn't very great by hi-fi standards—though it's far louder than most of the old home phonos ever permitted.

But in spite of these occasional reservations, I can only insist that on the most absolute listening grounds, in comparison with any equipment you can name, I am ready to go along with this new machine on the basis of plain music listening satisfaction—which is surely more than can be said for its equivalent in ordinary home phonographs of the same type.

The big difference, then, is in the two-speaker and stereo effects. I'm inclined, as a matter of fact, to think that the first is as important as the second. For whatever tape you play, stereo or monaural, the home listener here is actually "forced" to use two separate speaker systems widely spread apart—which adds immensely to musical realism (and hence to apparent sound quality) even without the stereo aspect itself. Single-channel monaural tape sounds pretty good, too, via this Victrola.

But just unhook the second speaker and see what you have. A home phonograph—no more. I tried it. Better not to.

If you can persuade the general public to buy *any* sort of two-speaker, two-cabinet set-up, stereo or no, you've con-

tributed a lot to good musical reproduction.

I take all this very seriously. The experiences I've had with this stereo Victrola surely apply to any low-priced home-style stereo equipment now on the market or likely soon to appear. (Granted, of course, that the two tracks are played in correctly exact synchronization, preferably via stacked heads.) Where Victrola goes, so goes the nation. It always has.

Now . . . if we could just get the cost of stereo tapes down a bit from present fantastic levels. It just does seem as if RCA ought soon to be launching some low-priced stereo tape to complement the low-priced Victrola. As of this writing, long before publication date, there is no visible move in that direction, but *maybe* the price dropping will come soon. (And, just between us, notice that some of the more recent RCA stereo tapes do *not* have the price printed on them, whereas the earlier RCA issues did. Maybe, just maybe, this could indicate. . . . We shall see.)

2. Convertible Amplifier

It has been a year or so since I first got hold of a GE Convertible Amplifier, 20 watts. The first one (it's model A1-320) was defective, according to my standard luck in such matters. Early-model trouble. I returned it and the second one, outwardly identical, has behaved very nicely, generally speaking. In fact the most important and vital thing I can say about it is simply that I have had it in constant use now for at least a year and nothing has gone wrong. Best recommendation I can give.

I'm not particularly concerned with the convertible feature, which involves detachable sub-assemblies so that the amplifier can be installed in a pleasant variety of ways, in one or in several parts. Good idea for servicemen and gadgeteers. The amplifier as it is packed is one-piece and mine has stayed so. Six round knobs in a row and two switches, plus a battery of inputs and outputs on a panel underneath, reachable by tipping the amplifier up on its rear. (Mine stays that way for days at a time even though the directions warn you to operate it horizontally. Nothing has gone amiss.)

Obviously, somebody here has tried hard to answer all the servicemen's and others' demands that could be met in one amplifier, and the results are pretty serviceable, if not overly handsome from the decorator's viewpoint. This is a practical, all-steel amplifier and the edges of the box are rough enough here and there to snag your fingers if you fuss around with it as I do. Most people will leave it lay, and all will be OK.

Suffice to say that this amplifier has all the most modern useful features that have turned up in the last few years to make for versatility in the home. You can take off from the preamp alone, through the tone and volume controls, or (for tape recorders) at a fixed level and without tone controls, so that these and the volume can be varied for the room without affecting the recording. There are LO-MAG and HI-MAG inputs, input for radio and another extra input, both with the all-essential level sets. There's still another, without. Everything, of course, via standard phono plugs. The usual bass and treble tone controls and equalization. Need I say more. This amplifier has Standard Equipment.

A few criticisms which I am sure GE will take in its stride. Most important is hum. My first one had objectionable hum—but that was a freak, early-model. Its later replacement, alas, also hums, but very slightly, just enough to annoy me with that B-natural that keeps getting mixed up with other keys, musically. This is no doubt a result of mass production and very possibly the current product is utterly humless. Easy enough to try. Mine, by the way, has *not* got any worse—as happens in some low-priced amplifiers.

Always remember that in any equipment designed for large-scale mass production, as no doubt this model is, the problems of tolerance in manufacture are very critical—far more so than in those small-scale operations where each unit is made and tested virtually individually. Hum tolerance is a typical factor in the adaptation of a unit like this to large-volume manufacturing though it is no problem (*No?* Ed.) at all in any given individually constructed amplifier. Takes awhile to get the big operation rolling within tolerances. Probably has happened long since—but check on yours, just to be sure.

I'm not fond of the use of two identical knobs for volume and loudness. Both must be turned up and I find myself constantly using the wrong one—or forgetting that the other is turned low. It saves having a separate levelset, I know, and this is GE's reason, no doubt. Good economy. But the knobs could be different, or placed far apart. They're next to each other.

And, in the interests of symmetry, GE has placed the on-off switch to the right and an identical switch to the left for the rumble filter (useable only with a GE cartridge or equivalent). I keep turning on the rumble filter when I mean to turn on the amplifier. Guess I'm just too left-handed, but it seems to me that if the rumble filter switch just looked and *felt* different. . . . Oh well.

That's all. No further basic complaints—and I repeat that this GE 20-watter *works*, and keeps on working. It doesn't burn out when you leave it on for a couple of hours by mistake, as did one much more expensive amplifier I had around last year. It doesn't overheat (though I wouldn't leave any LPs on its metal cover), doesn't seem to mind being dropped, doesn't burn your fingers with exposed red-hot tubes . . . just a good, solid workhorse.

Finally, note that this is the 20-watt amplifier I have been intentionally using with the AR-1 loudspeaker, which is supposed to require a minimum of 30 watts. (See last month.) For all average musical listening in homes at non-hi-fi volumes (i.e., no burst windows) GE's 20 watts will suffice with the AR-1, though every so often it overloads a bit on a particularly tough blast of transients. (A piece by Bartok for percussion and two pianos got it down today, for instance.) With more efficient

(*Continued on page 49*)

jazz and all that

CHARLES A. ROBERTSON*

Zoot Sims Goes to Jazzville
Dawn DLP1115

OF THE MANY PROBLEMS facing a new recording company in the jazz field, good engineering is the one most likely to be solved last, unless someone involved in the proceedings has more than a passing acquaintance with the value of good sound. So the first products of the small firm, with the exception of those started by audio specialists, usually range from bad to adequate. Rarely are they acclaimed for outstanding balance and other sonic virtues in the early stages of their existence. One such rarity is Dawn Records. It solved this problem in its first year, even to the satisfaction of those jazz lovers who regard such qualities as secondary to the music.

A happy meeting between Chuck Darwin, producer for the new label, and Dave Hancock, independent recording engineer, brought about this turn of events early in its history. At that time, Hancock was mainly occupied in cutting masters for a number of clients and extensive recording of folk-music artists. Ken Goldstein, a producer of one of these dates, recommended him to Darwin. The ensuing association resulted in a series of jazz discs with outstanding sound. The Sims' is the sixth to be released.

Most commendation is being attracted by The Kid From Denver, DLP1109, featuring Paul Quinichette and nine musicians drawn mostly from the Count Basie band. With a brass section of Thad Jones, Renauld Jones, and Joe Newman, trumpets, and Henry Coker, trombone, all the power of a big band is captured despite hall limitations. In solos the Quinichette tenor insinuates its way over the background, rather than seeming suddenly to leap from the loudspeaker as so many solo instruments do when improperly spotted. The rhythm section is held in balance, never obscured in ensembles, nor permitted to override the soloists. The drums are kept in correct perspective, and the whole session swings with some capable arranging and writing by leader Ernie Wilkins and Manny Albam.

It was enough to prompt a request to visit the thirty-year-old engineer in his home on the upper West Side of Manhattan in the hope he might expound on some of the methods behind his work, and on the recording scene in general. He has definite opinions—unfortunately, not all are printable in this family magazine. He has the benefit of three years piano study at Juilliard to aid him in transferring a performance to tape. This was completed in 1950, with the help of the G.I. Bill due to service in the Air Force. By then, as he stated the case, "It was evident that I did not have the psychology or talent necessary to become a concert pianist. Also, the way of life which such a career entails had lost its appeal. Teaching did not interest me much. I had been absorbed in electronics as a hobby for several years and it seemed to offer me a better living.

"I was fortunate enough to be able to serve a two-year apprenticeship with Peter Bartok. There is no way I can express my gratitude for what he taught me. He is still the engineer I admire most. He has done some fine things on his own label and up at M.I.T. for Unicorn. We still trade information and are ready to help each other out when necessary."

When he set up in business on his own, he soon found his four-room apartment was becoming hopelessly overcrowded. Activities were shifted to a four-story house where the neighbors are less likely to be disturbed. His equipment is distributed about a large front room on the second floor. Much of it he constructed himself, or has adapted to fit the requirements of the practicing engineer. The ceiling is treated with a covering of cardboard egg containers. A twelve-inch Wharfedale speaker is used with a JansZen electrostatic for monitoring.

"I have a great deal of respect for G. A. Briggs," he said, "not only as a technician, but as a philosopher. His thinking about sound is similar to mine and I have corresponded with him. It is not that of the button-pusher, who has the feeling that the newest and shiniest is always best. I use a modified lathe with a turntable made by Fred Van Eps and a Grampian cutter head. If I can find the time, I would like to develop my own cutter head. The Danes seem to be quite proud of a new one called the Ortofon and we can't let them get ahead of us."

Easily the most distinctive and newsworthy pieces of his equipment are two RCA 44A (MI-3026A) ribbon microphones. These have been considered obsolete for some time. A letter sent to the RCA service department last September brought the reply that no replacement parts were available as they had not been manufactured for twenty years.

Hancock justifies their use with the statement: "I had long thought the ribbon microphone had not been developed to its full extent and was in some respects more desirable than others. Tests made during recording sessions confirmed its pleasant acoustical properties and I set about improving the bass response. A different ribbon, magnet, and transformer were installed to reinforce the two extremities of frequency range. I recently took them down to Camden, N. J., to test them in the RCA anechoic chamber against their laboratory standard microphone. The charts show superior performance below 50 and above 10,000 cps, and RCA was interested enough to keep one for their files. From my experience with it, I am convinced the ribbon microphone is inherently a better design than the condenser, and its optimum performance, both from the standpoint of distortion and frequency response, is superior to the condenser microphone at its optimum.

"On jazz dates, I use one for the rhythm section and another for the rest of the band, recording the original tape with a modified Ampex 350. This permits the drummer to operate without constraint. I like musicians to play their instruments. My main trouble is with some of the modern pianists who sort of skitter over the keys. The controls are not touched after a balance is struck, but I like to accent soloists by having them move in one step on the mike.

"The tricks of the trade are in knowing what to do with a soggy bass and how to set up for various halls. Most of my work is done in Carl Fischer Hall, Steinway Concert Hall, or Carnegie Recital Hall. None of them is acoustically perfect, and the peculiarities of shape and characteristics of reverberation can upset the novice. I have seen the faces of musicians fall on arriving for a date and learned they previously had unfortunate experiences in that particular hall, even to the point of calling everything off and walking out. I try to be reassuring, but often it takes the finished product to convince them.

"The Quinichette date went well because the leader is musically aware and the men all good instrumentalists who knew what they were going to do and did it. A jazz date is approached with the same care I give to one of a classical nature. Both Peter Bartok and I believe it is easier to make a good recording of a symphony orchestra than of a string quartet. This may seem contrary to the popular feeling about sound on LP's where more chamber work has been done successfully than symphonies. But it is a frame of mind that allows me to handle a big band without much trouble."

Other companies Hancock has done recording or mastering for are Caedmon, Folkways, Period, Prestige, Tradition, and Vanguard. Also both jazz and some of the classical items for the highly recommended Music Minus One. "One of the things that pleases me in the association with Dawn is that the entire sound operation is up to me," he stated. "I do the recording, editing, and mastering. It offsets one of the disadvantages of the independent in that he often has to work with other people's tape. But in the larger companies, the same engineer rarely follows the whole process through. I think it gives the engineer considerable satisfaction to be responsible for everything, even though he may not be given a credit line on the label."

Another company using Hancock is Elektra as it expands into the jazz field. According to its head, Jac Holzman: "Dave has shown us the virtues of the ribbon microphone. We used them on our two latest recordings of the New York Jazz Quartet and the Jazz Messengers. We intend to use him on our stereophonic dates to operate one tape machine while our Leonard Ripley handles the other."

As a pianist, Hancock is most appreciative of someone of the caliber of Art Tatum in jazz. His real love is for classical chamber works and he would like the chance to record more of it. He recently

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

taped the former Benny Goodman pianist Mel Powell with a chamber group in classical works of his own composition. "I admire Mel both as a person and as a musician," he said. "His career in jazz was well established when he abandoned it to study with Hindemith at Yale. Though he must have met with discouragements, he stuck at composing. I think these pieces will show that the effort was not wasted."

Canadian-born Chuck Darwin is in charge of Dawn, an offshoot of Seeco, a company devoted mostly to Latin-American music. In outlining his aims, he said: "I intend to keep moving in a forward direction and to continue to record distinctive sounds, whether modern or otherwise. Before coming to New York five years ago, I had my own company in Montreal and in my experience Hancock is an engineer *par excellence*. The amount of planning for each session varies with the type of album. The hardest part is getting the right musicians in the studio at the right time. And then a great deal depends upon how they feel. The latest Mat Mathews was designed for the mood music audience, but the men liked the tunes so much they ended up doing some unusual things with them."

The first album to be recorded by Hancock for Dawn is **The Modern Art of Jazz** (Vol. 2), DLP 1104, featuring Mat Mathews, Art Farmer, Gigi Gryce, Julius Watkins, and Kenny Clarke. It was singled out by the *New York Times* as "one of the best jazz LP's of the year." Oscar Pettiford turns from bass to cello for an engaging duo with the accordion in one of the unique instrumental combinations found on this disc.

Next is **I'll Take Romance**, DLP1105, in which Donna Brooks sings with the Alex Smith trio. **A Message from Garcia**, DLP-1106, is arranged by Dick Garcia, long associated with Tony Scott and winner of a DOWNBEAT poll award as new guitar star. He is joined by a quartet, and a trio including pianist Bill Evans. **Jazzville** (Vol. 2), offers the trombonists Frank Rehak and Melba Liston in a blowing session, along with a group led by Alex Smith. Then comes the Quinichette disc.

The current addition to the series stems from the ambition of Zoot Sims to have his own group, after fifteen years of playing for others. With Jerry Lloyd on trumpet and pianist John Williams, he formed a quintet in 1956 to tour the club circuit. It was widely complimented, but the seasonal nature of the business, and its economic trials, left it stranded. On this reunion, Kansas City's Gus Johnson, formerly with the Basie band, is drummer and Bill Anthony shares duties on bass with Nabil Totah.

A lively *The Purple Cow* is an original by Williams. Lloyd provides a soulful *How Now Blues* and the up-tempo *The Big Stampede*. Al Cohen's *Jerry's Jaunt* goes at a fast clip in the Basie manner. Sims is heard on alto in *Stampede*, and in the standards *Too Close for Comfort* and *You're My Girl*. He shows his most lyric side on tenor in the mellow musings of the ballad *Ill Wind*. Everyone has a chance to exhibit technical virtuosity in the complexities of Monk's *Bye Ya*.

Prepared to show the varied aspects of of the unit at its best, the program is scattered with riches. Whether they are distributed too widely will depend on the tastes of the listener, but he should not have to wait too long for something of interest. One of the most vital tenormen since his Woody Herman days, Sims has never stopped developing. During a recent trip to Europe, he acquired his alto and is busy exploring its possibilities. This is the third album in as many months to display

his prowess. They should serve as a lever to set him up on his own.

Because two of the tracks were made during an expedition to the Doris Duke country estate, the liner does not bear the Hancock name as engineer. In these, Totah substitutes for Anthony on bass, and comparison will show that he was not placed right. The six remaining numbers were made at Carl Fischer Hall, with all the niceties of balance maintained.

New York Jazz Quartet — Elektra EKL115

This specialty label begins its jazz catalogue with a newly formed quartet of compatible musicians, who hope their first joint effort will lead to the commercial success needed to keep them together. All have substantial reputations on their own, and are looking for a collective outlet for their talents. As they think along the same lines, a feeling of unity is immediately evident. More time to think as a group should help them grow in proportion.

Mat Mathews brought his accordion over from Holland in 1952 and has succeeded in making it a part of the jazz scene. Herbie Mann's flute fits well with this instrumentation. He plays sensitive clarinet on his original *Adam's Theme*, and also contributes *Early Morning Blues*. Joe Puma, guitar, and Whitey Mitchell, bass, add rhythmic, stimulating lines. The close multi-miking, characteristic of Elektra, is well suited to the quartet. Though both the guitar and accordion are amplified, engineer Leonard Ripley keeps them under control.

Ivory Joe Hunter: I Get That Lonesome Feeling — M-G-M E3488

The art of record collecting once entailed a working knowledge of secondhand stores, junkshops, Salvation Army depots, and cut-rate remainder outlets. Since World War II and the rise of the LP, this sport has been reduced to a monthly check of the stars and black diamonds in the Schwann catalogue. Just as the fun of the lover of first editions is reduced by first printings running into thousands, the problems of the former hunter of old shellac are now mainly those of selection and budget. Two areas where ephemera still blossom are those of rhythm and blues and the paperback. Try to find a copy of a first novel which appeared a year or so ago only as a paperback.

As the hardy souls willing to separate the wheat from the chaff in the short-play field are few, any effort to lighten the task is welcome. Atlantic has presented Joe Turner, Jimmy Rushing has done his best work for Vanguard, and now M-G-M allows Ivory Joe Hunter to sing in his modernized version of the country blues style. Five of the dozen songs are originals, all essayed with a quiet dignity which sets him apart from the blues shouter. Both as a pianist and vocalist, he is in the great tradition and should be asked sometime to devote an album to the older numbers. The small band has a neat trumpet and has escaped the peculiar sound distortions frequently given this kind of music.

A Night In Old New Orleans — Capitol T792

A pleasant enough concoction of Bourbon Street dixieland finds Sharkey Bonano's trumpet leading his group through seven tunes and backing blues singer Lizzie Miles in five of her specialties, all recorded in New Orleans. Unfortunately, she has yet to reach discs with a band as suited to her style as Red Camp's piano. The indomitable Sharkey drives through *Eyes of Texas, In the Mood*, and *Blue Turning Grey*. If you like to watch televised prizefights, keep it on the turntable for *Look Sharp, Be Sharp* during the commercials.

Viennese Night at the "Proms" — Mercury MG50124

The expedition to England last year by Mercury's engineers and sound truck results in at least one "Pops" release as Sir John Barbirolli directs the Halle Orchestra in a Strauss potpourri. Recorded in Manchester's Free Trade Hall, the representative sampling of eight selections includes *Tales of the Vienna Woods, Blue Danube, Annen Polka, Radetzky March*, and so on. A full-blown performance, caught with the accent on the entire resources of the orchestra, rather than the more frothy accoutrements so often given the spotlight in this music. If Mary Ellen Moylan on the cover does not sell it, the fine, spacious sound will.

Musikkorps Der Schutzpolizei, Berlin: Die Schonsten Marsche und Marshlieder — Telefunken LGX66064

The Musikkorps of the Berlin Schutz-Polizei adds a distinctive voice to the growing list of nationalities represented by topflight bands on LP. It is a brisk marching unit and its ranks are enlivened by a precise male chorus in folk and student songs set to the invigorating tempos suited to the German pastime of hiking. Light opera is represented, and the swinging strains invoking the attentions of *Lore*.

Of the organizations on discs, it most closely resembles Vienna's Deutchmeister Band and direct comparison can be made in *Wien bleibt Wein*. It is a larger group, more distantly and spaciously recorded, with singing glockenspiel and healthy brass and woodwind choirs. This importation will be welcomed by fanciers as the first worthy march record from Germany since the war.

Echoes of the Storm — Audiophile AP20
Adventures in Cacophony — Audiophile AP37

Audiophile has kindly sent these two previously released records along for my examination and as a challenge to my audio equipment with the following communication from Mr. Nunn: "I am remastering many of my older tapes, those which have exceptional merit, and reprocessing the records, though the practice will hardly pay cash dividends. The result is much improved sound from every point of view, but only provided the playback equipment is good. For years I have used the Cook feedback cutter and amplifier system and while this has been the best system, based on performance, until recent months, I have just completed work on modifications to the Westrex dynamic feedback cutter combined with the McIntosh 60-watt amplifier and the results have been too convincing to be denied. I might say there is much good tape that has been ruined by poor mastering (poor cutter performance)—it is rather a shame. Big names and boasting are not necessarily productive of good results. All one needs is critically good equipment to hear it."

Although the storm was caught in Milwaukee in June, 1952, it is still a test for nerves and pickup with the changing pitch of the wind-driven torrent against the crash of thunder as it approaches and recedes. On the reverse is the high whine of a rotary saw, the steely blow of hammer on nail, water resounding in a galvanized pail, and the most realistic drums and cymbals on record. The air rushing from between the high-hat cymbals is practically audible. Of course, there is no problem of balance, but this company does almost as well when taking down an all-out band.

Cacophony is another crazy quilt of sounds and, though children love it, cats and dogs should be removed from the vicinity. A barnyard visit includes a squealing pig, chickens, cows, a dog, and a vocal family of felines. The mechanical side has the historic railroad crossing, tugs on the Milwaukee River, watch ticks, a typewriter, and the Saukville water pump. In case you missed these records before, at least one should be in any collection.

Caribbean Calypsos — Capitol T10071

The latest invasion of calypso reached London before Broadway and three performers popular in Britain are on this well-made EMI importation. Lord Beginner does six tunes, untouched by the influence of Tin Pan Alley. Tony Johnson sings four numbers and The Torpedo is represented by two. If you prefer to read about this sort of thing, have a London bookseller ship you *The Lonely London-*

era (Wingate, 12/6), by the young Trinidadian Samuel Selvon, who has written two novels about the island and now tells of the adventures of his countrymen in the big city.

Scottish Pipes! **Capitol T10081**

The bagpipers of the 1st Battalion Scots Guards, the 2nd Batt. Scots Guards, the City of Glasgow Pipe Band and Pipe Major Donald Shaw Ramsay are featured on twelve tracks recorded by EMI in Scotland, and a heritage of Scottish blood is not required to thrill to the two parts of "The Gathering of the Clans." Ramsay, a piper since the age of eight, is heard in *The Highland Fling, Sword Dance,* and *Shean Truibhs.* Perhaps the most representative disc of the music of Scotland, in a workmanlike recording to fit any loudspeaker.

Kurt Weill: Johnny Johnson
M-G-M E3447

Much the same forces responsible for the rewarding production of *The Threepenny Opera* are brought to bear on *Johnny Johnson,* Weill's 1936 anti-war effort for the Group Theatre and first work to reach the American stage after he made his home here. It came at a transition period in his life as he began the exploration of the music of our folk legend, expressed by Bob Shaver in the cowboy ballad *O, The Rio Grande,* and of the Broadway idiom in *To Love You and To Leave You,* as sung by Burgess Meredith. It marks the end of his concern with the superficial aspects of jazz, though he was always alive to its creative force in his treatment of strings and use of rhythm.

As the French nurse, Lotte Lenya sings *Mon Ami,* and Meredith acquits himself well in the title role. Conductor Samuel Matlowsky and producer Edward Cole repeat the union that made their first Weill opus a success. It is his most all-inclusive contribution, and is not to be missed.

Norene Tate: Tenderly
Elektra EKL113

A school teacher who embarked on a singing career after guesting with Noble Sissle, Norene Tate is a cafe entertainer of some parts. Her voice is made for low lights and late hours, and she delivers a dozen songs meant for this atmosphere. Those who have heard and liked her *Tenderly* will want to make a place for it in their collection as this superior recording gives it lots of presence. Pianist Isaac Royal contributes *The Wail.* The veteran Sonny Greer is the drummer and Al Hall plays bass.

Martyn Green: A Treasury of Ribaldry
Riverside RLP7001

The selections are taken from the anthology of the same title as edited by Louis Untermeyer, who provides a liner note in justification of this droll side of literature. The story of Martyn Green's three decades with the D'Oyle Carte Opera and subsequent public appearances is well known. His renown as an after-dinner speaker and entertainer is almost as great, though the audiences have been limited. This is remedied by his informal readings of Ovid, Silentiarius, Ben Franklin, Wilde, Herrick, Apuleius, Bassus, and Boccaccio. The section of limericks is by no means complete, which may indicate there are more to come.

George Lewis: Jazz at Vespers
Riverside RLP12-230

A regular Sunday evening vesper service at Holy Trinity Episcopal Church in the college town of Oxford, Ohio, is the setting for eight spirituals by George Lewis and his band. Arranged by The Reverend Alvin Kershaw in February, 1954, before he became a TV personality, for a congregation of students and faculty of Miami University, the program was recorded by the Ohio Folklore Archive. The band is at its most expressive and fully at home in the surroundings.

Some of the material is not otherwise to be found on discs. Though there is no lessening of the jazz spirit, such well known pieces in their repertoire as *Just a Little While to Stay*

Here and *Down by the Riverside*, receive a more graceful, searching treatment. The Lewis clarinet stays in chamaleau more than usual, and Jim Robinson's trombone probes into the source materials of the blues. Kid Howard plays trumpet and sings. Six of the numbers were once issued by Empirical, and lovers of the traditional who missed that 10-incher can not afford to pass it up now. *Just a Closer Walk with Thee* and *When the Saints Go Marching In* are added in this remastering which is gifted with better surfaces. Slight deficiences in the recording are more than offset by the good balance and the depth of the auditorium.

Josh White: Ballads and Blues — Elektra EKL114

Folk singer Josh White interprets a dozen characteristic songs in the style which won him acclaim for his two previous albums on this label. His maturing voice is heard with his guitar in *Midnight Special, Gloomy Sunday, Told My Captain, Hallelu, etc.* The close microphones give considerable depth to Al Hall's bass viol and Sonny Greer's bass drum, two sounds which can receive varied treatment. Engineer Leonard Ripley has his own way of handling them. You may like it, then you may not, but it is one way of dealing with studio limitations.

Music To Listen To Don Ewell By: Good Time Jazz L12021

The mood music title for this album is not as tricky as it seems, since it might easily be called: Mood Music For The Traditionalist. For this is the wholly relaxed, informal sort of playing that can be listened to by the hour. Pianist Don Ewell is fully at home in the idiom. With the New Orleans drummer Minor Hall and the veteran clarinetist Darnell Howard, the trio recalls the one Ewell formed in 1946 with Albert Nicholas and Baby Dodds. The dozen numbers include *Monday Date, Love Me or Leave Me, My Honey's Loving Arms*, and *Gee, Baby Ain't I Good to You*.

The bittersweet Howard clarinet, now part of the Earl Hines' Sextet, flows smoothly, and he contributes *Bush Street Scramble*. Ewell solos with *I Can't Believe that You're in Love with Me, Squeeze Me, You Took Advantage of Me*, and a blues improvisation. His originals for the trio are *South Side Strut* and *Parlor Social*. The recording has the benefit of the airy acoustics of an old dance hall in Oakland, California, and Roy DuNann found the ladies' room ample to hold his recording equipment.

Eddie Burleton's Rompers: Unexpurgated Jazz — Audiophile AP43

A clarinetist who has played around Milwaukee for about fifteen years, Eddie Burleton is one of the musicians Ewing Nunn used to have out at his home for sessions when he was experimenting with the recording techniques which led to the fine Audiophile sound. With the jazz scene what it is in those parts, he finds it expedient to hold a more prosaic daytime job, as do the five other members of the band. His musical activities are reserved for weekends and an occasional evening date, mostly with pickup groups. Not until last year did a series of club dates enable him to keep the same men together long enough to work up a unity of expression which he felt warranted a recording. These dozen full-blooded tracks of dixieland, with a slight touch of Chicago-style, resulted on the return to the studio.

Another veteran, Bill Ehlert, plays a fiery cornet, and Roland Woods fills out the fervent frontline on trombone. As soloists, they achieve a workmanlike level of competence, marked by experience rather than creative impetus. As a group, they function with a rollicking goodwill, paced by pianist Art Lande and bassist Art Kay, with drummer Eddie McMullen putting down a steady, pronounced beat that sets the feet to tapping.

They show discrimination in picking out the best things to say on such favorites as *Royal Garden Blues, Riverboat Shuffle, China Boy* and *Satanic Blues*. In their unpretentious way, they have some fun in *Take Me Out to the Ball Game*, and show their polka-minded hometown how *Blue Danube* can be played. Included are *Tin Roof Blues, Tiger Rag* and *South Rampart Street Parade*. There is no danger of jazz losing its spontaneity when there are semi-pros like this around. And the sound is just as uninhibited.

Kenny Burrell, Vol. 2 — Blue Note 1543

The second collection featuring Kenny Burrell is a most composite portrait of the considerable talent possessed by the young guitarist. He presents Gershwin's *But Not for Me* as a melodically persuasive solo. *Get Happy* takes on a Latin hue as he is joined by the group heard on his first LP, with the percussion duo of conga drummer Candido and Kenny Clarke. Saved from a jam session caught at the Cafe Bohemia, Kenny Dorham's *Mexico City* starts with a strong three-minute guitar solo.

Kansas City jazz days are recalled with a slow-riffed *Moten Swing*. On this and *Cheeta*, which rings the changes on *I Got Rhythm*, he is joined by Tommy Flanagan, piano; Oscar Pettiford, bass; Shadow Wilson, drums. The Basie tenorman Frank Foster is added for the blues-tinged *Now See How You Are* and the fast-paced *Phinupi*. Modern phrasing rejuvenates the old pop tune *How About You*. As far as I am concerned, Burrell here emerges as a leading contender in the current guitar sweepstakes and association with Benny Goodman should increase his stature.

Jazz Messengers: A Midnight Session — Elektra EKL120

The latest edition of the Jazz Messengers is heard in a midnight session at Carl Fischer Concert Hall with drummer Art Blakey in complete charge as he marshals his forces to spur his colleagues on from the drums. He is the only holdover from the original cooperatively formed group and the rhythmic imprint of his personality is indelibly stamped on its face. Although saxophonist Jackie McLean is the most important new addition and is rapidly building a reputation for his sinewy solos. The clipped, forceful trumpet fits in well, but each seems overly concerned not to sound like anyone else on his instrument. Sam Dockery is pianist and Spanky DeBrest plays bass.

The lines are mainly homing points for the soloists. Three are by Ray Draper, a sixteen-year-old tuba player, with Lee Sears contributing one number and Mal Waldron two more. But it is Blakey who propels the horns, underlining them with shifting dynamics and introducing them by bringing a press roll up off the floor. When they were pianists with the group, Horace Silver, and to a lesser extent Kenny Drew, helped in this task as well as writing for it from within. Someone of their stature is needed before the Jazz Messengers achieve real unity again. Blakey's drums have never sounded better as Dave Hancock's engineering takes them from a whisper to an earthquaking crescendo.

Max Roach Plus Four — EmArcy MG36098

This is the first record made by the Max Roach Quintet since the tragic deaths in an automobile accident last summer of Clifford Brown and Richie Powell, though the leader, tenorman Sonny Rollins and Kenny Dorham, trumpet, have added their valuable presence to numerous LP's in the interim. It shows a technical proficiency that is breathtaking, and a free exchange of ideas that comes from complete integration. *Ezz-thetic, Mr. X*, and *Woodyn' You* are typical bop workouts. *Just One of Those Things* is taken at a seemingly impossible clip, and by contrast *Body and Soul* slows down for sustained cadenzas by Rollins. In a twin-track recording, *Dr. Free-Zee* allows Roach to solo on tympani as well as drums, though not as effectively as in his date with Thelonious Monk. EmArcy does not always take as much care with sound as its parent Mercury, but this is not one of those times.

The New York Jazz Quartet Goes Native — Elektra EKL118

With aid of two exuberant bongo drummers, the New York Jazz Quartet bows to the current calypso craze and tries its hand with Latin rhythms. They range far for atmospheric touches in the melodies, and bits of Yma

Sumac or Villa-Lobos are apt to turn up beside their impressions of the most primitive forms. The originals are all arranged in the spirit of good fun. In the improvised sallies, the phrases flow with an ease that comes when accomplished jazzmen are relaxed and enjoying themselves.

Each has a turn at free blowing, starting with Mat Mathews, accordion, in an Afro-Cuban *Mat at Bat*. Whitey Mitchel abandons his stringed bass for a B-flat Yogurt bottle to help out Joe Puma, guitar, in a throbbing *Joe Blow*. Herbie Mann, flute, extends himself throughout to provide an authentic flavor and has *The Mann Act* on his own. He uses a piccolo to advantage on the Brazilian *March of the Sugar-Cured Hams*.

Whether due to the challenge presented in fusing jazz to Latin rhythms, or the greater length of time spent together, they emerge with more of a group feeling than in their first album. Such numbers as *Trade Winds*, *Coo Coo Calypso*, and *Sambalu* should outlive the present West Indian trend. This is the first Dave Hancock recording for this label and he holds the drummers. Manuel Ramos and Teiji Ito, in good balance. It was made in Carl Fischer Hall and may be had on stereophonic tape.

Music For Brass **Columbia CL941**

The Jazz and Classical Music Society was started in 1955 to give concerts of rarely heard contemporary music of both persuasions and the present program was planned for the 1956 concert. This was cancelled because the New York Philharmonic-Symphony scheduled the key work, Gunther Schuller's *Symphony for Brass and Percussion*. As first horn with the Metropolitan Opera Orchestra, he is well fitted to exploit the modern brass section. Dimitri Mitropoulos conducts the Society's Brass Ensemble, made up of classical musicians for the symphony. In the three jazz sketches by J. J. Johnson, John Lewis, and Jimmy Guiffre are such jazz stalwarts as Bernie Glow, Arthur Statter, and Joe Wilder, trumpets; Urbie Green and Johnson, trombones; Miles Davis solos on trumpet and fluegelhorn. Drummer Osie Johnson and bassist Milt Hinton are added, and Jim Buffington replaces Schuller, who conducts.

Johnson's *Poem for Brass* is distinguished by a Davis trumpet solo, one phrase of which has more outright jazz than is to be found in the rest of the scores. In *Three Little Feelings*, the more delicate lines of Lewis lie fallow without the *expertise* and mobility of the Modern Jazz Quartet. But he is rewarding when probing the resources of the ensemble and providing a skillful setting for the soloists, especially Johnson's somber forty-bar statement. In *Pharaoh*, Guiffre drops the jazz rhythm men and constructs a brass-bound strait jacket for all concerned. The rule of thumb which says to listen to classical music for the writing and jazz for the inventiveness of the soloists holds true. Schuller builds a strong facade of sound with enough movement to be used by Jose Limon in his choreography of "The Traitor." It is to be hoped that the Society's plans will lead him to compose for jazz soloists.

Joe Bushkin: A Fellow Needs A Girl
Capitol T832

Mat Mathews: The Gentle Art Of Love
Dawn DLP1111

Tailored for the mood music trade, these two albums show that the talents of jazzmen need not always be wasted in an aura of lushness. Their values in musical taste and choice of repertoires still break through. Backed by strings led by Glenn Osser, pianist Joe Bushkin gives a lilt to a dozen numbers from *These Foolish Things* to *Willow Weep for Me*.

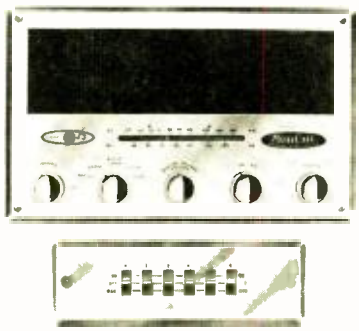
Accordionist Mat Mathews employs the varied setting of an Octet, Septet, and Sextet in twelve arrangements. The unlisted personnel includes: Art Farmer, trumpet; Dave Amram, french horn; Chase Dean, flute and bass clarinet; Teddy Charles, vibes; Joe Puma, guitar; Oscar Pettiford, bass. Violist Harry Lookofsky sets a tranquil tempo for some innovations of interest to the progressive fan in *If You Were the Only Girl*, *Indian Summer*, and the title tune by Pettiford. ●

NEW PRODUCTS

• Small Precision Audio Oscillator. A newly-developed circuit virtually eliminates switching and tuning transients in the new Model 401A audio oscillator recently introduced by Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y. Frequency

range of the instrument is 10 cps to 100 kc. It delivers 0.5 watt into 600 ohms with output constant to within 0.5 db over the entire frequency range. Distortion is under 0.25 per cent at any power or frequency setting for loads of 600 ohms or more. Weight of the 401A is only 12 lbs. **G-1**

• Music-Intercom System. Suited for use in home or office, the MusiCall consists of an AM-FM radio and intercom facilities combined in a single dual-purpose distribution system. The master station, in addition to containing the tuner and amplifier, affords individual control over all remote speakers. Each speaker is equipped with a volume control and a talk-listen switch which may be used to initiate calls to the



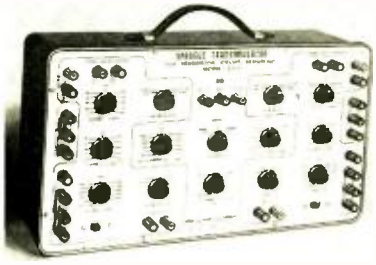
master station. The standard MusiCall system includes three 5-in. speakers for interior wall installation and a 4-in. speaker-microphone for front-door use. A phono jack permits use of recorded music when desired. Tastefully finished in antique copper, the MusiCall is delivered with all necessary materials for installation. MusiCall Corporation, Los Angeles, Calif. **G-2**

• Record Handler. Developed to reduce the possibility of surface damage to records while being handled, the Clarovox Miragrip permits the user to pick up any record with ease and hold it firmly without danger of finger prints or scratches, and with no danger of slipping. The pliers-like design of the Miragrip permits one-hand use with no likelihood of record breakage. The metal handles and body are chrome-plated and the rubber gripping sleeves are available in a variety of color finishes. Weight is only 7 ounces. Manufactured by Clarovox Products of Coventry, England, the Miragrip is distributed in the United States by Ercona Corp., 551 Fifth Ave., New York 17, N. Y. **G-3**

• Eico Speaker System. Exceptional performance at low cost is featured in the new Eico bookshelf-size two-way speaker system. Featuring a heavy-duty Jensen

8-in. woofer and a matching compression-type tweeter with exponential horn and level control, the HFS-1 system has a frequency range of 70 to 12,000 cps and a power handling capacity of 25 watts. All visible surfaces of the acoustically-engineered enclosure are smooth-sanded clear-grain birch. Any accepted furniture finishing technique may be applied. Ideal for stereo installations, each HFS-1 system measures 23 x 11 x 9 ins. Manufactured by Eico, 84 Withers St., Brooklyn 11, N. Y. **G-4**

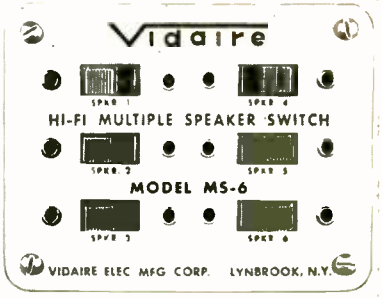
• Sprague Transistor Circuit Simulator. A new instrument which eliminates breadboard layout by simulating complete transistorized amplifier stages has been introduced by the Sprague Products Company, 241 Marshall St., North Adams, Mass.



Named the Model LF-1 "Transimulator," the unit can simulate any a.c. or direct-coupled amplifier stage short of high power audio output. Everything required for R-C amplifier circuits is built into the instrument, including 2- and 20-μf. direct coupling capacitors and posts for external coupling on both input and output. Bias resistance is continuously variable to 550,000 ohms and load resistance is continuously variable to 277,500 ohms. Built-in battery voltage supply for separate bias and load provides 1.5, 3, 4.5 and 6 volts d.c. A switch is provided for reversing polarity. Almost any external connection desired, including meters, transformer coupling, external supply voltage, degeneration, bypass, coupling, signal input and output, can easily be made at binding posts provided on the panels of the Transimulator. **G-5**

• Sonotone Low-Cost Coaxial Speaker. Although exceptionally low in price, the new Model CA-12 speaker, recently introduced by Sonotone, offers many of the features found in the company's higher-priced Linear Standard series. The CA-12 provides high flux density (woofer, 12,000 gauss; tweeter, 8500 gauss), low resonant frequency, frequency range of 40 to 14,000 cps, and an exclusive elliptical cone tweeter for wide dispersion. The unit contains a built-in L-C dividing network. Manufactured by Sonotone Corporation, Elmsford, N. Y. **G-6**

• Multiple Speaker Switch. This unit is so designed that any combination of six speakers may be switched into a circuit, with a constant impedance maintained at the amplifier output transformer. It is ideally suited for public address installa-



tions where several speakers are to be used in an assembly hall or auditorium. The six individual switches are contained on a polished brass plate which may be mounted on a panel, thus centralizing control of all speakers. Vidaire Electronics Manufacturing Corp., Lynbrook, N. Y. **G-7**

• Viscous-Damped Tone Arm. Many advances in tone-arm design are incorporated in the new AR-600 12-in. viscous-damped unit engineered by Argonne Electronics Mfg. Corp., 27 Thompson St., New York 13, N. Y., and manufactured under license of Columbia Broadcasting System. Fac-

tory-installed and sealed silicone damping fluid assures accuracy of damping action and prevents possibility of leakage. Automatic stylus pressure compensation is achieved by using individually designed cartridge adapters. Three-point base support is equipped with height and leveling adjustments. Tone-arm resonances do not fall within the audio range. **G-8**

HARVEY Reports on HI-FI

JULY-AUGUST 1957

Hi-Fi Manufacturers' specs in print at times run the gamut from the sublime to the ridiculous. It reaches a point of what's real and what's fantasy. Even organizations which test hi-fi components in an attempt to see if the specs "tell the story", may also tend to confuse the issue. There's really only one true way to test specs, even these products detailed below, and that's to let HARVEY'S staff of audio specialists analyze and demonstrate each component together with the rest of a hi-fi system through their fabulous listening rooms. HARVEY'S is the one place that translates written specs into genuine sound for your own ear-valuation.

With the SHERWOOD S-3000 high-fidelity FM Tuner you have one of those rare top quality tuners designed with just as much attention to audio quality as to RF circuit refinements. At 100% modulation, the specified intermodulation distortion is less than 1.5% and the harmonic distortion at 400 cps less than 1% — meaning very superior sound indeed. Specified FM sensitivity is also tops among commercially available tuners — 0.95 uv for 20 db quieting, made possible by the special 6BS8 cascode input stage and balanced antenna input transformer. Unbeatable at only $99.50.

The question of where the answer lies in the choice of a turntable or changer is dependent upon the individual high fidelity system and the regard one has for it. However, when it comes to turntables, the perfectionist today has an excellent unit in the Garrard Model 301, a quality endorsed product of the British Industries Corp. group. It is an uncompromisingly designed precision instrument worthy of the finest associated components. Speed, accuracy, freedom from wow and flutter, and absence of low frequency rumble will meet the most exacting standards. All three speeds are adjustable; construction can only be described as superb—truly a required component for the best systems, and at an exceptionally low price of $89.00.

In the very latest component combination from Pilot, the HF-30, you have a new compact, medium-powered all-in-one FM-AM tuner, preamp-equalizer and 12-watt Williamson-type amplifier, with exclusive "Beacon" tuning to insure distortion-free reception. The other superb features of this unit include a speaker selector switch for simultaneous operation of two speaker systems; loudness contour switch for compensation of Fletcher-Munson effect; output jack for tape recording independent of controls; equalization RIAA built-in LP, NAB, AES calibrated points on separate bass and treble tone controls; afc disabling switch for receiving weak stations adjacent to strong stations, and 10 kc AM preadjusted whistle filter. Power output is 12 watt continuous, harmonic distortion less than 1%, and frequency response from 20-20,000 cycles. With the intermodulation distortion less than 1.5%, and hum level 70 db below 12 watts, this marvelous combination from Pilot is only $169.50.

In the superlative REGENCY enclosure with 15TRXB 3-way speaker by ELECTRO-VOICE, E-V engineers have combined the advantages of folded-horn performance with room placement versatility. Because of an integrally built-in corner, you can use it against the wall of the room away from the corner for essentially flat response—or place it in the corner to use the very walls of the room for augmented bass reproduction. To reach the pinnacle of musical enjoyment, the E-V Model 15TRXB triaxial should be utilized. The enclosure and the speaker unit make a natural combination. As a three-way speaker system, it offers exceptionally wide range and clean reproduction with 20-watt power rating and a response from 30 to 15,000 cps. The enclosure is available in either mahogany or Korina blonde, and you will find the styling easily complements any decor. The Regency mahogany enclosure is $130.00, and the 15TRXB speaker is $79.00.

Hear the music . . . not the speaker . . . with the JansZen electrostatic. It is interesting to note that women are more sensitive than men to overtones in the higher ranges. If your present music system includes a dynamic tweeter, the resultant distortion of these overtones may well be the cause of your wife's complaints about the "shrillness" or "loudness" of your music system. The fact that the JansZen lets you hear the music and not the speaker, eliminating exaggerated and distorted highs, solves the problem for the sensitive listener, and it only costs you $184.00.

Over 30th Year

Of course, in case you've already decided that here's what you want for your system, HARVEY'S mail-order service will rush it out to you the same day as they receive your order. Just enclose an extra allowance for shipping charges (excess will be promptly refunded).

HARVEY RADIO CO., INC. 1123 Avenue of the Americas (6th Ave. at 43rd St.), New York 36, N.Y. **JUdson 2-1500**

ABOUT MUSIC

HAROLD LAWRENCE*

Composers in Business

IN THE LIVES of great composers, painters and writers, the picture of a stern father advising his son to give up his foolish ambition for a more practical career in business or the professions is a familiar one. Parents have always been convinced that (1) an artistic career is invariably unprofitable, and (2) art and business simply don't mix. They are wrong on both counts. Statistics may of course be in their favor, but the pattern is not inflexible. The history of music, for example, is replete with cases of eminently successful composers. Exceptions to the second count, although more infrequent, nevertheless do exist; the most outstanding of these are Italians and Americans.

The name of Giovanni Pierluigi Palestrina (1525–1594) evokes the serenity of angelic choirs echoing through the spacious vaulting of a Gothic cathedral. His masses and motets indicate a devout composer thoroughly immersed in the life of the Church. The purity of conception, cloudlike movement of contrapuntal strands, and luminous vocal "orchestration" certainly represent the true personality of the man. Yet there is another, more worldly, aspect to the picture.

Palestrina came from a family of landowners, from whom he inherited a practicality, independence of spirit and monetary ambition. Until his wife died in 1580, he had little opportunity to go into business. Indeed, sorrow over his loss prompted him to take steps toward becoming a priest. He had just received the tonsure when something happened which suddenly and unalterably sidetracked his decision. He met a wealthy widow who had a tidy dowry and a thriving fur and leather business with a trade monopoly at the papal court. Within a matter of days after their first meeting, they were married. Palestrina lost no time in taking over the business. He went into partnership with an employee of the firm who was to act as general manager and, in a period of five years, doubled the capital. Real estate also commanded his attention. With his wife's money and the company's profits, he bought plots and constructed houses, and acquired vineyards and fields outside the city's walls.

Next to Florentine-born Jean-Baptiste Lully (1632–1687) Palestrina was a small fry businessman. At his death, Lully left four sumptuously appointed houses located in the most desirable quarters of the French capital, a number of lucrative securities, and a fortune in jewelry. His total estate amounted to more than two million livres.

In amassing his vast wealth, Lully brought into play unusual talents in court politics, a remarkable business acumen, and of course the power of his musical genius. As a boy of 15, he came to the attention of Louis XIV, who was approximately his own age. The latter greatly admired Lully's violin playing and made him a member of the "Twenty-Four Violins." But Lully did not remain for long a mere orchestral musician. Impressed by his technical prowess, Louis created a special ensemble of players especially for Lully. A born courtier, Lully became a close friend of the king and was awarded many high-paying positions, including that of royal secretary, a post formerly granted only to the nobility. Small wonder that Lully quickly began to make enemies among the royal entourage.

But with the backing of Louis XIV, Lully overcame all opposition and set himself up as an absolute monarch in the French musical world. At the peak of his career, no opera could be performed in France without his express permission; he controlled the professional lives of his actors and dancers; and a rigid limitation on the number of musicians employed by other theatres was imposed by royal decree, so as not to detract from the impressiveness of his own works. As a result, virtually all competitive music was suppressed or thrust into the background. Only after Lully's passing from the scene did the name of Marc-Antoine Charpentier (1634–1704) finally come into its own. With the latter's exception, however, Lully was unquestionably the most imaginative composer in France during this period. Were it not for Louis XIV's innate musical taste, the effects upon French music might have been disastrous.

Another Italian composer with a flair for business enterprise was Muzio Clementi (1752–1832). At the age of 14 he was taken to England by a wealthy squire named Peter Beckford, who saw in the youngster the makings of an extraordinary pianist and composer. Clementi lived on Beckford's estate for seven years, practising the keyboard and soaking up a prodigious amount of musical knowledge. His patron finally launched him in 1773 before the London public with immediate success, and he went on to become a renowned conductor, composer and pianist. His 64 piano sonatas and the famous series of 100 études, *Gradus ad Parnassum*, laid the foundation for modern keyboard technique and composition.

Clementi had a long and eventful business career. It all started when he invested in the firm of his publisher, Longman & Broderip, "manufacturers of musical instruments and music sellers to their majesties." Clementi lost a sizable amount of money when the company went bankrupt. He decided there and then that he could do a better job of it himself, so he reorganized the business under the name of Longman, Clementi & Co. (it later became

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

Clementi & Co.) and built it up into one of England's leading piano-making concerns. To expand his market, Clementi traveled throughout Europe setting up agencies in Russia and Germany. He even exported his instruments to America where they achieved great popularity. (Arthur Loesser points out that some are still in existence in the United States: there is one in the whaling museum in New Bedford, Mass.; one in Barnard College, New York; and one in the New England Conservatory of Music.)

In 1807, fire wiped out his £40,000 business. Undaunted, he returned to the business world three years later and once again proved his rare commercial talents.

John Alden Carpenter (1876–1951) could not be described as a self-made businessman as were the above composers. A position in his father's mill, railway, and shipping supplies firm awaited him upon his graduation from Harvard. Yet a company cannot prosper indefinitely without competent leadership, and young John Alden provided that leadership as vice president of George B. Carpenter & Co. His business responsibilities did not interfere with his musical career. As he explained it: "The majority of serious composers are forced to seek a living outside of composition. They teach, they write, they lecture—each according to his individual skill and opportunity—and compose when they can. The composer in business is fundamentally in much the same case."

The case of Charles Ives (1874–1954), however, is unusual even in the annals of composer-businessmen. Not only did he make his fortune as partner in an insurance agency, but he contributed an impressive number of advanced ideas to his field, all of which were adopted by every major insurance company in the land. These included the initiation of training schools for insurance agents, the development of estate planning, and the modernization of public relations.

The careers of Lully and Palestrina merely demonstrate that some composers can be shrewd in business and finance; those of Clementi and Ives prove that they can be innovators as well. ●

AUDIO ETC

(*from page 39*)

speaker system—that is, with all others—the volume will be plenty for all but the superest hi-fi noise, and so I don't mind recommending the GE Convertible, with the above modest reservations, for all sorts of practical home music listening.

3. AR-2

In August 1955 I wrote, in connection with the then new AR-1 speaker:

"A final word, or rather a question: is the AR-1 principle—limp cone and air-spring—applicable to less expensive systems? . . . We'll have to wait for a hypothetical AR-2 to find out. But I can do some speculation, of an elemental sort. A speaker system using this principle must have an unusually well built cabinet, sealed tight. This costs money in

any size. If you're going to build a quality cabinet you might as well put quality inside it too—so there you are. I personally doubt if the AR principle will be introduced in really low-priced systems, unless a revolutionary cabinet—say of plastic—is invented to go with it."

I'd forgot all about this, but one day some months ago I received a small package from Acoustic Research in Cambridge—the AR factory. It was strangely soft and squashy; on opening it, I found a large pile of bread crumbs. In the middle of them was a clipping—the above words, blue-pencilled. The next day I received the AR-2. Credit the bread crumbs to Ed Villchur, AR-1's designer and AR-2's also.

Now I'm a small-speaker man, irrevocably. I fell for the RJ, as the first of the breed, and I go for any speaker system that offers an unusually good size-to-quality ratio. The RJ set off a trend that has since spread to large numbers of smallish speaker boxes, but of them all only a few seem to me to go beyond the good quality obtainable via well-managed bass reflex with a bit of incidental horn loading. Most of them are very good—as are the small speakers inside them—and some are boom boxes, pure and simple. The RJ went beyond all this and the AR-1 went further still, for a sound quality that is virtually uncompromised by the small size.

Now I have nothing against larger systems except my personal inclinations and needs. I freely admit that many of the larger systems give extraordinary performance and great satisfaction; but I don't have room for them, in either of my two dwelling places, and I don't want to make room. I haven't a single corner in either living room and the side walls are full of record shelves and book shelves and what-not. For me, it's a small speaker or nothing. And so you can understand why I bless such as AR-1. Plenty of others have the same problems.

AR-2 is simply a new and less expensive solution of the cost-versus-performance formula for this special type of design. It's about what I might have guessed, not cheap but a good deal less expensive than the original model. About 45 per cent. It is very nearly the same size—only about an inch shorter in the long dimension and no smaller in the others. But it weighs less (the cabinetry is not as heavy and the speaker magnet no doubt is also lighter) and it sacrifices an even octave of the very lowest bass. On the other hand, it is more efficient—louder, easier to drive—by 4 or 5 db, which makes its usefulness wider.

I find the AR-2 remarkably like the AR-1 in over-all sound coloration. Its cone tweeter is not the same, but there isn't much difference in sound. (It costs less, but that doesn't prove much.) On direct comparison, given a signal with plenty of bass component in the very bottom, you can tell the difference between the two in bass response. Most of the time, in ordinary listening, I am not aware of it at all. Remember that AR-1 descends so very low that true bass around 16 cycles gets through. Chop off an octave and you still have a bottom of 32 cycles, which is good for any system—if it is radiated without

spurious harmonics—and includes 99 per cent of all musical sound.

I find AR-2, as with AR-1, remarkably clean and unobtrusive in its sound, easy on the ears for long-period listening, easy also to ignore in favor of the music itself. Either speaker has a way of simply fading into the surroundings (the size helps) leaving the music unattached and disembodied in the room. Excellent illusion!

In my comparison playing I found I usually couldn't remember which was which, AR-1 or AR-2, after a few minutes. They really do sound alike. Family resemblance. But as a check I also hooked up an earlier rival, one of the first small RJ boxes with a Wharfedale eight-inch speaker inside. The sound was quite different, immediately. I recognized that peculiarly golden, bright sound of the Wharfedale treble and I heard the slight hollowness due to inadequate internal padding in this very early RJ production model. (Never got around to adding more myself.) The RJ bass was good—but, by my ear, not nearly as full nor as low as that of the more expensive AR-2. It did better when placed horizontally on the floor, instead of standing up.

The three compared interestingly in efficiency. You'll remember that RJ was criticized at first as being too hard to drive, and much time was spent working out a production compromise that allowed more sound to get through. Well, the RJ-Wharfedale combo was much the loudest of the three systems, far louder than AR-1 and quite a bit louder than AR-2! AR-1 is already famous as the least efficient speaker system now on the market (efficiency lost in favor of quality)—but seems to sell, which only goes to show how things have changed. AR-2, as mentioned, runs about 4 or 5 db louder on the same input, but still rates fairly low in the efficiency scale.

I noted with interest that on my GE Convertible 20-watt amplifier the point at which overloading set in was about the same on the volume control for both AR-1 and AR-2. But the sound volume that came out was different, and louder for AR-2. Whether this makes electrical sense I do not know.

I haven't yet compared the AR-1-JansZen combination with AR-2. I removed the JansZen tweeter and re-set the AR-1 to normal volume on its own tweeter for the comparison. The important AB test was obviously between AR-1 and AR-2 on their own. Think I'll wait awhile before going any further—I hear rumors of an AR-3 (still in the future quite a ways) and so I'll await it, for later.

Meanwhile I'm genuinely enthusiastic about AR-2 and recommend it highly to those who want lots of bass and lots of quality in a really small space—but who can't afford AR-1. ●

LOUDSPEAKER ENCLOSURE

(*from page 16*)

slit. This defect is easily overcome by applying some bass boost in the amplifier.

Full constructional data of a free-standing model of the enclosure is given in *Fig.* 12. With a few modifications the enclosure can easily be converted into a corner model. The construction is intended for use of a 12-inch bass-range loudspeaker. Bebore ordering wood be sure that the critical dimensions indicated by the thick arrows in the figure are sufficient to accomodate the speaker. We suppose that all panels are presawed to the correct dimensions and that the vertical posts *E* are dressed to a quarter of a cylinder in a cabinet shop. These vertical posts are used to allow the front panel to be shifted a few inches backward. As shown in *Fig.* 13, the space thus created between the posts accommodate a wooden frame Ç that bears the decorative grille used to hide the loudspeaker from view. In this way an excellent external appearance can be attained even by the unskilled home worker. The limited space does not permit us to describe the construction in all details. We will confine ourselves to a few general remarks. See *Fig.* 14.

Before assembling the parts, the side panels *A* are provided with 1″×1″ strips along the edges, and with strips *C* and *D* along the front-side edges. The latter strips are used to bear the vertical posts *E* and the front panel *B*. Strips placed on the panels at irregular intervals and in random directions serve for bracing purposes. Needless to say that all joints are glued and screwed in such a way that no heads of screws are visible from the outside. After addition of the vertical posts *E* the enclosure is erected by mounting the front and backside panels provisionally, that is, by means of screws one size too small. Top

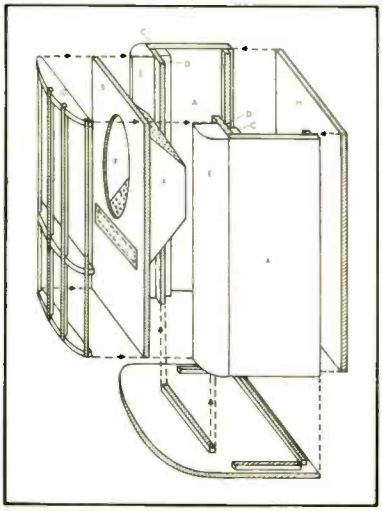


Fig. 14. Exploded view of aperiodic enclosure.

and bottom edges are checked to be exactly level and the corresponding panels are brought into place. All joints are again glued and screwed. After drying overnight the front and backside panels (which have been fastened by screws only) are removed to permit completing the front panel. Two wooden clamps *F* are used to house the perforated metal plate which bears the main resistive member. The terminal wires of the loudspeaker are led out of the cage through holes in these clamps so that they cannot touch hard surfaces when vibrating. The clamps are provided with rubber strips along their protruding edges in order to prevent vibrations of the metal plate. A two-inch layer of plastic foam is tightly sewn to the plate before the latter is secured to the clamps. A similar plate of perforated metal is fitted over the front side of the slit. For the first test run this is not equipped with damping material.

The enclosure is now assembled and tested by feeding it with pure tones. The voice-coil impedance can be determined from the voltage across it when the loudspeaker is fed by a nearly constant current. The test run reveals the usual two resonances of which the upper one appears to be heavily damped. Now the thickness of the absorbing material on the perforated plate is increased until the resonance has about disappeared. The lower resonance as well as the minimum in the impedance curve are still clearly visible (and audible). For arriving at the proper thickness of the material to be placed over the slit, it is necessary to install the wooden frame bearing the decorative grille. This can be screwed on the front panel just by removing the back side panel and screwing from the inside. The layer has to be about ¼ in. thick. When the adjustment has been completed, the upper resonance has completely disappeared, the lower one being still noticeable on measuring, but sufficiently damped by the audio amplifier. All screws, especially those of the loudspeaker, are once more tightly

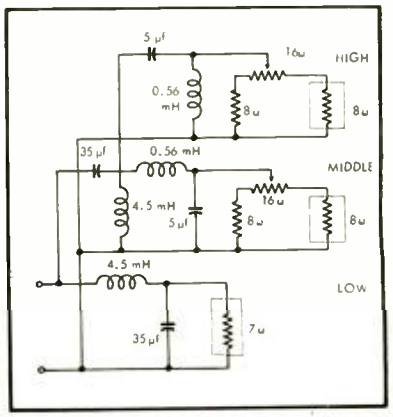


Fig. 15. Three-way crossover network.

secured and the enclosure is lined by 1 in. felt. The front and back panels are now mounted by large screws. A sturdy plug, fitted in such a way that no leakage of air can occur, serves as electrical connection.

Before concluding, a few additional remarks. Since this system has been provided with a decorative grille, it is not very suitable for all-range use. It is preferably used as the bass section of a multi-channel system. In this connection it is not superfluous to mention that the efficiency of the bass section has been reduced by the applied dampings so that introduction of attenuator pads in the other channels is necessary. *Figure* 15 depicts a three-way system with crossover frequencies of 400 and 3000 cps. The attenuators shown are capable of some 10 db of damping thereby providing a nearly constant impedance.

In the author's system the midrange speaker and the tweeter (direct radiators) are housed in small cabinets of which the rear sides are replaced by one-inch layers of plastic foam. This permits the loudspeaker to be oriented in such a way as to improve the diffusion of sound without causing trouble by backward radiation.

The enclosure's dimensions given apply to use of a 12 in. woofer. For larger sizes all dimensions can be increased in the same proportion as the cone diameter. The interior volume is not at all critical so that a somewhat smaller increase may be sufficient. ●

RC CROSSOVER

(*from page 19*)

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .98y^2 + .02y^4] \quad (5)$$

Two-stage non-interacting network:

$$A = 1 - x^2 + j^2x \quad (6)$$

$$\phi = \tan^{-1} \frac{2x}{1 - x^2} \quad (7)$$

$$db = 10 \log_{10} [1 + 2x^2 + x^4] \quad (8)$$

Loss at half ultimate phase shift, 90°, $x = 1$:

$$db = 10 \log_{10} 4 = 6.021 \text{ db} \quad (8a)$$

Half-power point given by

$$1 + 2x^2 + x^4 = 2; \quad x = .643 \quad (9)$$

Phase at half-power point:

$$\phi = \tan^{-1} \frac{1.286}{.586} = 65.5° \quad (7a)$$

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .828y^2 + .171y^4] \quad (10)$$

Three-stage networks, using identical components in cascade:

$$A = 1 - 5x^2 + j6x - jx^3 \quad (11)$$

$$\phi = \tan^{-1} \frac{6x - x^3}{1 - 5x^2} \quad (12)$$

$$db = 10 \log_{10} [1 + 26x^2 + 13x^4 + x^6] \quad (13)$$

Half ultimate phase shift given by ($\phi = 135°$)

$$\tan \phi = \frac{6x - x^3}{1 - 5x^2} = -1 \qquad x = 1.077 \quad (12a)$$

Loss at half ultimate phase shift:

$$db = 10 \log_{10} 50 = 16.99 \text{ db.} \quad (13a)$$

Half-power point given by

$$1 + 26x^2 + 13x^4 + x^6 = 2; \quad x = .196 \quad (14)$$

Phase at half-power point:

$$\phi = \tan^{-1} \frac{1.169}{.8075} = 55.35° \quad (12b)$$

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .982y^2 + .018y^4 + .000054y^6] \quad (15)$$

Three-stage networks, non-interacting:

$$A = 1 - 3x^2 + j3x - jx^3 \quad (16)$$

$$\phi = \tan^{-1} \frac{3x - x^3}{1 - 3x^2} \quad (17)$$

$$db = 10 \log_{10} [1 + 3x^2 + 3x^4 + x^6] \quad (18)$$

Half ultimate phase shift given by ($\phi = 135°$)

$$\tan \phi = \frac{3x - x^3}{1 - 3x^2} = -1 \qquad x = 1 \quad (17a)$$

Loss at half ultimate phase shift:

$$db = 10 \log_{10} 8 = 9.03 \text{ db.} \quad (18a)$$

Half-power point given by

$$1 + 3x^2 + 3x^4 + x^6 = 2 \qquad x = .51 \quad (19)$$

Phase at half-power point:

$$\phi = \tan^{-1} 6.35 = 81.05° \quad (17b)$$

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .78y^2 + .2025y^4 + .0175y^6] \quad (20)$$

Four-stage networks, using identical components in cascade:

$$A = 1 - 15x^2 + x^4 + j10x - j7x^3 \quad (21)$$

$$\phi = \tan^{-1} \frac{10x - 7x^3}{1 - 15x^2 + x^4} \quad (22)$$

$$db = 10 \log_{10} [1 + 70x^2 + 87x^4 + 19x^6 + x^8] \quad (23)$$

Loss at half ultimate phase shift, 180°, $x^2 = 10/7$,

$$db = 10 \log_{10} 238.4 = 23.78 \text{ db.} \quad (23a)$$

Half-power point given by

$$1 + 70x^2 + 87x^4 + 19x^6 + x^8 = 2; \quad x = .1182 \quad (24)$$

Phase at half-power point:

$$\phi = \tan^{-1} 1.482 = 56° \quad (22a)$$

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .98y^2 + .017y^4 + .000052y^6 + .0000000386y^8] \quad (25)$$

Four-stage networks, non-interacting:

$$A = 1 - 6x^2 + x^4 + j4x - j4x^3 \quad (26)$$

$$\phi = \tan^{-1} \frac{4x(1 - x^2)}{1 - 6x^2 + x^4} \quad (27)$$

$$db = 10 \log_{10} [1 + 4x^2 + 6x^4 + 4x^6 + x^8] \quad (28)$$

Loss at half ultimate phase shift, 180°, $x = 1$.

$$db = 10 \log_{10} 16 = 12.04 \text{ db.} \quad (28a)$$

Half-power point given by

$$1 + 4x^2 + 6x^4 + 4x^6 + x^8 = 2; \quad x = .435 \quad (29)$$

Phase at half-power points:

$$\phi = \tan^{-1} - 14.4 = 94° \quad (27a)$$

Response referred to half-power point as crossover:

$$db = 10 \log_{10} [1 + .756y^2 + .143y^4 + .027y^6 + .00128y^8] \quad (30)$$

NEW LITERATURE

● **British Industries Corporation,** Port Washington, N. Y., illustrates and describes its entire line of audio products in a handsome new pocket-size booklet prepared for distribution to jobbers and dealers. Entitled "Your B.I.C. Line," the publication is complete in every respect, including full specifications and prices of all items. It will be of distinct value to all companies engaged in retail selling of high fidelity equipment. **G-9**

● **Minnesota Mining & Manufacturing Co.,** St. Paul 6, Minn., performs a great service to tape recordists, manufacturers of recorders, as well as to contemporary manufacturers of magnetic tape, with the publication of Sound Talk Bulletin No. 34, a treatise titled "Various Aspects of 'Tape Noise'," by R. A. Von Behren, research and development manager of 3M's Magnetic Products Division. Although it covers a subject which is fairly technical in nature this paper is couched in practical terms, which makes it entirely understandable to the informed amateur as well as to the advanced scientist. This is an excellent monograph which should be in the hands of everyone with a serious interest in tape recording. **G-10**

● **General Electric Company,** Schenectady, N.Y., describes its micro-miniature Tantalytic capacitors for low-voltage d.c. applications where large capacitance values are required in small space, in a new technical bulletin which has just been released. Included in the publication are ratings and dimensions. Requests for copy should specify Bulletin GEA-6065C. **G-11**

● **Argos Products Company,** 310 Main St., Genoa, Ill., announces a new catalog containing its complete line of speaker cabinetry. Heading the listings is the "Californian" speaker enclosure which was engineered acoustically by Jensen and styled by Argus. Other listings include two series of compact corner baffles which are described as excellent for extension speakers in hi-fi systems. **G-12**

● **Crest Transformer Corp.,** 1834 W. North Ave., Chicago, Ill., has available a 4-page catalog listing of transistor transformers which are carried as stock items. Produced in two core sizes, the Crest transformers fall into categories which will find almost universal application in laboratories, on production lines, and with amateurs and experimenters. Copy will be mailed free on request. **G-13**

● **General Transistor Corporation,** 91-27 138th Place, Jamaica 35, N. Y., is distributing a new wall chart which shows applications, maximum ratings, and typical characteristics at 25 deg. C. of 56 types of germanium junction alloyed transistors. The chart also contains a handy interchangeability table, outlines of five different transistor cases, diagrams of various circuits and standard IRE symbols and definitions. Users of transistors may obtain a copy of the comprehensive chart free by writing in care of the Promotion Department. **G-14**

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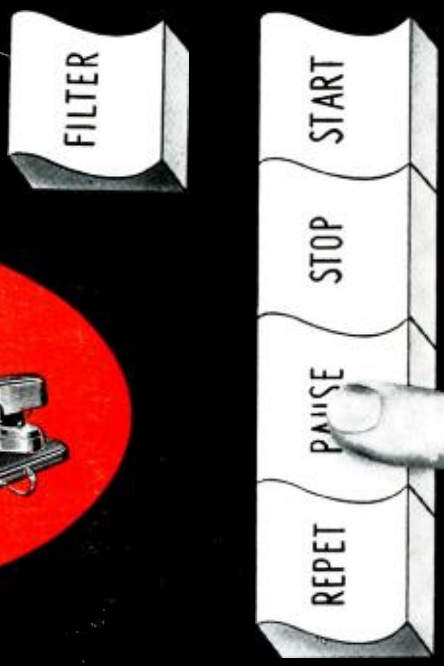

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