"HOT" SOLO...and as he dips low, then soars high, the excitement mounts! Capturing the realism of a thrilling musical experience truly tests any high-quality audio amplifier you design. Meet the challenge with ease by designing around the RCA-7027-A. Two of these "star performers", in Class AB, push-pull service, for example, can deliver up to 76 watts of audio power with only 2% distortion!

Structural features which make such performance possible include: heavy copper-core stem leads, low-thermal-resistance plate material, metal-base sleeve, radiating fins on control grid, and double base-pin connections for both control grid and screen grid.

So for high power and low distortion in your quality audio-amplifier designs, consider the RCA-7027-A. Check the data at right, then, for further information, ask your RCA Field Representative or write RCA Commercial Engineering, Section G91DE, Harrison, New Jersey.

**RCA-7027-A beam power tube offers new high-power capabilities in high-quality audio amplifiers:**

<table>
<thead>
<tr>
<th>Design-Maximum Ratings:</th>
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</thead>
<tbody>
<tr>
<td>Plate Volts</td>
<td>600</td>
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<td>Grid-No. 2 Volts</td>
<td>500</td>
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<tr>
<td>Plate Dissipation (Watts)</td>
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<td>Grid-No. 2 Input (Watts)</td>
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**Typical Operation in Class AB:**

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<th>Push-Pull Service:</th>
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<tbody>
<tr>
<td>Plate Volts</td>
<td>540</td>
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<tr>
<td>Peak AF Grid-No. 1 to Grid-No. 1 Volts</td>
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</tr>
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<td>Max.-Sig. Power Output (Watts)</td>
<td>76</td>
</tr>
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Humboldt 5-3900

**MIDWEST:**
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Chicago 54, Illinois
Whitehall 4-2900

**WEST:**
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Raymond 3-6361
What makes Garrard Record Players the finest in the world?

One could say it is the patient attention to detail so apparent in any Garrard design... or, the painstaking quality control techniques followed in the manufacture of all Garrard products... but, an equally significant factor would be the matter of Garrard service and spare parts!

Like all other record players, Garrard models are mechanical devices, ultimately requiring some form of service or adjustment. But, unlike all other record players... a Garrard lasts longer before needing service... and when the time comes, Garrard owners are taken care of magnificently.

We are pleased to reproduce here excerpts from a few of the unsolicited letters sent to us...

"Last Monday I telephoned your office to request a selector arm extension cap to replace the one which had become displaced or lost on my Garrard changer. It arrived in the mail this morning, and to my additional pleasure, I see that you have supplied it without charge. This letter is to let you know how much I appreciate your sending it along so promptly. Such responsible servicing is unusual nowadays, and all the more satisfying when encountered. With Sincere Thanks."

W.N.J., New York

"I am sincerely at a loss for words in thanking you for the work and parts put into my Garrard changer 398 (purchased three years ago) sent in for examination. You have just inherited a living, breathing testimonial and goodwill ambassador... for life."

E.J.B., Chicago

"Please accept my belated, but most sincere thanks for sending me a replacement for my speed control on my Garrard RC-99. This was a most unexpected pleasure. It shows that when one buys the best that one also gets better than best service. The Garrard player now works perfectly, thanks to you... and I love it."

K.F.B., Severna Pk., Md.
"I have received and installed the Garrard RC-50 motor and wish to report that it is in fine working condition. It is very rare nowadays to find a company such as yours that is willing to stand behind their product to the extent that you have and when one does, I must express my appreciation. When my friends discuss high fidelity equipment and the various components, I shall remember the fine treatment and personal service that the Garrard Sales Corporation has given me. Thanks again, not only for a fine product but for an equally fine company.


"It is a pleasure to do business with a firm such as yours that is ready to stand back of any service needs and we would certainly recommend Garrard to anyone assembling their own record playing equipment."

W.E.C., Oak Park, Ill.

"Your organization is to be highly complimented for the manner in which you handled your problem, and you can rest assured Garrard products are tops as far as I am concerned and in my discussions with high fliers.

F.P., Anderson, Ind.

"...The RC-50 turntable you shipped out to me is almost as rare as a transcription table. . . Before closing may I add that your service and Garrard will always remain high in my estimation. Thanking you again."

A.S., Brooklyn, N. Y.

"We wish to express our appreciation of the prompt and very satisfactory service given to us by Garrard in repairing and reversing our record player."

H.L.H., Camp Hill, Pa.

"This letter is in regard to all of our correspondence I should like to express my appreciation for the service which you gave me and your cooperation in this matter. It has been a pleasure doing business with your company."

F.A.O., Galesburg, Ill.

"...May I thank you again for your personal attention to this matter and for your extra kindness in involving the material rather than holding up delivery to me."

C.W., Brooklyn, N. Y.

"...I should like you to know that I am grateful to you for your kindness. When the opportunity arises you may be assured that I shall always have a propositive word to say on behalf of GARRARD."

R.S.V., Brockville, Ontario

"...I am very happy with your handling of this matter, and I shall not hesitate to recommend your company to any of my friends who want a reliable concern."

D.H., Yoder, Ind.

"...I wish to express my sincere appreciation for your kind and prompt response to my request. Your efforts to maintain good customer relationship will certainly be made known to all of my many audiophile friends."

V.R.M., San Rafael, Calif.

"I am completely satisfied as to your handling of this matter. Just last week (as a result of my own treatment) I persuaded a fellow officer to purchase your RC-98. I plan a similar exercise in June. I remain a hearty endorser of GARRARD."

L.W.B.R., APO, New York, N. Y.

It may interest you to know that almost all of the units referred to in the letters are three or more years old. As a matter of fact, the Garrard Service Department often handles motors that have seen as much as two decades of play. For example, the aristocratic RC30's and RC65's of the 78 rpm days, still in daily use, are brought in for checkups and adjustments from time to time. Continual service and replacement of parts is, of course, the guarantee of continued satisfaction with any fine mechanism, and Garrard record players hold their pre-eminent position through the finest service facilities and spare parts stocks in the high fidelity industry...the facilities of British Industries Corporation.

For your free Garrard Comparator Guide

Address Dept. GG 19

GARRARD SALES CORPORATION, Port Washington, N. Y.

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COVER PHOTO: Convenience and flexibility are offered by the cabinet arrangement in an installation by Kierulf Sound Corporation, Los Angeles. The three Bryson cabinet sections may be rearranged as desired. As shown, the first section houses the loudspeaker system; second section houses amplifier, tuner, and records; third section accommodates Garrard changer and more records. This installation is in the home of Mr. and Mrs. Steve Kusley.

Discover for yourself why Sherwood is the most honored line of high fidelity components in the field. Sherwood Tuners (the first ever to achieve sensitivity under 0.95 microvolts) feature: Inter-Channel Hush, a noise muting system which makes FM tuning easier than ever; FM Multiplex Output; "Feather-Ray" Tuning Eye; Automatic Frequency Control; Flywheel Tuning. Combine these tuners with either of Sherwood’s "mated" stereo amplifier choices; 20 - 20 watts or 36+36 watts. And only Sherwood offers all these features: Single/Dual Bass & Treble Controls; Mid-Range Presence Rise; Stereo-Mono Function Indicator Lights; Phase-Reverse Switch; Damping Factor selection. Sherwood also offers either 36 or 60 watt monaural amplifiers, FM Multiplex Adapters and a complete decorator-styled line of cabinetry and 3-way speaker systems.

The Finest in High Fidelity, Sherwood Electronic Laboratories, Inc., 4300 N. California Avenue, Chicago 18, Illinois.

For complete technical details write Dept. A-1.
For Your Information Again

Earlier readers of AUDIOCLINIC have read these words before. Because of our many new readers, however, a restatement of these ideas seems in order.

It is the policy of AUDIOCLINIC that all letters to this column should receive individual answers regardless of the suitability of the material for inclusion in the column itself. Because of the increasing volume of this correspondence, a quick response is not always possible. Please be patient; an answer will come unless, as sometimes happens, no reply is possible because of incorrect address, handwriting which cannot be read, and so on.

Enclosure of a stamped, self-addressed envelope will facilitate answering. Please address all mail directly to the writer at the address below instead of to AUDIO.

The following questions were submitted by Mr. D. M. Anglin, Seattle, Washington.

Amplifier Ground Systems

Q. For stereo I wish to construct two identical power amplifiers on one chassis. I use a bus bar for the ground lead in all units I build, and ground it on the chassis at one point only. If I use one bus bar as a common ground for both units, would that be a hum hazard when this one-point chassis ground is used? Would it be better to use a bus bar for each unit and ground them both at one, or one chassis point?

A. In regard to the use of bus bars, I recommend that you use two separate ground systems—one for each stereo unit. As a matter of fact, you can do a cleaner job by not using a bus bar system at all. It would be advisable to ground the wire to one point on the chassis, but rather than run it in the form of a bus, use insulated wire and run it along the chassis. Ground points may then be brought from this wire and connected to insulated tie lugs—which, in turn, can be mounted in the proper location with respect to the circuit elements.

Automatic Loudness Control

Q. Would an automatic loudness control be of value in either a stereophonic or a monophonic system?

A. I do not recommend automatic loudness controls. At a live concert the listener has no means of automatic loudness compensation with changes in musical dynamics. Therefore, when such a device is introduced into a home music system, the results are artificial. This is true regardless of whether the material being listened to is monophonic or stereophonic.

Ganged Potentiometers

Q. Can a ganged volume control be used successfully with a preamplifier whose balance is adjusted by means of the power amplifier's volume controls? May the bass and treble controls be ganged or should they be separate? Is there really so much difference in the bass and treble channels that a ganged control will fail to adjust it?

A. Commercially available ganged controls rarely track properly. This means that the change of resistance in one section of the ganged potentiometer with a given amount of shaft rotation will not be equal to the change of resistance in the other section of the potentiometer with the same amount of rotation. This holds for volume as well as tone-control circuits. It is the reason why Marantz and others have resorted to the use of ganged stepped switches in their equipment. Ampex uses potentiometers fitted with taps from which resistors are shunted to ground. These cause the potentiometer to track more uniformly. Therefore, if you wish to gang your tone controls, bear in mind that some compensation for tracking error may be required.

An added disadvantage of ganged volume controls stems from an inability to balance the two stereo channels with each other. A balance which is correct for one stereo tape or disc may not be correct for the next one played. I therefore recommend the use of either separate volume controls or a special balance control. An interesting balance circuit can be found in AUDIOCLINIC for June, 1959.

45-45 Stereo

Q. Since the vertical channel seems to have less frequency response than does the horizontal channel, I am using my 15-inch speaker and a tweeter for that channel and my 15-inch woofers and a tweeter for the other. Will I be able to get some sort of match with that combination?

A. Stereo discs are recorded with each channel 45 degrees from a horizontal line or, to put it another way, at 45 degrees from a vertical line. Therefore, each channel is identical, neither being vertically oriented and the other horizontally oriented. Since the two channels are identical, their frequency responses are identical. For this reason, you need no more frequency correction for one channel than you do for the other. Hence, your speakers should be matched as closely as possible. Your tone controls should be set to the same equalization point. The degree to which the sound in each channel can be matched depends partly upon the similarity of the speakers. For instance, when the two speakers are manufactured by the same firm there is often a family resemblance in their sound qualities regardless of their variation of operating parameters. When the speakers are dissimilar, sometimes a fair match may be achieved by varying the equalization of one channel or the other.

3-Pin Stereo Cartridge

Q. Would a two-conductor shielded cable be useful when used with a 3-pin stereo cartridge?

A. When using stereo cartridges employing three terminals, it is common practice to employ two-conductor shielded...
"Nothing Short of Superb," says Raymond E. Ward, Distributor-Sales Mgr., Shure Brothers, Inc. "That's our unanimous verdict on the results we have had with the Garrards used for laboratory testing of our new Stereo Dynetic Cartridges. Because we can rely on Garrard's precision construction and consistently accurate performance, we have been able to concentrate fully on developing the exceptional sound reproduction Garrard and Shure users expect...and get. Now, our sales records show that more of our new cartridges are being installed in Garrard Record Changers than in any other changer or turntable. This is only natural, because they work so well together."

"Complaints from Garrard Users? Practically Zero!" says Joseph Pickert, Mgr., Service Dept., Shure Brothers, Inc. "That's right! Garrard owners who install the new Shure Stereo Dynetic Cartridge get such perfect sound reproduction that we rarely get a complaint. The exact fit of the cartridge in the Garrard shell, the precision mounting of the tone arm, the controlled arm action and tracking at the lightest specified weight mean longer life for cartridge and records...along with the finest audio for stereo and monaural."

"Garrard changers are eminently superior with Shure stereo cartridges"

What Mr. Ward and Mr. Pickert say about the Garrard Changer—for stereo—is typical of its universal acceptance by component manufacturers and high fidelity enthusiasts.

In fact, more Garrard Changers are sold today as components for stereo—than all other turntables and changers combined! That's why—before you buy—you should see and hear stereo records played on a Garrard Changer such as the incomparable RC88.

The same reasons why Garrard Changers perform so well with Shure Dynetic Stereo Cartridges account for Garrard's popularity with all other manufacturers of fine stereo cartridges—Electro-Voice, Fairchild, General Electric, Pickering, etc.

- Vertical and lateral rumble completely inaudible. Wow and flutter far below existing "broadcast tolerances" standards.
- Exclusive Aluminum tone arm precision-mounted at engineering works for optimum tracking angle, perfect sound reproduction.
- Unrestricted choice of stereo cartridges—any of them will track at the manufacturer's highest specified weight.
- Record handling gentler than the surest human hand.
- The important convenience of manual play plus completely automatic operation without compromising in performance.

These are the FACTS, so one can deny them with authority—and they are backed by the 36 years of experience that have created Garrard's unique reputation for unsurpassed quality.

For the best in Stereo... Insist on a Garrard CHANGER THE WORLD'S FINEST!

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

GARRARD SALES CORPORATION, Division of British Industries Corporation, PORT WASHINGTON, N. Y.

Canadian Inquiries to Chas. W. Pointon, Ltd., 8 Algina Ave., Toronto.

cable with the shield serving as ground for both channels. It would be better, however, to use three-conductor shielded wire with one of the conductors serving as ground for both channels with the shield grounded only at one preamplifier input. However, if this cable is too thick, the freedom of the tone arm to move will be impaired with a consequent increase in distortion and possible damage to discs.

About Transformers

Q. 1. In power transformer specifications, does the phrase, "50 volts CT" mean 50 volts across the outside connections of that particular winding and 25 volts from centertap to either of the outside windings?

2. When the impedance of the primary of a coupling transformer is 100 ohms CT, does this mean 100 ohms across the complete winding or 100 ohms on either side of the centertap?

3. What is meant by the term given in coupling transformer specifications: "maximum unbalanced d.c. in the primary?"

F. C. F., Aberdeen, Md.

A. 1. When a power transformer is rated as being 50 volts centertapped, it means that this transformer gives 25 v. each side of center, and the full 50 volts appear across the winding.

2. The same situation holds for the primary impedance of a coupling transformer. If this impedance is 100 ohms centertapped, 50 ohms will apply to each side of the winding and its center tap. You might at first suspect that this impedance is 50 ohms each side of center, but this is not the case, because the impedance is equal to the square of the turns. This means that when the number of the complete winding in relation to one end of it and the center tap) the impedance goes up by a factor of 4.

3. The unbalanced current in the primary or secondary of a coupling transformer refers to the maximum d.c. which is passed through the winding of a single-ended circuit without saturating the iron core magnetically. The balanced current is always higher than the unbalanced current because the current in a push-pull circuit is oppositely polarized in each half of the winding. This cancels the magnetizing force to a considerable extent, allowing a higher current to be passed through the transformer winding without undesirable saturation.

Erratum

The March, 1959 installment of this column contains a discussion of loudspeaker efficiency in which it is stated that the efficiency of any device is equal to the power fed into it divided by its power out. One of our readers pointed out that this word formula should read the other way around: Efficiency is equal to the power yield of a device divided by the power fed into it. He's quite correct, and we thank him for his observation. If there are others among you who wish to comment — good or bad — we will be sincerely interested in hearing from you. J.G.

Jenson Manufacturing Company, 6661 S. Laramie Ave., Chicago 38, Ill., will mail Brochure KK, an illustrated sheet covering the new DP-1 Duette speaker system, without cost or obligation. This latest Duette model is an economically priced professional two-way loudspeaker featuring a wide frequency range with clean bass response down to 36 cps. It is well illustrated and thoroughly described in the brochure.

Unimax Switch Division, The W. L. Masson Corporation, Waltham, Mass., introduces an extensive line of subminiature switches which meet Military Specifications for a wide variety of rigorous services in Catalog No. 159. Convenient pictorial index shows where to find dimensional drawings, descriptions, force and movement specifications tables, and electrical ratings for each Unimax switch listed. Data on bases, terminals, circuit arrangements and NEMA standard definitions of several switch terms are also included. Requests for copies should be directed to the attention of Mr. J. Martines.

Atlas Sound Corporation, 1419 39th St., Brooklyn 18, N. Y., illustrates and describes its complete line of commercial sound equipment in a 16-page two-color catalog which is now available. The catalog also commemorates the company's twenty-fifth anniversary as an industry leader in its field. Included in the publication are explanatory technical diagrams and full specifications on all Atlas loudspeakers, transformers, driver units, and speaker and microphone mounting accessories. Among new models introduced for the first time this year is a Duette speaker for attractive interior installation. Catalog No. 559 may be obtained without cost by writing to the address shown above.

Lipp, Inc., a division of Lipp Engineering, 1513 Colorado Ave., Santa Monica, Calif., announces the publication and availability of a 4-page brochure describing a new replacement and repair service now available to owners and users of professional and semi-professional recording equipment. Requests for copies should specify Bulletin AM-22.

Electro-Voice, Inc., Buchanan, Mich., is now releasing Bulletin 25A, a new sales folder describing the E-V line of public-address equipment, which should aid the prospective buyer in obtaining full information on compound diffraction projectors, paging units, outdoor speaker systems, accessories, and microphones. A copy of Bulletin 25A will be mailed upon written request.

Telecstromic Corporation, 25-16 37th St., Long Island City 1, N. Y., describes and illustrates its new line of tape recorders in a 12-page consumer brochure which has just been published. The book is divided into two sections, the first of which is devoted to the enjoyment and advantages found in tape recording. Section II is concerned with turns is doubled

The Tape Recorder Club, 73 Grand Parade, Harringway, London, N.4, England, has published the last issue of its Club Bulletin. A large number of the Club's members are "very keen to make contact with American tape recorder owners," and with this thought in mind D. V. Lane, Principle, has asked that we bring the matter to the attention of our readers. Letters of Inquiry should be addressed to Mr. Lane at the address shown above.

NEW LITERATURE
the all-new VR-22 stereo cartridge

VR-225 5 mil diamond stylus. For professional-type tone arms, $27.95.

VR-227 7 mil diamond stylus. For record changer or turntable, $24.95.

Now, outstanding in all four critical areas of stereo cartridge performance—Compliance—Tracks precisely, not a trace of stiffness. Channel Separation—Up to 30 db for maximum stereo effect. Nothing higher on the market! Response—Smooth and flat for superior sound from 20 to 20,000 cycles (VR-225), 20 to 17,000 cycles (VR-227). Virtually hum-free—triple shielded against stray currents. This is our masterpiece. We urge you to hear it.

GENERAL ELECTRIC

Audio Components Section, Auburn, N. Y.

AUDIO • JULY, 1959
LETTERS

Stereo Thoughts and Queries

Sir:

Hereewith a few long-repressed notes on a variety of topics, mostly stereo.

1. I won't buy compatibility with AM-FM stereo as an argument for left-right FM stereo because I won't buy AM-FM stereo at all. If one of your earlier letter writers has problems, as mentioned in last December's issue, I have several. Of an even dozen "good music" or educational FM stations I listen to with fair regularity, no less than five schedule AM-FM stereo. Not one of the corresponding AM stations is receivable with usable quality on good equipment in this area. Pure frustration.

2. WJBR in Wilmington, Del., carried experimental Crosby system stereo for several months. I have heard them regularly for about two months on a home-grown adapter (courtesy of a couple of your articles). Quality, both monophonically and stereophonically, has been excellent.

3. Some time ago, WASH in Washington, D. C., began experimental multiplex stereo broadcasts, with the right channel on 67 kc. They have also done AM-FM off the same programming with WDON (AM) of Wheaton, Md., which I can't receive. The broadband adapter gets only noise for them yet, but appropriate modifications are planned.

4. On the basis of lots of forced listening to only one side of stereo transmissions, I must admit that to this one set of ears one-channel-only does not sound bad. However, where both have been available, the mixture of the two channels has been found far preferable to either one alone for monophonic listening.

5. I have some slight qualms about the action of the "Dimension" control on the Crosby-system adapters. S+2D undoubtedly gives SL+SR, and S+2D would appear to give 1/2L+1/2R and 1/2L+1/2R, which would be expected to give "reduced separation," as would the use of a "blend" control. I'm not too clear on the effect of adding too much difference channel, i.e., S+2D to give SL-R and SR-L. (See page 22, however, En.) Without taking a stand on the mechanics of stereo orientation, it would seem that information corresponding to increased mike spacing would be missing. The relative intensities of various voices in the two channels are the same for S+2D as for S+2D, (3 to 1), but with a phase reversal of the off-channel component. The simple phase reversal is not equivalent to the complex frequency-dependent phase shifts that would result from increasing mike spacing. There might be some sense of increased speaker separation due to essentially out-of-phase signals, a partial ease of the last word in augmented senses, schemes, deliberatively throwing the speakers out of phase.

One export, (ETC, November, 1958) has branded this approach as musically false. Also, it would seem that in phase components in the L+R channels would be partially cancelled, tending to cause a loss of low-frequency content. Am I missing a point?

6. Along the same line, what happens when a signal from a stereo cartridge connected out of phase to allow use of a "Two-Way Stereophonic Amplifier" (Oak-tober, 1958) is fed into a control unit with "blend" control? (Guess you don't have to use it.) (Or an argument for four-pin cartridges—flexibility at the expense of simplicity.)

7. When tapping multiplex signals off the air, it pays to be sure the subcarrier gets well-filtered out before the end of the recording amplifier. If treble pre-emphasis doesn't cause overloading, the subcarrier may probably beat with the bias frequency.

J. David Dykstra
677 Plater St.
Aberdeen, Md.

(Mr. Dykstra's letter indicates that he does some serious thinking on this subject. Perhaps some other similarly or equally serious thinker can exchange ideas with him preferably through this column for the enlightenment of all our readers. Actually, the reason for the engineering tests of the various stereo broadcasting systems is to determine how they work out in practice, which is not always in accordance with how they work on paper. We are interested in other comments on the various stereo broadcasting systems. Etc.)

We Never Expected This

Sir:

My husband renewed his subscription for two years through your representative at the Los Angeles High Fidelity Show in February.

May I take this opportunity to express our enjoyment of your excellent magazine? Yes—I, too, enjoy Audio though I am not a member of the engineering profession. I find it helps me understand the many projects my husband undertakes with his audio equipment. Your magazine has been of truly inestimable value to him.

Jane M. Hall
(Mrs. Donald Q. Hall)
438 S. Placentia St.
Anaheim, Calif.

(Gentlemen: We submit that this is the kind of a wife a man should have—one who will read a technical magazine so she can understand her husband's hobby better. We take our hat off to her. Ed.)
...aligned, and the entire AM circuit
sensitivity
ual flywheel
disturbing stereo or monaural
...tuning
frequency control)
The
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AM
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SE-1 (center unit) $149.95
Shpg. Wt. 16 lbs.
MODEL SC-1 (speaker enclosure) $39.95 each
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Superbly designed cabinetry to house your complete stereo system.
Delivered with pre-cut panels to fit Heathkit AM-FM tuner (PT-1),
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panels also supplied to cut out for any other equipment you may now
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**PROFESSIONAL STEREO-MONOAURAL AM-FM TUNER KIT**
MODEL PT-1 $89.95
The 10-tube FM circuit features AFC (automatic frequency control) as well as AGC. An accurate
tuning meter operates on both AM and FM while
a 3-position switch selects meter functions without
disturbing stereo or monaural listening. Individu-
al flywheel tuning on both AM and FM. FM
sensitivity is three microvolts for 30 db of quieting.
The 3-tube FM front end is prewired and pre-
aligned, and the entire AM circuit is on one printed
circuit board for ease of construction. Shpg. Wt.
20 lbs.

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**World's largest manufacturer of**
electronic instruments in kit form

**HEATH COMPANY**
Benton Harbor, 25, Michigan

**HIGH FIDELITY RECORD CHANGER KIT**
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Turntable quality with fully automatic
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record to fall gently into place while turntable is stopped. The tone
arm engages the motionless record, and a friction clutch assures
smooth start. Automatic speed selector plays mixed 33½ and 45
RPM records regardless of sequence. Four speeds available: 16, 33½,
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diamond LP and sapphire 78 stylus, changer base, stylus pressure
gauge and 45 RPM spindle. Shpg. Wt. 19 lbs.

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

** AUDIO • JULY, 1959**
14-WATT HI-FI ECONOMY AMPLIFIER
MODEL EA-3 $2995

From HEATHKIT audio labs comes an exciting new kit... New Styling, New Features, Brilliant Performance! Designed to function as the center of your hi-fi system, the EA-3 combines the preamplifier and amplifier into one compact package. Providing a full 14 watts of high fidelity power, more than adequate for operating the average system, the EA-3 provides all the controls necessary for precise blending of musical reproduction to your individual taste. Clearly marked controls give you finger-tip command of bass and treble "boost" and "cut" action, switch selection of three separate inputs, "on-off" and volume control. A hum balance control is also provided. The circuit is a three stage monaural type with the front panel showing true separate left and right channel drivers, while the control knobs are black with gold inserts. Shpg. Wt. 15 lbs.

"MASTER CONTROL" PREAMPLIFIER KIT
MODEL WA-P2 $1976 (Not Illustrated):
All the controls you need to master a complete high fidelity system are incorporated in this versatile amplifier. Features 3 switch-selected inputs with level control, provides tape recorder and cathode-follower outputs. Full frequency response is obtained within ±3½ db from 15 to 35,000 cps and will do full justice to the finest available program sources. Equalization is provided for LP, RIAA, AES, and early 78 records. Shpg. Wt. 7 lbs.

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Precision parts hold flutter and wow to less than 0.35%. Four-pole, fan-cooled motor. One control lever selects all tape handling functions. Each tape preamplifier features NARTB playback equalization, separate record and playback gain controls, cathode follower output, mike or line input, and two circuit boards for easy construction and high stability. Complete instructions guide assembly.

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

MODEL FM-4 $3495
(with cabinet)

HIGH FIDELITY FM TUNER KIT (FM-4)
The all new model FM-4 incorporates the latest advancement in circuit design. Features include better than 2.5 microvolt sensitivity for 20 db of quieting, automatic frequency control (afc) with defeat switch, flywheel tuning and prewired, prealigned and pretested tuning unit. Prealigned IF transformers and prewired tuning unit assure easy assembly with no further need of alignment. The five tube circuit features a generous power supply utilizing a silicon diode rectifier. Shpg. Wt. 8 lbs.

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MODEL UA-1 $2195

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

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Describing Required No available today. Nominally over fields. Also contains the frequency range 50 to 12,000 CPS. Crossover circuit is built in with balance control. Impedance is 16 ohms. Power rating 50 watts. Tweeter horn rotates so that the speaker may be used in either an upright or horizontal position. Cabinet is made of veneer-surfaced furniture-grade plywood suitable for light or dark finish. Both wood parts are precut and predrilled for easy assembly. Shpg. Wt. 26 lbs.

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The SS-1B employs a 15" woofer and super tweeter to extend overall response of basic SS-2 speaker from 35 to 16,000 CPS ± 5 db. Crossover circuit is built in. Impedance is 16 ohms, power rating 35 watts. Constructed of 1/4" veneer-surfaced plywood suitable for light or dark finish. Shpg. Wt. 80 lbs.

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1. QUARTER-TRACK

I'm still waiting. Waiting, that is, for the RCA Victor tape cartridge, a year old and not yet born. Here it is the first anniversary of this article and the subject of this article, and it might seem, as of now, that my direct alternative guess has come true—the RCA cartridge will pop onto the market in the middle of a sea of stereo discs—fizzle awhile and die with a wet plop.

It didn't even get to fizzle; it hasn't had the opportunity. "Maybe its coming was timed unfortunately," I continued, and was I right. It was timed so that if the stereo disc succeeds, it wouldn't have a chance. Last I heard, RCA was going to make a big announcement on the cartridge during May. Not a peep yet and May is repaired. Before that, it was to be out for the Xmas rush, 1958. It wasn't. But, as mentioned before, the spark of life is still aglow; RCA engineers have been actively demonstrating their cartridge right through this spring in various hi-fi clubs, engineering gatherings, and the like.

Nope, I don't expect the RCA cartridge is dead yet, in spite of the 100 per cent official silence, up to this writing. And I still think it's good. Having read over my remarks of last July (Audio ETC) I find them still convincing and don't feel inclined to take back a single word of the basic argument.

Moreover, though the cartridge itself is incommunicado these days, the technical development in tape recording that made it possible is very much alive—the quarter-track tape system, as it is now called.

Things aren't standing still at all in quarter-track. Indeed, RCA aside, the developments have been quite fast and furious. To begin with, most of the 1959 home tape recorders came out with provision included for playing quarter-track tapes, and for recording the same, mono or even in stereo. Though RCA got the cold shoulder, the quarter-track system itself didn't. Quarter-track recorded stereo tapes are out, too, on ordinary reels.

The smaller quarter-track heads—the main technical revolution involved—are being used dual-purpose, to play the older half-track tapes as well as their own kind, with mechanical adjustments that are relatively clumsy but, for the time being, effective enough. In some situations, the opposite is being promoted, i.e. the playing of quarter-track recordings by existing half-track heads—a poor idea since a half-track tape plays too much blank tape and thereby produces an uncomfortable quantity of background hiss. (This from a helpful correspondent who tried it. He also says that one track plays at a lower level than the other, making for more bias in the balancing.) Anyhow—the quarter-track system has succeeded after all. It has held its own in the marketplace field in force and it's there to stay.

We've only seen the beginning. I feel now, as I did a year ago, that we are in for another complete revolution here and I suspect that in a few years quarter-track tape will entirely replace half-track for the same use in home use in radio magazine or on plain old fashioned reel or, perchance in some other arrangement still to be launched.

Our present standard half-track tape, along with its counterpart in two-track stereo, will gradually become less and less "standard," more and more secondary, like the 78 record and the 3-mil stylus. We'll have both systems for quite awhile, and maybe both magazine and plain reels in one machine later on—but the whole quarter-track equipment will gradually take over until, one fine day, there'll be a rash of new tape recorders that won't even play half-track tapes at all. Not too far off.

I'm about to acquire a quarter-track home recorder for experiment and expect to report on it, for whatever interest it may prove to have, later in the year. Meanwhile, though, I'm off on a prophesying binge—and I haven't even used a quarter-track machine. But the signs and circumstances are multiplying and I don't need to wait, in order to see fundamental sense in the new quarter-track standard, whether it is in magazines or the thread-it-by-hand system.

First, it obviously was not a public failure. The fact that half the RCA quarter-track stereo tape cartridge. The public never got to try it, and few have ever heard it. A few hi-fi fanatics, here and there, are hardly going to make or break such a development. Clearly, something didn't pan out as anticipated, and the only thing that matters, as it stood, is that the change in RCA plans should not be construed as affecting quarter-track tape's value, generally. Far from it.

Maybe RCA did hope to get its stereo cartridge in ahead of the then-doubtful stereo disc and so decided to launch the two at once in 1959 (the press got it June 1958), to cover any eventualities. Maybe the tape machine makers did put a crimp in the big plans by refusing to man to rush forth with magazine tape players for 1959 (10, autumn, 1958). They declined (though they had the RCA specs back in January of 1958) and instead came out with the quarter-track heads, minus the magazine. It hardly seems as if this is what RCA had hoped for, to put it mildly. In any case, all this is now water under the bridge, tape past the capstan, and the tape cartridge, as of this writing, enters its second year in the deep freeze. It can still be of immense importance, just the same, and with quarter-track itself gaining ground, RCA's position is improving day by day. Not to mention a friend of mine, I've lost all this! I harbored a good deal of my thinking on the new system last July (look up your back copy) but it seems a proper time now, in the interim period, to point out again why quarter-track remains a good bet.

The biggest reason is simply that it represents a basic improvement in tape quality—that is, in quality relative to the amount of tape used. In other words, quarter-track has been virtually doubled, and doubled again, via the jump from two tracks to four along with the reduction of tape speed to 3¾ ips from 7½. This change relates to the similar change that occurred about five years ago with Ampex's narrow gap heads. Yes, I know that right now there's a big storm going on over the merits of 7½ vs. 3¾ ips in quarter track, but I'll wait until later for my own decision on that—the subject is still too hot. I'm more interested in the longer range implications of quarter-track, both as to width of track and speed.

Upward Revamping

What this amounts to, then, is another revamping upward in the whole tape hierarchy of speeds and qualities, a sort of slipping of a cog in the basic ratio, towards better performance. I don't need to bother with the technical details except to mention the ultra-narrow-gap quarter-track head that is the prime ingredient. (Better tape, better transport mechanisms, more know-how in the mechanical configurations of tape heads, are other factors that come to mind.)

In effect, the basic quality of the older 7½ ips home tape now is available at half the speed and on double the tracks. Maybe it isn't quite equal, yet—yet the groans of many a hi-fi fan are to be heard throughout the land. But the solid work is already accomplished and a good deal of quarter-track sound is already equal to the run of half-track tape sound during the last few years.

Remember that when tape first came out for the home around 1948, the practical limit for the upper frequencies on 7½ ips tape was generally at 7000 to 8000 cps. Few would know low in technology can be, but we all can remember, too, if we're old enough, the muffled sound of those first home 7½ ips tapes. Even the original Magneocorder, a pioneer home instrument though designed for professional use, didn't bother to claim much more than the usual 8000 cps top for its seven-and-a-half-ips band.

Then came Ampex's narrower gap, with the 400 and later the 600 line, and all at once we had sound at 7½ ips that was very nearly equivalent to that at 15, the professional standard. For the last few years, the speeds have been realigning themselves on this newer basis. In the home, 7½ ips is the high-quality, wide-range tape speed now, and 3¾ ips is the entry-level speed, taking the old 8000-cps limit over for itself. The original 3¾ ips speed, which I remember as unhappily muddy in the early days (and nastily, too) with a top of around 4000 cps at best, is now the ordinary speed that to all intents and purposes equals the original 7½. At the bottom, the lovely 1½ ips is the minimum practicality, "voix frequency" speed.

Edward Latanell Canby

Audio etc.
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MONO INTEGRATED AMPLIFIERS (use 2 for stereo)

HF52: (50W, HF52 (30W), HF52C (20W), HF52D (12W), from Kit $34.95. Wired $77.95.

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HF52: Bookshelf Speaker System, complete with factory-built cabinet. Jensen 8" woofer, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass, crisp extended highs. 30-12,000 c/s range. Capacity 25 w, 8 ohms. HFD 8" x 11" x 12" x 3½". Price $28.95. HG-1 Bass Trap. Matching 14" Egos easily convert HFDs into attractive combination. All brackets & hardware provided. $3.95.

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And now—quarter-track and another jump. Just as 7½ was hiked up to approximate the hi-fi sound of fifteen-inch professional tape, so 2¾, is now hiked up to approximate the new-standard hi-fi 7½. As far as I can judge, the jump is just as extensive as that earlier jump.

The bugs aren’t gone yet by any means and quarter-track perhaps isn’t yet as reliable as standard 7½. The background noise may sometimes be high. The distortion level not satisfactory, the frequency range a bit restricted, the alignment not always solid and stable. (Cross-talk is generally not a problem, since it occurs mostly in the heads themselves and quarter-track heads are spaced further apart—by one intervening track—than standard half-track heads.) Those are all problems-of-the-moment. They’ve existed before. They’ll be ironed out—they have been ironed out already in many new machines.

Newer and Better

In the long run, then, what with constant improvement, there’s every reason to suppose that quarter-track 2¾ ips sound may soon generally equal present standard half-track 7½ sound, right down the line. I can’t see how it will be otherwise. There are inherent disadvantages to the slower speeds and narrower tracks, but we must prove that they are insurmountable in practice before we condemn the new system as unworkable. I don’t think they are.

Indeed, one of the most persuasive arguments in favor of quarter-track tape was suggested to me by the maker of some of the new quarter-track recorded stereo tapes and confirmed by an Audio correspondent who had bought one to try and had heard it played via Ampex quarter-track equipment. “The quality seemed to me to be just as high as the best of the conventional stereo tapes, and a good deal higher than some I have heard—and own! The tape hiss is very low...”, he writes, and there you have it in a nutshell. As the tape’s producer puts it, the best argument of all in favor of quarter-track is simply that it is new.

The very factor of newness tends to put it ahead of older half-track sound, in spite of theoretical disadvantages. Newer, in these fast-moving days, means more advanced, even in the fact of seemingly huge problems. It happens all the time. Engineering ingenuity being what it is, disadvantages products are after the other tend to end up even better than their more favorable predecessors.

It happened with the LP, whose difficulties were so overwhelming back in 1948 that many engineers proved to themselves and all who would listen that it was unworkable and inferior. It was—just as they said. But it also had enormous potential advantages, notably in its musical and sales aspects, and its faults were soon overcome to the point where in practice it was far superior to the old 78. So, too, with the stereo disc, already. It isn’t technically superior yet, but the much-groused-over complexities of last fall already seem years back, and the best stereo discs are now pretty much equal to the best mono even though ideally the mono record is still the simple, better product. Mind you, the 78 rpm disc (particularly microgroove) is still ideally better than any LP, in its basic potentialities. Practically, it’s a very dead duck.

The stereo cartridge is perhaps a classic example. With four terminals instead of two, a double element, single stylus, a two-way response instead of one-dimensional, it presented appalling complications as compared to the relatively simple mono cartridge. Inherently, the stereo cartridge is a hulk of a problem; inherently, the mono cartridge is "better" by far. Yet already, in actual practice, the best stereo cartridges are as good as the best monos of a few years back—perhaps better. Inevitably, the stereo cartridge will end up well ahead.

So will quarter-track tape, and here is the crux of the question. The potentialities practicably for every reason have been overcome, and further progress is merely a matter of refinement and experience. The present quarter-track tape is not as good as the best mono—yet! But the new system is in the same position as the LP was when it first appeared. It’s a matter of mere time before the first problems are ironed out, and the new system is ready to take its place as one of the great achievements of the audio industry.
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AUDIO • JULY, 1959
imaginable between the poles of no stereo and all stereo. Only a few outfits dared come straight out with stereo-mono dual releases and retail them as such; the rest kept it all very much a matter of wildy guessing—would there be a stereo version later on? Probably the company itself didn't know, and didn't care. They would want to decide. If the market would hear it, maybe in a few months. . . . And, tother way around, many a stereo disc seems based on its own to see what might happen, with the mono version (if any) trailing far in the background, on a maybe basis.

All things considered, and still as of this moment, there has been the continuing question, what shall we do with the earlier stereo releases? The big backlog? It has been coming out in dribs and drabs, in small batches and, I'm forced to observe, the announcements haven't always been quite clear as to whether the stuff is new or old. To tell the truth, it doesn't really matter, so long as the original tape was a good one and the disc version isn't too far too. Only the record reviewers hear the hair seriously about such matters. (Now, is this the one I reviewed in mono two years ago and now is this a new recording?)

It's only natural, I guess, for the general sales people to cover their tracks a bit here, just in case, playing hookey with numbers never to pin the pinning of some importance. They can't tell the new releases from the re-releases. It does indicate a certain lack of confidence in the ready market, buyer, who may decide that anything older than three months must be utterly unplayable. Just don't tell him, then, and he'll never know.

Yet the fact is that many of the older stereo master tapes stand up extremely well to later competition, even on a mere two-stands. There is much room for brand new, strictly on their own merits. But a much more important thought is simply that if the original mono master tape is still available in the catalogue, then the stereo alternative should most certainly be there too—since it brings with it a decided musical improvement in the impact of the recording.

If you'll look at it in this light, I am sure you'll be delighted to rush out and buy the stereo releases of as many of your favorite monos as appear in that form. A bargain! After all, most record buyers get all their favorite items like familiar friends. Imagine being able to replace that Number One, top-rated group you bought years ago. The one that's been a standby of the young one, who can practically where, with a brand new disc of the same same performance, as familiar as ever, but now in stereo. Terrific.

I recommend this line of thought to the record companies' public relations people.

And with that thought I come to the item that started all this, the new policy at Capitol, which embodies all I have said in a highly satisfactory re-vamping of its former mono program. Formerly, Capitol (and Angel too) released stereo and mono discs more or less separately, as the developing of the market seemed to allow. Now stereo discs for each month were listed apart from new monos; you weren't always sure whether both versions were being released when, in fact they were. All a part of the inevitable hocus pocus mentioned above, and what with a mono and stereo release list, popular and classical (and some other categories too) for each of the three labels every month, things were getting really pretty complicated.

Now, Capitol puts all its 'cards' straight on the printed page for all of us, each month. Every listing is recorded with two columns of record numbers off to its left, headed Monophonic and Stereophonic. And the catalogue numbers, incidentally, are the same, with RCA Victor and a few others. Better still, though, the notation 'Previously Released is put under the mono column when the stereo is a re-issue and no shilly-shallying about it. Capitol has faith in its older recordings (and so do we, anyway). If there is no stereo version, for one reason or another, the notation notion is put down, plainly for all to see. After all, there's still a lot of top-notch mono material being issued.

I've just been through my own card catalogue and am gratified to find that a number of the April, 1959, Capitol stereo releases were put out in mono form as far back as 1956. Some of the best records in the stereo catalogue, at that. Why, somebody may be asking me, don't you mention the other companies that do the same thing in their announcements? Vox, for example, or RCA Victor. Both of these companies have listed mono and stereo releases side by side for quite awhile. Well, you see, it's significant to me that Capitol didn't—and now does. It indicates a very important development in Capitol's thinking and by collection, an even more important development in stereo disc itself, these last crucial months.

Stereo, my friends, is a success.

3. SENATORS ON LIMB

Seems even the New York Times agrees with me about the publicity barrage in the mail, as described here in the April issue. A nice little news article with the above title appeared recently. Utterly dead, it described something called the Kenting-Javis press release machine (the two Senators from New York). This monster, "long feared and respected as thedest of the Capitol Hill, finally stripped its gears today and began running wildly ahead of the news." All it did was to announce that the President had nominated a certain judge "today" but, alas, the date was still weeks off and the President hadn't done a thing about it yet.

Ah, how easily this can happen, as we all know, in a fast-moving press release system. Most remarkably, one doesn't involve Ike in such matters, if one can manage not to. Won't do at all. Frantic inquiries at the White House produced only one of these, "we have no knowledge statements that (suggests The Times) mean the W.H. doesn't want to say anything for the moment. (I.e. until it figures out what went wrong).

Things were presently untangled via a phone call from a "harried operator" of the Kenting-Javis machine—which had gone all-out in praise of the judge-nominee. Yes, the man would indeed "quote mostly next week," said the White House, upon hearing this, but would the machine please hold onto itself until time caught up with it. The Times didn't quite feel like stopping at this point and neither did I. I went on to say that "close observers of Kenting's judicial career" had "recently" been "pressed into service" by the New York Times to "write fresh news among them, but there was little surprise on hearing that the situation had slipped its girders in the last 5 or 6 months.

"Since Congress opening in January it has been turning out releases by the ton. The volume and variety of its productions, outpacing the output of other Senator's" by 5-to-1, made it inevitable that overhauls would be needed by spring." End of The Times comment, with no further comment needed.

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EDITOR'S REVIEW

TAPE TO THE FORE—AGAIN

Several years ago, magnetic tape was the only satisfactory means by which we could have stereo reproduction in our homes, and tape people—both those who made equipment and those who made recordings—prospered. Then came the stereo disc, and the tape industry went into a lean year. Fortunately this happened just about the same time that TV tape recording boomed so strongly, so at least some of the equipment manufacturers went merrily on. But the market for recorded tapes dropped badly, as we all know.

Now it is a well known fact that tapes at 7½ ips can be of better listening quality than LP records, but the investment required for playing them is certainly more than is needed for the less expensive discs. The dual-track monophonic tape on a good tape machine offered better quality than the average disc, but the cost of the tape was greater. Four-track tape at 3½ ips has it all over discs for cost, but this observer, at least, has not heard any that were considered comparable from a quality standpoint to the LP. Four-track 7½ tape of today is easily comparable to two-track 7½ of two years ago, and better than single-track 7½ of six or eight years ago. Maybe—and that's as far as we will go—maybe four-track 3¾ will get up there, but the disc manufacturers are not going to stand still—they too will make improvements.

As we see it, it is likely that the four-track 7½ tape will end up as of slightly better quality than the disc—particularly for stereo—and the cost should be about the same, minute for minute. As a matter of fact, that is about the way the economics of the subject will force it to be. If the reproducing equipment is of the highest grade, the tape will undoubtedly be much superior.

But where does all this get us? Certainly a Rolls Royce gives a better ride, a more luxurious one, than any of the "lowest priced three," but does that mean that everyone is going to buy a Rolls? Not for a minute—not all of us can afford the difference even though we realize the advantages. Many others just don't think the extra cost is worth it for the results to be gained.

We don't think for a minute that a $75 tape player is going to compare with a $950 one—which is about the same percentage difference as between the automobiles mentioned. We believe that there will always be some who think that the extra expense is justified for the better quality just as there are those who prefer to be filled up on a six-dollar porterhouse instead of 85 cents worth of hamburger.

However, now that the tape industry has rolled with the punches, it has come up with a high-quality product—four-track 7½ recorded tapes—and a new division of Ampex Audio has been formed to distribute nationally the products of the many tape producers. This division—United Stereo Tapes—will put tapes back on the dealers' shelves, and tape will again become the leading medium for top quality of reproduction.

And just as a reminder of our interest in the best in sound reproduction, please note that we established a new section—The Tape Guide—beginning with the May issue this year. This section has for its principal aim the improvement of tape usage in the home, and any serious tape user will find something of interest in the Guide. And many will continue to offer their own experiences and suggestions for the help they may be to others—incidentally receiving some loot for their trouble, which same can be plowed back into more and better tape equipment in their own installations, or even in more recorded tapes.

We look forward to the tape industry's best year in the next twelve months.

JAZZ FROM KJAZ

Don't try to pronounce that—even though some New Yorkers try a phonetic pronunciation of WQXR, resulting in something like "kewsohr," KJAZ is a radio station in the San Francisco Bay area that finally got tired of the conventional "top 40" programming common to today's AM station, local and network alike, and decided to devote itself to jazz. From noon to midnight every day, the schedule shows some real ingenuity—with such programs as "Jazz for Housewives" in the afternoon with a medley of jazz vocalists and low-pressure swinging; "Dinner Jazz," with "oh so polite, yet swinging" background to evening meals; "Jazz Conversations" with visiting artists; and even "Jazz Goes to Church," featuring spirituals and gospel songs. Pat Henry and Dave Larsen, the originators of this idea, are to be complimented on their brainchild. Maybe some other AM broadcasters will think up some innovations to set them apart from the usual programming—the kind where you can't tell what station you are listening to until they announce the call letters because they all sound alike.

We even miss the several hours of radio whodunits that the networks used to carry in the evening hours—we just aren't interested enough to stare at TV programs several hours a week.
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A LIFETIME WARRANTY

\[ 2371 \text{ A} \]
In Arizona, the telephone company faced a problem. How could it supply more telephone service between Phoenix and Flagstaff—through 135 miles of difficult mountain territory?

Radio offered the economical answer: a new microwave radio-relay system recently created at Bell Telephone Laboratories. Operating at 11,000 megacycles, it was just right for the distance, and the number of conversations that had to be carried.

But first other problems had to be solved: how to house the complex electronic equipment; how to assemble and test it at hard-to-reach relay stations way up in the mountains; and how to do it economically.

On-the-spot telephone company engineers had some ideas. They worked them out with engineers at the American Telephone and Telegraph Company and at Bell Telephone Laboratories. The result: a packaged unit.

The electronic equipment was assembled in trailer-like containers at convenient locations and thoroughly checked out. The complete units were then trucked up the mountains and lifted into position.

The system, now operating, keeps a watch on itself. When equipment falters, a relay station switches in standby equipment, then calls for help over its own beam.

The new Phoenix-Flagstaff link illustrates again how Bell System engineers work together to improve telephone service. Back of their efforts is the constant development of new communications systems at Bell Telephone Laboratories.
FM-Band Reception in Fringe-Areas

W. N. COFFEY

When the best antenna installation you can make is still not sufficient to bring in those distant FM stations, try this booster unit which is designed for low-noise amplification at signal frequency.

Are you a consistent FM listener with cosmopolitan tastes? Do you draw on program material from a number of stations? If you are fortunate in living in or near a metropolitan area, you probably are satisfied in this respect. However, if you are located beyond the primary service area of many stations, and are limited to listening to just a few stations, this article will be of interest. In fact, this article is addressed specifically to the "fringe area" listener, the individual who lives, say, 100 miles or more from the nearest FM stations. The principal concern of this type of listener may be to improve the efficiency of his receiving equipment. Let us consider now what an effective fringe-area receiving station should include.

Antenna System

First, one should take utmost advantage of the antenna system to provide maximum signal voltage delivered to the antenna terminals of the tuner. In order to accomplish this at FM-band frequencies, the antenna should be placed in the clear and at a sufficient height above the ground. A minimum height of 20 feet should be maintained, and a continuing improvement with increasing height up to 40-50 feet may be realized, depending on local topography.

A single six-element Yagi antenna designed for the FM band should give around 7-10 db gain over a single one-half wavelength dipole. A pair of such antennas fed in phase and stacked with \( \frac{1}{2} \) wavelength vertical separation should provide around 10-14 db gain over the dipole. Several antennas of this type are available in radio parts stores. When it is remembered that 10 db of antenna gain means that, in effect, the power of all stations received would be increased by 10 times, one can appreciate the advantage of using high-gain antennas.

Then, too, the added directivity characteristic which goes hand-in-hand with higher gain is an effective aid in reducing co-channel interference provided the interfering stations do not lie in the same direction with respect to the receiving antenna. When using such an antenna, the optimum heading to a particular station can be found by rotating the antenna until maximum signal strength is obtained, as evidenced by the signal strength indicator on the receiver, or by the point of maximum quieting. Even a short treatment on optimum antenna design is beyond the intent of this article; however, several excellent sources are available for those who may care to pursue the subject more thoroughly.

Transmission Line

The transmission line which connects the antenna to the receiver is an important link in the equipment chain. To insure that the signal suffers minimum attenuation in finding its way to the receiver, a low-loss line should be used. Tubular 300-ohm line is excellent in this respect and is inexpensive. Where a long line must be run, a 300-ohm open-wire line is preferred because of its extremely low attenuation constant. Although even less expensive than the tubular variety, it may be more difficult to install. It is important to keep all parts of the 300-ohm line at least 6 inches away from metallic objects such as roof gutters, down spouts, water pipes, heating ducts, and so on. Coaxial cable has the advantage that since it is a shielded line, it can be run anywhere, even buried in the ground, or carried along a water pipe. However, it is more expensive than 300-ohm line, and in sizes \( \frac{1}{2} \) inch in diameter or smaller it has more loss.

Since most FM antennas and receivers are designed to work in conjunction with a balanced 300-ohm line, special impedance-changing transformers called baluns (balanced-to-unbalanced transformers) should be used when connecting a balanced 300-ohm line (or antenna, or receiver) to an unbalanced 75-ohm line (or antenna, or receiver). For the protection of your equipment, your dwelling, and yourself, the antenna system including the mast should be grounded properly. However, make
the characteristic. Adjacent stages obtained in most of these amplifiers are inherently noisier than amplifiers, the first stage must provide a large signal amplification so that the amplified signal overcomes the noise generated in the mixer. Obviously the r.f. amplifier itself should generate a minimum of noise. Earlier it was stated that the i.f. gain should be high enough to allow full limiting even on weak signals. Therefore the smaller the amount of noise generated by the tuner, the smaller the signal can be before it is lost in this noise. Actually the i.f. gain should be sufficient to produce limiting on this noise.

One may well ask now, “What generates this noise?” Some of this noise is generated thermally in the effective generator resistance of the device (in this case the antenna) driving the first stage. Some of the noise may enter the antenna from extra-terrestrial sources, such as galactic, cosmic, and solar noise. Man-made electrical noise from such sources as motors, lamps, automobile ignition systems, and the like, may also be present depending upon the particular situation. In the usual case the main component of noise is generated within the amplifier, and in a well designed tuner, within the tube immediately following the antenna circuit.

In the frequency range of interest, 88-108 mc, tube noise, in triodes, consists of shot noise and induced-grid noise. In pentode and other multigrid tubes an additional component called partition noise is generated. It is for

![Fig. 2. Internal arrangement of parts for the booster amplifier.](image)

certain that the lightning arrester does not by-pass some of the FM signal to ground, thus reducing the effectiveness of the antenna system.

The Tuner

One of the requirements of the tuner is that it should have sufficient amplification to bring the desired (and usually weak) signal up to full limiting. Most of this amplification is ordinarily obtained in the intermediate frequency (i.f.) amplifiers and amplifier/limiter stages operating at 10.7 mc. The amplifier should also provide the necessary adjacent-channel rejection by virtue of its selectivity (or band-pass) characteristic. Some readers may have improved the performance of their gain-starved receivers by adding another amplifier/limiter stage.

This type of improvement can be carried only so far. Eventually a point may be reached where the over-all i.f. gain has become so great that positive feedback from the last stage back to the front end of the amplifier (over feedback paths wholly unsuspected) becomes comparable to the magnitude of the input signal. If this occurs, either the amplifier tends to oscillate on a permanent basis, or if this feedback is somewhat milder in nature, it will tend to distort the over-all band-pass characteristic of the i.f. amplifier. Methods of preventing this type of feedback include stage-to-stage shielding, adequate decoupling of those circuits common to all i.f. stages (such as heater and d.c. supply leads), or employing a second frequency converter in the i.f. system (double-conversion receiver).

Limitation Due to Tube Noise

Nevertheless, as still higher i.f. gain is realized without instability due to undesirable feedback, another limitation is eventually reached, i.e., the level of noise generated in the tubes preceding the i.f. amplifier. It is true that all the amplifier stages generate noise. However in any stage, following the first, the signal has been brought up to a level so high compared to the noise generated in that stage, that the contribution of noise from that stage is insignificant.

Most FM receivers consist of an r.f. amplifier, followed by a frequency converter or a mixer, which is followed in turn by the i.f. system. Because frequency converters and mixers are inherently noisier than amplifiers, the first stage must provide a large signal amplification so that the amplified signal overcomes the noise generated in the mixer. Obviously the r.f. amplifier itself should generate a minimum of noise. Earlier it was stated that the i.f. gain should be high enough to allow full limiting even on weak signals. Therefore the smaller the amount of noise generated by the tuner, the smaller the signal can be before it is lost in this noise. Actually the i.f. gain should be sufficient to produce limiting on this noise.
the net apparent increase in power of all stations would be four times.

The author has never measured the noise figure of a representative cross section of FM tuners. What few have been observed range from 7 to 20 db. In other words, after the user has installed a first-class antenna system he probably still has a good chance of improving his tuner sensitivity by improving its noise figure.

**Description of Preampifier**

To be described is a single-tube preampifier operating at signal frequency to be used ahead of the FM receiver. It employs the new 6922 tube in a cascode circuit. It has a measured noise figure of 3.5 db at band center, a gain of about 30 db, and has improved the sensitivity of several tuners with which it has been used. More about performance later.

Its construction is straightforward and should be no problem for the audiophile who has had some experience in building his own equipment. Use only resistors soldered and, because it is a high-frequency amplifier keep connecting leads as short as possible. The completed amplifier is shown in Fig. 1. The amplifier is built on a 4" x 5" copper plate, and this mounted on a 3" x 4" x 5" crackle-finished steel box. A self-contained power supply mounted in the box provides the necessary heater and plate voltages. It is not feasible to get this power from the FM receiver.

It is suggested that the arrangement of components shown in Fig 2 be followed. The circuit schematic is shown in Fig. 3. It will be observed that the preamplifier is designed to work from and into an impedance of 75 ohms unbalanced. If, as in the usual case, the line impedance is 300 ohms balanced, a balun must be used to provide the necessary impedance transformation. A coil balun such as the TACO Model 1570 is quite satisfactory, or one can make a coaxial line balun as described in Fig. 4. In the interest of simplicity an 1-type network, comprising $G_2$ and $L_1$ is used to couple a 75-ohm source to the input of the first tube. For minimum noise figure $G_2$ should be around 6 pf. Coil $L_2$ resonates at mid-band with the grid-to-plate capacitance of the grounded-cathode stage. $L_3$ permits

**TABLE 1**

<table>
<thead>
<tr>
<th>COIL WINDING DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_1$ 0.2 mH 5 turns No. 15 AWG copper wire 0.395 in. 1. D., with turns spaced to give a winding length of 0.4 in., and self supporting. Tune by lengthening or shortening coil.</td>
</tr>
<tr>
<td>$L_2$ 1.2 mH 13 turns No. 23 AWG enamelled copper wire, copper close wound on Millen 69043 ceramic form. Tune by Ferrite slug.</td>
</tr>
<tr>
<td>$L_3$ 0.3 mH 7 turns No. 18 AWG enamelled copper wire, close wound on 0.31-in. diameter form. Use Ohmite 1-megohm, 2-watt resistor. Untuned.</td>
</tr>
<tr>
<td>$L_4$ 0.4 mH 6 3/4 turns No. 18 AWG enamelled copper wire, close wound on Millen 69043 ceramic form. Tune by Ferrite slug.</td>
</tr>
</tbody>
</table>
Despite claims to the contrary, stereo is not perfect—yet. There are astounding differences between different records and tapes, even those from one company. This is the reason behind the Phasing, Channel Reversal, and Blend controls on many of the best stereo amplifiers. The first two, Phasing and Channel Reversal, can be dispensed with once all tapes and discs are properly standardized since both are simple right-or-wrong propositions; however, stereo blend is a matter of taste and depends on many factors.

Blend controls were originally introduced to combat the "ping-pong" or "hole-in-the-middle" effect present in many of the first stereo records and tapes due to the record companies' attempts to overemphasize the stereo effect. These were simple potentiometers bridging the two channels to permit mixing of the signals of the two channels. As such, they could destroy the stereo effect, but could not increase it. Yet many discs could obviously profit by an increase in their stereo effect. This prompted the design of the dimension control.

A glance at the diagram reveals a striking similarity to the matrixing circuits which would be used in a multiplex converter for receiving FM stereo broadcasts using the Crosby multiplex system. Basically, the left and right channel inputs are applied to $V_{1b}$ and $V_{1a}$ respectively. Since $V_{1b}$ is a split-load phase inverter, its outputs are 180 deg. out of phase. The four 100k resistors mix (matrix) the signals to provide a "sum" signal and a "difference" signal. This difference signal stands for the difference between the left and right channels and therefore contains all the stereo information. The "dimension" potentiometer acts as a level control for the difference information and therefore controls the over-all stereo effect. A voltage divider in the grid of $V_{2a}$ slightly attenuates the sum signal thus permitting a relative increase in the difference level at high settings of the dimension potentiometer.

The variable dimension control is designed to be used between the preamplifier and amplifier of a stereo system. It is essential, however, that the input levels of both channels be exactly equal: if the left and right channels are not of the same level, additional volume controls may have to be inserted to equalize the channel volumes. Likewise, all components in the circuitry associated with $V_{2a}$ should be matched within very close tolerances to assure exactly equal levels at the matrixing network.

Adjustment is very easy. Feeding a signal into the left input, adjust the dimension pot for zero output from the right speaker. If very careful matching was done in choosing the components, this should be possible. Otherwise, a very sharp null will be observed. Now check that a signal in the right input produces no sound in the left speaker, at the same control setting. Mark the position of the control. This is the neutral setting which does not change the stereo effect either way. A lower setting of the potentiometer will produce stereo suppression until, at a zero setting, a complete mixing of channels takes place. A higher setting of the control increases apparent depth and separation within reasonable limits. Needless to say, even this control can't make something out of nothing: monophonic discs will still be . . . monophonic.

---

Fig. 1. Schematic of variable stereo dimension control, affording versatile control of stereo separation both sides of normal.
Audio Oscillator Circuits, Old and New

NORMAN H. CROWHURST

A discussion of various types of audio oscillators which were explored in a search for an extremely stable unit intended for very low frequency applications.

This investigation was instigated by the need for rather-low-frequency audio oscillators for two particular applications, both of which required descending below 20 cps, down into the region of 1 cps. The requirements for both applications were similar, so an investigation was carried out into the properties of different circuits for this purpose. A sinusoidal output of variable frequency is required, preferably with push-pull balanced output. While the development work carried out in connection with this investigation was specifically directed toward an oscillator for the very-low-frequency range, there is no reason why the results should not be applied to conventional oscillators covering the more normal audio-frequency range.

The first thing obvious for the very-low-frequency range, however, is that the frequency control must be a variable resistor, or ganged variable resistors, rather than variable capacitors, because the reactance of variable capacitors in available sizes at the very low frequencies becomes prohibitive.

The first possibility investigated was that of a phase shift oscillator using the circuit of (A) in Fig. 1. It is not practical to vary more than two of the resistors as a maximum for two reasons. One is the limitation in availability of multigang resistors. The more important one is that variation of more of the resistors would drastically vary the loop gain of the arrangement due to the impedance variation of the whole circuit.

The best possibility of obtaining variable frequency proved to be using a stepped, or tapered R/C arrangement, in which the successive values of R and C are stepped up in impedance. Using this arrangement, preliminary calculations showed a change in frequency approaching the change in resistance value can be achieved. However, even with this arrangement the loop gain changes drastically with resistance setting and some means is required to maintain uniform gain so that the waveform is reasonably consistent.

An ingenious possibility in this direction utilizes a fixed component of resistance that modifies the gain in a manner inverse to the change in loop gain due to the relationship between phase shift and attenuation. This is shown at (B) in Fig. 1. Choice of circuit parameters makes the attenuation accompanying the requisite 180-deg. phase shift the same at both extremes of resistance control. This is achieved as follows:

When the attenuation is a maximum due to the resistance divider action, the attenuation accompanying the phase-shift network is made a minimum by making all of the R/C elements of identical time constant. Increasing the frequency-control-resistance value reduces the attenuation of the resistance divider and at the same time shifts the phase/attenuation relationship of the successive networks so there is greater attenuation at the 180-deg. point. The fixed portions of the resistance divider are adjusted so the attenuation is the same at 180-deg. phase shift for both extreme settings of the control.

The disadvantage is that this method allows the attenuation to be equalized at only two points. While the frequency analysis of such a network assumes that individual frequencies are transmitted around the loop, the actual behavior is one determined by the instant-to-instant changes in electrical charge in individual stages of the network. As a result, the nonlinearity of the tube characteristic can become quite exaggerated and the frequency shifted because the circuit does not behave as a frequency-analytical device but as a differentiator or integrator network according to which way the R/C combinations are arranged.

Twin-T Feedback

The next type to be considered was the twin-feedback type using a twin-T in the negative feedback and resistance elements only in the positive feedback. Use of a large forward gain enables the twin-T to apply very considerable feedback at harmonic frequencies and to give a good null at the oscillation frequency. The positive feedback is then used to maintain oscillation at this frequency (Fig. 2).
half Wien bridge type of Fig. 3. This again uses a lamp as the automatic adjustment feature but in a different configuration. Here the positive feedback uses the frequency selective elements while the negative feedback uses a lamp to control the amount of feedback. While this circuit could be made to work, it too suffers from the disadvantage that the lamp shows cyclic variation of resistance when the frequency gets much below 20 cycles. As the lamp is in the negative feedback, the intention of which is to clean up waveform, cyclic variation of resistance results in waveform distortion.

The Author’s Circuits

Some years ago the author wanted a very simple, single-tube oscillator with stable output and good waveform and developed the circuit of Fig. 4. This utilizes a pentode diode tube in which the "triode" portion of the pentode, consisting of the cathode, grid and screen grid, acts as an oscillator circuit using a tuned grid LC arrangement with small coupling from the screen. In this way the screen voltage is almost constant, having only a slight fluctuation due to the voltage drop across the few turns necessary to maintain oscillation. So the rest of the tube functions like a pentode amplifier.

Output is taken from the plate which merely uses a tuned circuit as an additional means of securing a very pure waveform. In the particular application for which this circuit was developed, further coupling was incorporated between the plate circuit and the following stage, to achieve a positive feedback arrangement that produced a virtual-infinite-impedance source.

The useful feature of this circuit for the present application was that a pentode amplifier with appreciable gain provided a large output from which to control the bias so as to maintain steady oscillation in the "triode" portion without running to clipping. This was obtained by utilizing the diode as a means of biasing, deriving the signal for the diode to rectify from the plate circuit. This circuit achieved very steady oscillation conditions and an extremely sinusoidal waveform.

To apply this to very low frequency, obviously inductors are not practical. They would have to be iron cored with a very small air gap and this would mean the inductance would be non-linear throughout the oscillatory cycle, which would result in distortion. So another arrangement utilizing an adaptation of the half Wien bridge principle was built around a twin triode. This is shown at Fig. 5.

The circuit looks deceptively simple but its operation provides quite a stable waveform and good control of both frequency and amplitude. In this case we have both positive and negative feedback as well as a means of controlling the bias of the gain tube for maintaining oscillation.

The gain and phase inverter halves of the oscillator are R/C coupled. But, because the phase inverter is of the split-load type, the effective grid input resistance is extremely high and consequently a very long time constant can be achieved in this coupling without the necessity for a very large capacitor.

Bias for the phase inverter is achieved by grid current. This means the bias will be strictly proportional to signal magnitude. Consequently, the d.c. voltages appearing at the cathode and plate of the phase inverter will vary with signal amplitude. Fortunately, the half Wien bridge which takes the feed from cathode and plate circuit of this tube back to the grid of the gain tube has a d.c. return path through the coupling from cathode.

Assuming the first half tube had infinite gain, so a hypothetical condition can be considered as a design starting point...
is that both positive and negative feedback utilize the same circuit elements and, consequently, do not impose excessive loading upon the output stage of the arrangement. The previous Wien bridge circuit, where the negative feedback was applied to the cathode of the gain stage, invariably necessitated an extremely low impedance value loading on the output stage and an inordinately large capacitor for coupling it if very low frequencies were required.

In this new arrangement each capacitor has a useful function in the operation of the circuit. The capacitor coupling from phase-inverter plate to grid of the gain stage is part of the frequency selective arrangement. The capacitor shunting from grid of the gain stage to the tap of the cathode load is also a part of the frequency-determining network. The coupling capacitor from plate of the gain stage to grid of the phase inverter serves as a bias storage element for the grid of the phase inverter, whereas through the cathode load controls the bias point of the gain stage so as to maintain oscillation at a steady level.

With these values an extremely stable oscillation can be attained at quite low level (of the order of a few volts) using whatever high voltage supply happens to be available. It is quite easily possible to increase the output from this arrangement by tapping down both cathode and plate portions for the takeoff of the frequency selective network, as shown at Fig. 6. This means the output builds up to a larger amplitude before the necessary negative bias is achieved to reduce gain to the balanced operation point.

This can be carried far enough to produce an output in the region of 50 volts, peak-to-peak, at plate and cathode of the phase inverter. The large supply voltage in the region of 250 volts. However, the effective positive and negative feedbacks are considerably reduced by this modification so that operation is somewhat more critical and slight deviation from correct values can more readily result in distortion or complete cessation of oscillation, than is the case in the circuit intended for lower output.

An important feature in designing such a circuit for variable oscillation is that the positive and negative feedback elements should not introduce appreciable loading across the phase-inverter loads, or the portions across which they are applied. This is relatively easy to achieve because fairly low resistance values can be used in the plate and cathode circuit of the phase inverter without materially interfering with the phase inversion function. It is quite possible to use a 12AX7 with cathode and plate resistors in the order of 10,000 ohms. If the frequency-selective network uses a fixed resistor of 100k ohms and a gauged variable resistor of 1 meg, it is possible to achieve 10 to 1 frequency change with negligible loading on the phase inverter to throw this out of balance. So far so good.

Transistorization

Now came the difficult question, a transistor version. For both the applications mentioned it was desirable that the possibility of transistorization be considered.

Most of the foregoing circuits can be converted to transistor operation, at least for one frequency. The difficulty encountered for transistorizing the very-low-frequency type oscillator is due to the fact that the control variable has to be a resistance rather than a capacitance. In a tube circuit the variation in impedance at oscillation frequency is taken care of quite conveniently by making the frequency-selective network of quite high value relative to the source resistance from which it feeds. The grid of the gain stage is always operated in negative region, so voltage division only has to be considered.

In a transistor circuit this does not prove to be quite so easy. The output loading of any feedback circuit is basically a current loading. This fact promoted quite considerable thought to the possibility of changing circuit parameters so as to use a current operation base instead of a voltage operation. However this is figured, the position of C's and R's seems to be difficult for the purpose of producing a variable arrangement using a change of R values to control frequency.

Using current division in place of voltage division as the basis for design, the logical thing would be to couple a collector of a stage into the tapping of a series/parallel circuit and take the output from the top end. (Fig. 7). However, this has two unsatisfactory aspects.

(1) The variable resistance in parallel at the input is used to control frequency, this will vary the collector load of the input stage, and

(2) The series capacitor at the output end is not particularly desirable since it blocks the d.c. connection to the base of the stage to which the circuit feeds and necessitates some provision for bias by other means.

![Fig. 6. A variation of the circuit of Fig. 5, to give bigger output at slight sacrifice of purity and stability.](image)

![Fig. 7. A logical transposition of the frequency-selective elements, when the design is based on current division rather than voltage division.](image)
Undoubtedly the complete dual equivalent of the tube circuit, utilizing inductors in place of capacitors, as well as the other conversions, could be derived and such a circuit might conceivably work, except for one important limitation: linear inductances for use at very low frequencies are much harder to come by than are linear capacitors.

So, nice as the idea might be to change our thinking from the conventional voltage source basis we have used with the phase inverter. This cannot be achieved conveniently by use of the phase inverter's internal characteristics, as in the case of a triode tube. The natural return point for a bias resistance from the base of a transistor is not the emitter, but some point negative (using the conventional PNP types).

The phase inverter stage was set up with a biasing arrangement incorporating a diode, shown in Fig. 9. By biasing the base so that, without signal, the phase-inverter transistor is passing a maximum current with a margin to operate as a phase inverter, and phasing the diode so that signal biases the base more positive, so as to reduce the transistor current, a satisfactory d.c. component can be obtained. Utilizing a bias point for the other side of the diode suitable for this purpose, the phase-inverter current swings quite conveniently in proportion to the signal amplitude being handled.

On thing more is necessary at this point. When this is coupled to the gain stage, the diode current introduces distortion in the form of clipping on one side of the waveform. To obviate this, the diode needs feeding from an emitter follower through a capacitor.

The other emitter follower, shown at the extreme left of Fig. 8, is needed to avoid the change in impedance due to frequency adjustment from materially affecting the loop gain. This emitter follower has the effect of transforming the impedance on both sides of it by a ratio proportional to the current gain of the stage.

Now we come to the difficult part. How to operate the gain stage with zero external emitter resistance? The first method tried was to reduce this resistance to a very low value, by using a potentiometer biasing on the emitter, similar to that shown in Fig. 5 for the tube version. Values down to 8 ohms be-

(Continued on page 58)
Radio Interference in Audio Equipment

JOHN C. RICE

The author describes some sources and effects of radio-frequency disturbance in audio circuitry and suggests methods by which these effects may be eliminated or reduced.

Upon the recent addition of a new preamplifier and low-level magnetic cartridge to a stereo system, an annoying buzz was noticed. In this particular case, the cause was traced to radio-frequency interference from a nearby television station. These experiences and hints are intended for those who are troubled by radio-frequency disturbance in their music systems.

Sources of Interference

To understand the following it is necessary to realize that interference is introduced to the amplifier or other audio equipment as an r.f. signal. In the equipment the signal is demodulated into an audio-frequency noise.

The first two obvious sources are that of radio and television. Interference of this type is found in strong-signal areas, usually in cities or around transmitting towers. Broadcast stations (and local amateurs) can be recognized by their program content, although sometimes more than one station will be heard simultaneously. In cases of TV interference, the amplitude-modulated TV picture transmission is heard, after demodulation, as buzz. The cable placement in the audio equipment is critical and a person's position near the equipment may have an effect on the buzz. In fact the input cable behaves in much the same manner as a pair of TV rabbit ears in its placement.

A second source of interference is spurious radiation. Generators of this noise would be electrical equipment, motors, switches, (including the phonograph switch), and neon and fluorescent lamps. Fluorescent lamps are radiators of r.f. which carries a modulation of hum or buzz at the power frequency. Additional generators of this type would be ignition systems, including oil burners.

The origin of still other problems lies in external electronic equipment. For instance random oscillation of one stage in a neighbors TV or radio set may have surprising effects. His set may radiate a tone or perhaps an electrical noise present in his area. His equipment may even receive, detect, and retransmit the entire program content at another frequency.

Injection of Interference

To become an audio disturbance, the r.f. signal must get into the equipment and be detected. Signal introduction can occur in a number of ways. One path is through the shielded low-level input lead, which acts as a VHF antenna. If this is the case, the signal level at the first tube must reach a voltage greater than the bias grid rectification (and subsequent detection) to occur.

After detection the noise will appear at every following stage.

However, interference need not be introduced at the first stage. Other leads may introduce a signal to a later stage. An unshielded tube may receive the radiated noise directly; or perhaps the filament line itself may carry the signal. If the signal is injected at a stage other than the first it will generally have to be at a very high level to begin with.

First, because bias on successive stages is higher, and second, because the lower amplification it will receive in the fewer remaining stages will reduce its apparent level.

Elimination of Interference

To remedy the annoyance, the troublesome amplifier stage must first be located. This can be done by simply starting at the output and removing tubes until the interference stops. The r.f. signal, once located, is then removed with shielding or a filter of some sort.

An r.f. signal present on the grid of a tube may be removed by an r.f. choke or a resistor (Fig. 1) which, in combination with wiring and input capacitance of the tube, forms a low-pass filter for the removal of the r.f. The value of the added component is chosen to provide, with the capacitance of the tube, the necessary filter action for the frequency you desire to attenuate. An additional small-value capacitor could be connected between the grid and ground to provide a lower filter cutoff frequency. There is usually no harm in the addition of a resistor, because whatever grid current there is flowing is exceedingly small. However the series combination of filter and grid resistor should not exceed the manufacturer's maximum specified grid resistance. A small value r.f. choke in place of the resistor might result in an oscillation which, although inaudible, could cause distortion at that amplifier stage. Caution should be used when adding components to avoid affecting audio response.

Filament radiation may be corrected by the addition of r.f. chokes and/or capacitors to the filament line in the manner of Fig. 2. Most r.f. interference on the power line will not pass a good electrostatically shielded power transformer. However under-chassis lead capacitance may effectively bypass the shielding. In these cases a power line interference filter could reduce the noise problems considerably.

If the annoyance is caused by television synchronization buzz coming in

Fig. 1. Location of grid filter in first stage of preamplifier.

Fig. 2. Method of adding r.f. filtering to filament circuits.

(Continued on page 64)
Loudspeaker Distortion Due to the Doppler Effect

VIRGINIA RETTINGER

Why does a two- or three-way loudspeaker system usually sound better than a single-unit radiator? The authoress shows how the action of a loudspeaker cone carrying two frequencies simultaneously results in a form of distortion.

The action of a loudspeaker cone is sometimes likened to that of a flat, weightless circular piston vibrating in an infinite baffle, or to that of a pulsating sphere whose radius periodically increases and decreases, or to that of an oscillating sphere whose radius remains constant while the sphere moves forward and backward. None of these concepts coincides accurately with existing conditions as far as the movement of the paper cone of a direct-radiator loudspeaker is concerned. Hence, while the following concept of a vibrating piston in an infinite baffle will be employed, it must be understood that there are limitations to the applied theory, and that calculations may or may not coincide precisely with corresponding physical measurements.

Under the excitation of a low-frequency electrical current, a woofer cone moves, more or less, as a unit. Under the excitation of a high-frequency current, however, it is generally the central portions of the diaphragm which vibrate most intensely. But what happens when a low- and a high-frequency signal are simultaneously actuating the speaker? The answer is that the high-frequency radiator (central part of cone) is moving back and forth in space at the rate determined by the low-frequency signal. This phenomenon, considered a form of distortion, has been termed frequency-modulation distortion, and was first examined by G. L. Beers and H. Belar.

This type of distortion is directly proportional to the excursion required by the speaker cone to execute its low-frequency travel for a given power input, and to the modulated, or high, frequency. Mathematically this relationship is given by

\[ D \cdot F_s = .033 \cdot df_v \]

where

\[ D \cdot F_s = \text{distortion factor} \]
\[ d = \text{amplitude of cone motion (each side of mean position) in inches} \]

At the modulating, or low, frequency,

\[ f_v = \text{modulated, or high, frequency} \]

The derivation of the equation, given in the noted reference, is rather long and complicated, and cannot be repeated here. Suffice to say that it is based on the concept of the Doppler effect and the well known analysis of frequency modulation. A frequency-modulated wave can be considered to consist of a carrier and an infinite number of side-bands. The carrier has a constant amplitude, and the side-bands are located symmetrically about the carrier and are spaced at intervals equal to the modulating frequency. Depending on the degree of modulation, however, the amplitude of the carrier is less than that of the original wave. The distortion factor is defined as the ratio of the square root of the side-band power to the square root of the total power.

The Doppler effect is also well known, and is characterized by a change in sound pitch due to the relative motion of the source and observer. When a sound generator and a listener are approaching each other, as in the case of a train coming towards one, the noted pitch is higher than the actual frequency of the source. Similarly, when a generator and observer separate, the observed pitch becomes lower.

Mathematically the Doppler effect may be expressed by

\[ f = \frac{v - v_o}{v} \cdot f_s \]

where

\[ v = \text{velocity of sound in medium} \]
\[ v_o = \text{velocity of observer (assumed to be zero for this case)} \]
\[ K = \text{constant} \]
\[ f_s = \text{frequency of source, or modulating frequency} \]
\[ f_v = \text{modulated frequency} \]
\[ f = \text{observed frequency} \]

Substituting these values in the above equation, we obtain

\[ f = \frac{v - v_o}{v} \cdot f_s \]

The relationship for the amplitude of a vibrating piston in an infinite baffle is given by

\[ d = \frac{1.185 \times 10^5 \cdot \sqrt{W}}{f^2 D^2} \text{ (inches)} \]

where

\[ D = \text{piston diameter, inches} \]
\[ W = \text{acoustic power, watts} \]
\[ f = \text{frequency} \]

Figure 1 shows the relationship graphically, for one acoustic watt output on part of the piston.

To appreciate what large cone deflections are involved in the case of the really low frequencies, consider a 16-in. diameter piston radiating 0.25 watts of acous-
A car doesn’t have to have 200 or 300 horsepower to function adequately. Witness the popularity of small low-powered imported cars. In much the same way, an amplifier will still provide ample volume for home systems even though it may produce less power than most amplifiers now on the market. From PIONEER of Japan comes the STEREOMASTER, a stereo amplifier with an output of 15 watts. It incorporates on a single compact chassis a sensitive FM-AM-short wave/medium wave and stereo preamplifier and power amplifier, thus providing unequalled versatility and simplicity in assembling a stereo system for the home.

OUTSTANDING FEATURES:
- Low distortion, low noise and unexcelled high sensitivity tuned circuit
- Provides tape playback directly from tape playback head
- More than enough power for home applications
- May be used as channel amplifiers for HI-LO two-channel system

SPECIFICATIONS
- Range: AM 535 to 1,605 kilocycles
- FM 80 to 108 megacycles
- Rated Power: 15 watts (7.5 watts X 2)
- Frequency Response: within 0.5 db from 20 to 20,000 cps
- Crossover Frequency: 3,500 cps (6db per octave attenuation)
The Magic Eye Tube

While there are several versions of the magic eye tube, the most common type employed in tape recorders is that represented in Fig. 2. With no signal applied to the tube (grid), a green fluorescence glow suffuses about three quarters of the face of the tube, as at (A). The remaining quarter is in shadow; in other words, the eye is open. As audio signal is applied to the tube, the shadow narrows, as indicated at (B). If sufficient signal is applied, the eye closes completely, as at (C), or even overlaps.

The problem—of the manufacturer or service technician—is to correlate the amount of signal fed to the magic eye tube with the amount of signal impressed on the tape so that when the eye barely closes this corresponds to maximum permissible recording level. On home recorders, the maximum level is usually between 3 and 5 per cent harmonic distortion, corresponding roughly to 30 per cent or more of intermodulation distortion. This is a tremendous amount of 1M distortion, but occurs only—or is supposed to occur only—on peaks. At normal levels, which are typically 10 to 20 db below peaks on audio material, intermodulation distortion will drop to levels consistent with fidelity standards.

Figure 3 shows how the magic eye indicator is tied in with the signal going to the record head and hence onto the tape. At a suitable point in the record amplifier, the audio signal is tapped off and fed to the magic eye tube. This signal goes through a voltage divider, which supplies the proper proportion of the signal required to drive the indicator. This proportion is experimentally determined by the manufacturer of the tape machine. It is more the exception than the rule to find a variable voltage divider in home machines so that one can adjust the amount of signal fed to the record-level indicator. However, a few home machines do contain a control—usually accessible internally—which permits the service technician or any other person equipped with the necessary instruments and knowledge to adjust the signal going to the magic eye tube so that its indication will correspond with maximum permissible distortion on the tape.

Assuming that the magic eye tube is properly calibrated, optimum results are obtained if the operator allows the eye to close just barely on audio peaks. If the eye overlaps once in a great while, there is probably no significant harm. But if the eye completely closes or overlaps many times a minute, then the recorded signal is apt to take on the roughness and mushiness symptomatic of excessive distortion. On the other hand, if the eye seldom or never quite closes, the chances are that the recording level is too low, which means an unnecessary sacrifice in signal-to-noise ratio; and there is none of this to spare in any machine, much less one of the home type.

To some extent, the permissible recording level will vary with the nature of the program material. Ordinarily, more distortion is tolerable on speech than on music. And on certain kinds of music a given amount of distortion is less offensive than on others. This is where experience and skill in recording enter into the picture.

As mentioned before, a prime advantage of the electronic indicator is that it responds instantaneously to transients (usually responsible for the peak audio levels), so that one obtains a correct indication of how much signal is going onto the tape. On the other hand this immediate response is not only an advantage but can also be a source of difficulty. When the transients are strong and frequent, the magic eye will fluctuate so rapidly that the operator finds it difficult to discern its meaning and to set recording level properly. The extent of this difficulty, depends of course upon the nature of the program material being recorded. A fiery composition is apt to offer much more of a problem than quiet, relaxed music.

To minimize the problem, a number of tape recorders, as indicated in Fig. 4, incorporate a “floating action” circuit which maintains the eye for a brief period at the maximum degree of closure. This circuit may be described as a “one way street.” It permits the eye to respond (to close) very quickly when a transient comes along. But it does not permit the eye to open with the same degree of rapidity. Thus the high reading is maintained for a short while. A typical floating action circuit may allow the eye to close in about one-thousandth of a second, but may not allow it to open for about one-twentieth of a second. Although one-twentieth of a second may seem extremely brief, yet it is long enough to increase substantially the fidelity with which the magic eye can be read. If the persistence time were increased greatly, it would become difficult to judge the frequency of transients and make a corresponding adjustment of recording level, bearing in mind that this adjustment depends not only upon how great the signal peaks are but also how

(Continued on page 35)
from McIntosh...

PERFECTION in Stereo Control

Simplicity, flexibility, and beauty have been integrated by careful engineering and design in the McIntosh C-20 Stereo Compensator. The greatest listening pleasure in stereo or monophonic reproduction is assured as a result of over a year of careful and diligent research in the requirements of a new preamplifier designed for stereo. Full stereo flexibility has been provided plus built in protection for your investment in monophonic records. McIntosh has designed in the C-20 Stereo Compensator the necessary features required to give the finest monophonic reproduction the keenest listener may require.

Complete satisfaction is yours in monophonic and stereophonic with the McIntosh C-20 Stereo Compensator.
FACILITIES

Mode Selector: 6 positions including Stereo, Stereo Reverse. Left channel on left speaker only, Right channel on right speaker only. Left channel on both speakers, and Right channel on both speakers.

Monophonic: Internally parallels and decouples a stereo phono cartridge to offer best quality reproduction from monophonic records.

Tone Controls: Treble: boost 13 db at 20,000 cycles attenuate 18 db at 20,000 cycles
Bass: boost 16 db at 20 cycles attenuate 20 db at 20 cycles

Trim Controls: Separate channel back panel controls to balance the frequency response of the system independent of front panel controls.

Equalization: Separate bass and treble 6 position switches, including NAB tape and flat for mike or any other low level flat source.

Aural Compensator: Fletcher-Munsen compensation, continuously variable.

Rumble Filter: Rolloff to reject low frequency disturbances such as rumble.

High Frequency Cutoff: Two positions, 9 KC and 5 KC to suppress high frequency hiss and noise.

Phase: 180° phase reversal to compensate for out of phase speakers or source material.

Balance: Attenuates alternate sides of center +0 db each channel to balance for unequal source material.

Tape: Front panel jacks, push button switch controlled, to permit the addition of a portable tape recorder without disrupting the equipment permanently installed.

Tape Monitor: To permit instantaneous monitoring of tape before and after recording.

SPECIFICATIONS

Power Requirements: 117 VAC; 35 watts

Input Sensitivity and Impedance: Auxiliary, Tape, and 2 Tuner 0.25 V at 470 K
2 Phono, Low: 2.5 MV at 47 K
High: 12.5 MV at 47 K
XTal: 0.1 V, very high
2 Tape Head, Low: 1.25 MV at 47 K
High: 6.25 MV at 270 K
Tape Monitor: 0.25 V at 130 K

Frequency Response: ±0.5 db 20 to 20,000 cycles

Distortion: Less than 0.2% at rated output, 20 to 20,000 cycles

Hum and Noise: High level inputs: 85 db below rated output
Low level inputs: less than 2 microvolts at input terminals (-115 dbm)

Outputs: Main: 2.5 V with rated input
Tape: 0.25 V with rated input

Gain: Low level inputs: 1000-1 Main Output
Low level inputs: 100-1 Tape Output
High level inputs: 10-1 Main Output
High level inputs: 1-1 Tape Output

A.C. Aux. Outlets: 1 unswitched for tape machine or turntable and 3 switched

Size: Chassis: 14½ inches wide; 4½ inches high; 12 inches deep
Front panel: 14¾ inches wide; 4¼ inches high

Weight: 17 pounds
The Neon Lamp

Least expensive of all record-level indicators is the neon lamp. This is an on-off, device, with no intermediate indication. It produces an indication only when the recording level is at or above a certain point. If the recording level is too low (with signal-to-noise ratio unnecessarily reduced), the lamp does not indicate how much too low. Even the magic eye tube, with its varying shadow, provides some indication of the extent to which the recording level is below normal. If the recording level is too high, the neon lamp fails to indicate by how much. The magic eye tube provides a little information in this respect, as indicated by eye overlap. The only indication of over-recording in the ease of the neon lamp is how frequently it ignites.

The greatest flaw is the failure to provide an indication when recording level is too low. However, this is corrected in some machines by using two neon lamps, as in Fig. 5. One, called the "distort" lamp (or similar term), ignites at the maximum permissible recording level. The other, called the "normal" lamp (or similar term), ignites at a lower level—usually about 6 to 10 db below the acceptable distortion point. The objective for the operator is to try to adjust the recording level so that the normal lamp is ignited most of the time but the distort lamp is ignited as seldom as possible. Again, the nature of the program material must affect the operator's decision concerning recording level.

The neon lamp has inherent floating action. That is, the signal required to fire the lamp is appreciably greater than the voltage at which the lamp goes out. Accordingly, the glow produced by a transient lasts longer than the transient.

The VU Meter

The VU meter—or a similar type of meter—is most commonly found in semi-professional and professional tape recorders, although on occasion it also appears in the so-called home machine. As a matter of fact, there has been an increasing trend toward use of meters in home-grade machines, and some familiarity with the operation and characteristics of meters as record-level indicators is therefore all the more likely to be useful to the home recordist.

Characteristics of the VU Meter

VU means volume units. These units are simply decibels. The zero point on the scale (see Fig. 6) is an arbitrary reference level; when the VU meter is connected in the standard manner—with a 9600-ohm series resistor across a 600-ohm line (see Fig. 7)—a 0 reading denotes 1.23 volts of signal at the source (or 2.5 milliwatts of power in the line). All other readings on the VU scale are simply in terms of decibels above or below the 0 reference level. For recording purposes, the reference level is significant only in relative terms, denoting that maximum permissible recording level has been reached, after which point tape distortion becomes excessive. The absolute meaning of the reference level—1.23 volts—is of no consequences for recording purposes.

As may be seen in Fig. 6, the VU meter also contains a 0 to 100 (per cent of maximum permissible voltage) scale, which some users may find more convenient for recording purposes. In fact, in some VU meters the positions of the two scales are reversed, as shown in Fig. 8.

The VU meter has been designed not only to have a certain sensitivity but, much more important, to have certain characteristics that facilitate the operator's understanding of the nature of the audio signal. For one thing, the standard VU meter must have a frequency response within ±0.2 db between

![Fig. 6. The VU meter, Type A scale.](image)

![Fig. 5. Use of two neon lamps as record-level indicators.](image)

![Fig. 7. Standard method of connecting a VU meter.](image)

![Fig. 8. Type B VU meter scale, which features units showing percentage of maximum permissible voltage.](image)
Fig. 9. Use of the VU meter to measure bias current and playback level, in addition to normal use in measuring recording level.

reduction quite closely. With an electronic indicator, however, he could not be sure whether the reduction is of the correct amount.

2. The VU meter, if made by a reputable manufacturer, is a standard and relatively accurate product, so that one meter provides essentially the same indications as another. If the meter must be replaced (much more likely due to accident than normal usage), the new one will provide very nearly the same indications as its predecessor. This is not nearly as true of electronic indicators, where the tolerances are such that significantly different readings may be obtained between two magic eye tubes or two neon lamps for the same signal. Thus one neon lamp may fire at a voltage 3 db higher or lower than another neon lamp of the same kind.

3. The characteristics of the VU meter remain stable with use and the passage of time.

4. If one insists upon top quality recording in terms of low distortion and wide frequency response, accompanied by high signal-to-noise ratio, and if at the same time one wishes to record at speeds below 15 ips, the value of bias current supplied to the record head is quite critical. It is very important then to adjust bias current to the correct value as indicated by the tape recorder manufacturer or as determined by the recordist equipped with the instruments for checking frequency response and distortion. Assuming that the correct bias current is known, it is highly desirable to be able to check quickly and easily whether the actual value corresponds to the desired value. In many high-quality machines containing a meter, a switching arrangement is incorporated that permits one to use the meter to measure bias, as illustrated in Fig. 9. The machine will also have a control (usually on the rear panel or internal) that permits bias current to be adjusted if its value proves to be incorrect. (However, enough warmup time—15 minutes or more—should be allowed for bias current to stabilize.)

The electron-ray tube and the neon lamp are not sufficiently accurate in their characteristics to enable them to be used for measuring bias current with the necessary precision. If bias current is too great, high-frequency response will suffer, although distortion usually will decrease at the same time. If bias current is too low, there will be considerably better high-frequency response, but at the expense of more distortion. Thus the correct value of bias represents a fairly critical compromise point.

5. In some instances, as in a recording or broadcast studio or in other instances where professional equipment is employed, it is necessary to know the level of the tape playback signal to be sure that the following equipment is being neither overloaded nor supplied too little signal for proper operation. Therefore in semi-professional and professional tape machines it is the practice to have a switching arrangement that enables the meter to measure the playback level, also shown in Fig. 9.

On the other side of the coin, there are also disadvantages to the use of a meter as a record-level indicator. One is that the meter is relatively expensive compared with electronic indicators. Another is that the meter requires special circuitry to drive it properly and to isolate it from the recording signal (a low impedance source is required), which further raises the cost. A third, as already mentioned is that the meter does not follow transients but lags behind them; this important problem is discussed at greater length in the next section.

Calibration of the VU Meter

Due to mechanical inertia, the meter pointer cannot follow very sudden and strong impulses. Thus one may obtain a meter indication as much as 10 db, and on some occasions as much as 20 db, below the true signal level, as illustrated in Fig. 10. Therefore in calibrating the VU meter so that its indication corresponds to maximum permissible recording level, a different procedure may be in order than for electronic indicators. In the case of the meter, it is desirable to make an allowance for the difference between the pointer indication and the actual level.

Accordingly, a number of manufacturers of tape recorders adjust the calibration so that the meter will read 0 VU when a sine wave (usually 400 cycles) is being recorded at a level substantially less than that which causes maximum permissible distortion on the tape. The safety margin is usually between 6 db and 10 db, depending upon the tape recorder in question. In other words, the meter is set ahead, so that on a steady signal it indicates distortion “too soon.” But on program material, where the meter fails to keep up with transients, the amount by which the meter is set ahead more or less compensates for the amount that it lags behind.

It is not absolutely necessary that the meter be set ahead in the manner described. In fact, some tape recorders fail to do so at all. It then becomes necessary for the recordist to make full allowance for the lagging nature of the meter. This means that he should not allow the pointer to exceed approximately the –10 VU mark. However, this crowds the operating range of the meter into a relatively small part of the scale.

It should be clear from the above discussion that if one acquires a tape recorder with a meter type of indicator, it is important to keep in mind that if the meter is set ahead and by how much. To illustrate the point, a recent review of a tape machine employing a meter emphasized that clean recordings could be obtained with this unit only if the pointer were kept below the –10 VU mark.

Whether or not the meter is set ahead, the adjustment of recording level is far from a mechanical operation. Instead, experience and judgment must be brought to bear. The relationship between average levels, as indicated by the meter, and peak levels, which the meter cannot follow, will change in accordance with the material being recorded. As previously indicated, peaks may be as much as 20 db higher than the program average. Or they may be only 6 db higher. Thus in some cases the recordist may allow the VU meter to hit 0 VU or even higher without incurring audible distortion. For other program material, he may find it necessary to hold the pointer well below 0 VU in order to keep distortion inaudible.

Other Meters

Not all meters found in tape recorders are VU meters. In some instances, particularly machines of the home variety, the manufacturer has incorporated an inexpensive meter that simulates professional appearance without professional performance. Its main virtue is that it wiggles. The writer has

Fig. 10. Difference between actual signal level and VU meter indication.
The world's most sensitive
FM TUNER
is now the
FISHER FM-100

New! And designed for a long future!

FISHER DOES IT AGAIN! Year after year, tuner after tuner, there is only one best—THE FISHER. Today, the leader is the FM-100, latest in a series of FISHER FM tuners now used by radio stations, the Satellite Tracking Project of Ohio State University and by many government agencies. The reason is simple—these tuners meet the exacting standards of performance and reliability required by professional users.

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AUDIO • JULY, 1959

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

LIVE vs. RECORDED CONCERT at CARNEGIE RECITAL HALL

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

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

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

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

The formal concert, during one of the “live” portions
from the audio signal by an extra tube stage, usually a cathode follower, as shown in Fig. 11.

**Recording on the Basis of Playback Level**

In some tape recorders, either through the operator's choice or through the design of the machine, the recording level is determined on the basis of the signal coming off the tape rather than on the basis of the signal going to the record head. As illustrated in Fig. 12, the VU meter is connected to the playback amplifier, a suitable proportion of the playback signal, obtained through a voltage divider, is fed to the meter so that the latter gives the proper reading. At the same time, the gain control of the playback amplifier is placed in a predetermined position so that the meter reading may correctly indicate recording level.

Through the above technique, one is judging recording level on the basis of the signal that actually gets onto the tape. When using different brands of tape or different lots of the same brand, there may be differences of a few dB in tape efficiency; that is, for the same signal presented to the tape there may be different amounts of signal recorded on the tape. But the amount of distortion tends to vary with the signal recorded on the tape. Therefore it may be more desirable to set recording level in terms of the amount of signal on the tape rather than in terms of the signal presented to the tape. Furthermore, in a recording or broadcast studio there may be operational advantages in leaving the meter always connected to the playback amplifier (except when checking bias current).

On the other hand, there is at least one disadvantage to the above procedure. The level of the program material cannot be checked unless the tape is in motion and being recorded; otherwise there is no playback signal. Many recordists, however, will wish to evaluate first the level of the program material, adjust the recording gain control accordingly, and then put the tape into motion.

---

**High Fidelity**

"The [listeners] up front were able to discern an occasional difference during transitions from live to recorded sound, while the deception was essentially complete for the man farther back . . . But during the pizzicato movement from the Bartók . . . source location seemed to make no difference; the recording fooled just about everyone."

---

**Bergen Evening Record**

"Only by observing the musicians was it possible to detect the switch . . . The reproduced sound was so like the original it was difficult to believe."

The ultimate test of sound reproducing equipment, we believe, is its ability to stand up under an "A-B" test in which "A" is the real thing. The influence of dramatic but unnatural coloration is automatically eliminated, and faithfulness to the original sound becomes the sole standard.

The speaker systems and amplifiers used in this concert were designed for the highest quality possible, limited only by the present state of the art. Descriptive literature is available for the asking from:

- **DYNACO, INC.**
  - Mark III amplifier kit $79.95
  - 617 41st St. Preamp kit $34.95
  - Phila., Pa. Stereo Control kit $12.95

- **ACOUSTIC RESEARCH, INC.**
  - AR-3 AR-3 speaker $196.00
  - Cambridge 41, Mass.
EQUIPMENT

PROFILE

AMPEx 960 TAPE RECORDER AND ASSOCIATED EQUIPMENT

By virtue of appearance, size, and simplicity of operation, the Ampex 960 is in the "home tape recorder" class. In performance it is professional. It is a highly versatile stereo machine capable of meeting almost any desired mode of operation. It operates at either 7.5 ips or 3.75 ips. It can operate monophonically or stereophonically. It can play either two-track or four-track stereo tapes. It has separate record and playback heads, desirable not only for monitoring purposes to ascertain whether the recording is a faithful imitation of the original signal, but also desirable to achieve various special effects that will be discussed later. It permits mixing of low-level and high-level signals that are being recorded. And so forth. About the only thing of consequence that it cannot do is to record four-track stereo tapes.

As a complete stereo machine the 960 contains four separate amplifiers, two for recording the left and right channels and two for playing the left and right channels. These amplifiers can be used in various combinations, depending upon the positions of a recording selector switch and a playback selector switch. For recording, there are altogether four gain controls. Two are for high-level input signals, one being for the left channel and the other for the right channel. These controls are coaxially mounted, and while they may be operated individually, they may also be operated as a single gauged control because there is sufficient friction between the shafts so that turning one will turn the other. Similarly, there are two coaxial gain controls for left and right microphonic inputs. And there are two coaxial gain controls for playback, one for the left channel and the other for the right channel.

The playback selector switch has four positions: OFF (entire machine shut off), MONITOR, SINGLE, STEREO. In the off position the incoming signal from a high-level source is routed to the output jack; this is true for each channel. Frequently a tape recorder is connected to a control amplifier so that the recorder interrupts the path of signals going through the amplifier; instead, these signals are routed to the tape machine for recording purposes. At the same time, the only signal that can go through the control amplifier is that which comes from the output jack of the tape machine. Accordingly, in the off position the Ampex 960 provides for continuation of the signal path.

Exactly the same thing happens in the monitor position of the playback selector switch; also, the 960 is turned on in this and subsequent positions of the switch. By alternation between one of the subsequent playback positions and the monitor position, one can compare the quality of the playback signal, as heard through one's audio system or through headphones, with the original signal that is being recorded. The next position of the playback selector switch, called stereo, is installed for monophonically playback. This routes the signal from the left channel into both output jacks, so that one may hear the sound on both speakers. The last position, MONITOR, routes the playback signal from the left channel to the left output jack, and the right channel to the right output jack.

The recording selector switch has three positions, two for stereo and one for mono. There are two stereo positions, marked R and D. In either position the machine is recording, provided one has pushed down the record button when turning the play-record knob to set the transport in motion. With the switch set to R, the record level meter reads the signal fed to the right channel; with the switch set to L, the record level meter reads the signal fed to the left channel.

When the switch is set to single (mono), recording takes place only on the left channel. This prevents smearing of materials on the right channel.

The three heads—erase, record, and playback—are of the stacked two-track stereo type. However, for playing four-track stereo tapes, the playback head can be moved up slightly so that the two gaps will correspond to the tracks on a four-track tape. The head is moved by a small lever protruding from behind the head housing.

The record-level indicator is of the meter type. It is not a VU meter (although its action is similar) but is driven by a vacuum tube amplifier and rectifier. The dial is divided into two sections. About two-thirds of the area to the left is labeled normal, while the remainder is labeled high. The normal and high recording level so that at maximum excursions the pointer hits the limit of the normal area but does not exceed it; of course this is very somewhat in keeping with the recommended type of material being recorded. When the machine is set to record, the meter is illuminated. This not only facilitates reading the meter but, more important, serves as a warning that the tape is being recorded and thereby guards against accidental erasure of a tape.

Like most professional machines, the 960 does not employ pressure pads to maintain close contact between the tape and the heads but depends upon the guide path and tape tension to maintain such contact. Avoidance of pressure pads helps minimize wow and flutter, weight frequency flutter, which is more objectionable and a greater deterrent to clean recording than wow, and frequency flutter which is produced by the tape around a spring arm, which, when suddenly released as the result of the tape running out, stops the reels.

The recorder has internal adjustments for bias level, for varying the record-level indication, and for minimizing noise due to the bias frequency (by balancing the two halves of the dual-triode oscillator). These are all important adjustments which may be necessary when replacing the oscillator tube, the tube that drives the record-level meter, or the record head. The bias and record-level adjustments may also prove useful if one employs a tape with substantially different characteristics than the tapes commonly used, for example a high-output tape.

Equalization, contrary to the practice of many professional machines, is fixed. On the other hand, 5 per cent components are used in both the record and playback equalization networks to assure close conformity with the required curves.

In recording, the 960 produces about 1 per cent harmonic distortion at 4000 cps when the meter pointer is at maximum normal position. At a level about 6 db below, well into the high audio range, about 3 per cent harmonic distortion is generated, which nowadays is generally considered the maximum permissible recording level. (Most professional machines lose 10 percent as the allowable maximum; on the other hand, many home machines, including

Fig. 1. The Ampex 960, shown with the Ampex Stereo-Gra[h, described in the text.
New Bogen stereo receiver is years ahead in price and in performance

NO ONE BUT BOGEN, builder of over one million high-fidelity and sound-distribution components, could have engineered this new high-fidelity stereo receiver, the SRB 20. A superb all-in-one stereo instrument, it's a highly sensitive FM-AM stereo tuner, it's a versatile stereo audio control center, it's a magnificent 20 watt (10 per channel) stereo amplifier, and it's yours for only $199.50—a price you'd expect to pay for a comparable tuner alone!

BOGEN'S ENGINEERING STAFF, largest of any sound-equipment maker, designed each circuit stage of the SRB 20 as an individual unit. By concentrating on each stage separately, they can pack more value, more clean performance in less space than is otherwise possible. The separate stages are then carefully, logically arranged in an overall circuit of proven superiority. This new Bogen concept eliminates wiring clutter, prevents hum and distortion, provides savings which are passed on to you.

Bogen's engineering excellence, crystallized during 25 years of building specialized sound systems for schools, theatres, industrial plants and offices, is yours to enjoy in the new SRB 20. Put it in a cabinet or on your bookshelf (it fits easily). Ask your Bogen dealer to show it to you today.

CONTROLS: Selector, FM Tuning. AM Tuning. Separate Bass and Treble for each channel (lock for simultaneous control of both). Volume for each channel (correct imbalance, then lock for simultaneous control). Separate On-Off Power. FM On-Off and AFC. AM On-Off. Multiplex.

Send for illustrated booklet, "Understanding High Fidelity." 64-page explanation of hi-fi and stereo. Enclose 25c please.

BOGEN-PRESTO CO., Dept. A79, P. O. Box 500, Paramus, N. J. A division of the Siegler Corporation
several of very high quality, treat 5 per cent as the allowable maximum. Accordingly, the meter provides some 6 db margin, based on a 3 per cent distortion level, for the fact that the pointer lags behind transients. In other words, the pointer shows maximum permissible level when a steady-state signal is actually 6 db below that level. This is a reasonable margin of safety to prevent over recording due to the inability of the meter to keep up with the signal.

Based on a 400-eps signal recorded at a level producing 3 per cent harmonic distortion, this observer measured a signal to noise ratio of 57 db in playback at 7.5 ips. Needless to say, this is remarkably good. The user will not have to worry about noise and hum marred his enjoyment, as so often the case with home tape recorders. Even at very loud playback levels, and during quiet passages, noise and hum from the 960 are nonintrusive; tape hiss is the dominating noise.

Frequency response was measured both by ear and instrument. The car is a better test. A high-quality mono phonograph record was simultaneously recorded and played back at 7.5 ips on the left (mono) channel. Monitoring the original signal against the tape playback signal, the writer could perceive only extremely slight differences from time to time, and was led to believe there was a noticeable difference he could not be sure whether he was listening directly to the record or to the tape playback, except for the latter's position of the playback selector switch. With someone else operating this switch, he was left in a quandary. In sum, the recording was close to a perfect facsimile of the original.

However, when recording on the right channel, there was a slight veiling of the high end. An instrument check revealed that frequency response was down 2 db at 10,000 eps and 12 db at 15,000 eps on the right channel at 7.5 ips, whereas response was but 2.5 db down at 15,000 eps on the left channel. The latter is very close to the Ampex specifications of 2 db down at 15,000 eps. When operating at 3.75 ips on the left channel, there was a similar slight veiling of the sound. Nonetheless, the quality of reproduction could still be considered very good by all except highly critical ears. When recording and playing back at 3.75 ips on the right channel, the veiling effect became more definite. At 3.75 ips, response at 10,000 eps measured only 2 db down on the left channel and 9 db down on the right channel.

It is possible that the discrepancy between the left and right channels with respect to high frequency response in the unit tested by the writer lies in the azimuth alignment of the lower and upper gaps with respect to each other in either the record or the playback head. Accurate azimuth alignment of the gaps relative to each other is very difficult to achieve, and it is to be expected that an occasional head will fail to measure up to the desired accuracy.

Sensitivity of the 960 appears to be quite adequate for microphones. However, it appears marginal for high level inputs such as 0.3 volt is required at 400 eps to enable one to record at a level suitably high to produce 3 per cent harmonic distortion. Playing a record with an ESL C-60 cartridge through a Dynakit control amplifier and feeding the 960 from the tape output jack of the Dynakit, the writer found it necessary to turn the high-level gain control of the 960 almost full on to obtain adequate recording level. It seems possible that on low-level records or weak radio or TV signals one might not be able to record to a satisfactorily high level.

Motion of the transport mechanism is very good, as checked by ear on steady signals and as observed on an oscilloscope. Speed is quite consistent for a machine not using a hysteresis motor. The writer measured speed as being about 4 seconds fast as a minute at 3.75 ips and slightly slow as a minute at 7.5 ips. This is almost 1/2 of 1 per cent error in which extremely few of us can detect.

On the whole the 960 handles well in terms of transporting the tape at operating speed and in terms of rapid wind and rewind. The writer found it virtually impossible to break the tape by changing quickly from one mode of operation to another, even when the motor is shut off during rapid wind or rewind, a difficult test to pass. However, he did find one mechanical difficulty of serious proportions, which may or may not be an aberration unique to the unit that was tested. If the machine were put into fast wind position, the stop button pushed, and—before the needle had come to a halt—the play-record knob actuated to move the tape at normal speed, this would cause a rubber belt in the drive mechanism to jam. The belt is the one that drives an idler wheel which in turn drives the takeup reel. When the takeup reel moves faster than the idler wheel and the two are brought together (by the play-record knob), this causes the belt to throw a loop to the right side, jamming the idler and the support for the record level meter. Extricating the belt is simple, but first one must remove the top plate, which requires several minutes and is a nuisance. If the difficulty is characterized rather than confined to a single machine, it seems the manufacturer could readily solve it by including an additional guide to prevent the belt from looping excessively. Of course, one shouldn't put any tape recorder in the play or record mode while the reels are moving, it could be done by inadvertence.

Some difficulty was also noted concerning the speed selector knob. The knob causes a rubber belt between the motor shaft and the capstan to move up or down, thereby raising either a large diameter (up) or small diameter (down) portion of the shaft. The "owner's manual" supplied with the 960 has a note stating "Equipment must be on when changing speeds." This does not appear adequate for two reasons. First, the note is not displayed prominently enough; it appears nowhere in the instruction booklet or the "stereo-graph" accompanying the 960. Second, it is difficult to change from the 3.75 ips speed to the 7.5 ips speed (from down to up) if the equipment is on but the tape is in motion. One should attempt this speed change only when the equipment is on and the transport mechanism is in the idle position. If one attempts to change from 3.75 to 7.5 under other circumstances there is danger of jamming the capstan drive belt. In fact, even when making the change properly, one will occasionally hear a retreating sound from the belt, signifying that it is not moving as intended. The thing to do is to push the speed change knob down again, then try once more using a sure, quick motion to bring it up.

There is an interesting point worth mentioning in connection with the two knobs used for wind-rewind or setting the transport into the play-recorder modes. These knobs are of easy type, which is produced so that they are intended as show knobs that will break in the event the operator tries to force the transport into a mode of operation for which it is not intended—for example, if one attempts to turn the play-record knob when the transport is in the fast wind mode. This is characteristic of the intelligent design that is apparent when one looks "under the hood" of the 960 to inspect its mechanical operation.

**Electronics**

The record and playback amplifiers in the 960 are of simple, straightforward design. In recording, two triode stages are employed for amplification of high-level signals, the second triode serving as the record-head driver. All recording equalization—treble boost—is achieved by what is practically a standard circuit, consisting of a large cathode resistor which is bypassed.
From the supreme B-310A to the new "Spinet"...

Big or Little...Best Buy is BOZAK

Every Bozak speaker system, from the magnificent B-310A and B-400 to the competent little new "SPINET" Series offers the very best sound in its class. All are made from the same components—have the same capacity for Systematic Growth—and are distinguished above all others for outstanding musical quality. Even where space is sharply limited yet musical standards are high, the new Bozak two-way B-500 and the three-way B-502 out-perform any other small speaker system. Only 14½" x 23½" x 11½" deep, they combine modest price and size with an unmuffled bass, balanced midrange, sweet, musical highs, and clean transients. From the largest to the smallest, your Best Buy is BOZAK • DARIEN • CONNECTICUT

AUDIO • JULY, 1959
by a series resonant coil and capacitor tuned to about 15,000 cps. When responding from a microphone, two additional triode stages are used.

In playback, one dual triode provides all the amplification but for one channel (for the other channel it is succeeded by a cathode follower to produce a low output impedance. Peak output is about 0.5 volt, which should be sufficient to drive most high-fidelity audio systems.

Playback bass boost is provided by a push-pull cathode-to-cathode negative feedback (from the second triode to the first), using a turnover frequency of about 3000 cps at 7.5 ips, which is compatible with the tone control equivalence (the precise NARTB turnover is 3180 cps). For high gain and simplicity, the equalization circuit does not incorporate a turnover point at 50 cps, per NARTB requirements, but depends upon the characteristic "sloppiness" of the feedback curve at very low frequencies to level out the bass boost in the manner required by NARTB.

The writer measured response down 2 db at 50 cps, which agrees with the Ampex specifications; the NARTB standard permits response to be down as much as 4 db at 50 cps.

At 3.75 ips, Ampex uses bass boost with a peak at approximately 120 cps, which is interesting to know in view of the industry's tendency to follow Ampex's lead.

As stated earlier, the 960 is a very versatile unit. It offers a wealth of facilities, such as echo-channel effects, sound-on-sound recording, and language instruction, where instructor and student record on separate tracks and the results are summated.

The 960 is an attractive package and, considering all that it contains, a compact one. It is only 7" wide, which makes it compact and reasonably priced. However, the tone control is available for correction.

The writer played several stereo tapes of good quality and found no distortion in conjunction with 2010's, and the results were highly satisfactory. One of the tapes was a violin concerto, and in the passages for full orchestra the writer found the richness and depth that made it difficult to believe it was emanating from two relatively tiny speakers in a room. The sound was completely disassociated from the speakers.

There was no information in any of the materials accompanying the 2010 as to its power rating and other specifications. The writer wanted to make measurements, but found it very difficult to regulate the amplifier from its case because of a tight fit, and gave up the attempt. This raises a question as to what the owner will do when he wishes to test and/or replace tube.

**Ampex 880 Stereo Microphones**

The 880 is a set of two microphones, each with an 8-foot cable. They appear to be Electro-Voice 625 microphones, which are high-impedance dynamic units with a rated response of 60 to 12,000 cps. The cable is limited to 8 feet in order to prevent significant treble loss. The cable has about 500 uF capacitance, which is about 60 uF per foot. Should the user need to work at a greater distance, he may substitute any cable of the same size and length feasible.

The microphone does a very good job, consistent with the quality of the 960 tape recorder. When a tape was made with one of these microphones as the source, reproduction was quite life-like upon playback through a high-quality speaker system (although better when played through the 1990). The 880 microphones, compared with a more expensive Electro-Voice microphone that is very well regarded in audio circles, were considered to be a very good bargain. The writer attempted to choose between the two. Some listeners preferred one and some the other. (Incidentally, this points to the desirability of microphones, some of which sound perfectly equal, but are better evaluated subjectively than objectively.)

**Ampex 881 Stereo Headphones**

The 881 consists of headphones with provision for feeding the left signal to one ear and the right signal to the other ear. It has a 5-foot cable and comes with an adapter having a 1/4"-socket, so that it may be used at distance from the tape machine. At one end of the adapter are two phone plugs that fit into the output jacks of the 960. At the other end, a small adapter terminates in 3.5-mm phone plugs in parallel. Each jack carries both the left and right signals and is designed to accept a 3.5-mm speaker phone plug. The headphones terminate in such a plug. The purpose of the extra output jack of the amplifier is to accommodate a second pair of headphones.

The Ampex 881 is the only item of Ampex's home stereo equipment that proved a disappointment to the writer, possibly because the unit tested was defective. The sound was tinny and not pleasant, in no way comparable with the quality of the headphones when the writer was using them, which he attributes to the fact that the headphones have been equipped with loudspeakers, and that the writer has encountered an outdoor sound. Moreover, the headphones are not more than a few minutes proved oppressive and uncomfortable. One reason is that the speakers and headphones, the only reason that the writer can find for using the headphones.

**PRECISE MARK XXIV "INTEGRA" STEREO AMPLIFIER**

Combining many attractive and normal features, the newly marketed Integra立体声音响器材 is somewhat of a manufacturing chore these days. But Precision seems to have done just that with the new "Integra" stereo amplifier, Mark XXIV. This unit incorporates two individual amplifier-preamps in a single compact unit, with each one capable of 20 watts output, or when paralleled, a total of 40 watts on the resulting single channel.

This amplifier, shown in Fig. 4, is built with an unusual layout—each section being essentially separate. The left three knobs in the top row pertain to the channel 1 amplifier, while those in the second channel 2 with bass, treble, and volume controls. The lower left knob is a master loudness control affecting both channels, thus permitting independent adjustment of levels yet providing for a ganged control for convenience in operation. The lower right knob is the selector, with positions for stereo phone, stereo tuner, tuner with TV, TV alone, and tape amplifier. The signal in the phone jack is balanced, and it is possible to turn the power on and off, with a third position controlling the main volume lamp; controls include gain, with normal, -10, and -20 settings; tone, with positions for presence, midrange, and presence; monophonic and stereo.
There are two ways to design a piece of equipment: One is to fix the cost and design around it. The other is the Pilot way: produce the finest unit possible and then price it accordingly. If we knew of another useful feature to add to our Pilot 690-A, you would find it in the list below. Not cost for cost’s sake, but for performance’s sake.

PILOT 690-A STEREOPHONIC FM-AM TUNER-DUAL PREAMP:

**$289.50**

**Tuner Section:** A deluxe, professional stereo unit offering the ultimate in reception, even in difficult fringe areas. Its independent FM and AM sections may be used individually for FM or AM alone, or simultaneously for FM/AM stereophonic broadcasts. With an external Multiplex demodulator, the 690-A will provide FM Multiplex stereo reception. FM tuner features include: 3 microvolt sensitivity for 20 dB of quieting; low-noise, dual-triode golden-grid cascode RF amplifier with accurately tracked antenna and interstage circuit tuning. Freedom from drift is assured by means of a temperature compensated oscillator. Wide-band detection (10,000 kc wide) makes tuning completely non-critical. Audio output constant and independent of signal level. 3 I.F. stages and 2 limiters, dynamic gated beam and saturation type inter-stage noise suppression (muting) with control for optional muting defeat. Independent FM tuning meter for true center of channel tuning and precise station selection. Built-in FM power/amplifier, and facilities for 300-ohm twin lead and 72-ohm coaxial cable included. AM Section: Sensitivity, 2 microvolts; employs germanium diode detector for maximum efficiency, lowest distortion. Features high-gain pentode RF amplifier, 2 steep-skirted I.F. stages with front panel bandwidth control and 10 kc whistle filter. I.F. interference rejection trap. Separate AM tuning meter. Built-in ferrite-core antenna. Dual cathode follower outputs permit long cables without signal loss.

**Preamplifier Section:** The preamplifier has two identical channels. Unique automatic shutoff enables record changer to optionally turn off entire system after last record has played. DC heater supply, feedback tone control circuits, audio and tape outputs. 4 independent tone controls. 4 independent tone controls. 4 pairs of high level inputs for permanent simultaneous connection of FM/AM tuner, Multiplex adjuster and tape recorder. 4 pairs of low level inputs for tape head, microphone and permanent connection of record changer and turntable. All inputs non-shorting to permit tape recording and playback without short-circuiting tape recording signal or changing of plugs. Electronic crossover for monophonic operation. Mono position on Mode switch automatically cancels out undesired vertical stereo cartridge response when playing monophonic records. 18 tubes, 3 diodes, plus rectifier. Size: 14" wide x 5½" high x 14½" deep. Weight: 25 pounds. Complete with enclosure. $299.50.

Write for our Brochure describing in detail the Pilot 40th Anniversary Stereophonic Component Series: Stereophonic Tuners - $179.50 to $289.50. Stereophonic Preamplifiers - $99.50 to $199.50. Stereophonic Amplifiers - $89.50 to $199.50. Stereophonic Preamplifier-Amplifiers - $129.50 to $289.50. All prices slightly higher in the West.

PILOT RADIO CORP., 37-04 36th St., Long Island City 1, N. Y.
Fig. 4. Precise Mark XXIV stereo amplifier, the "Integra."

Telephone—; and a channel reversing switch.

The chassis is arranged to accommodate a multiple amplifier inside the case, but being necessary only to make a number of connections after the amplifier is installed physically. Thus no external devices must be added to make it possible to add multiple output to the amplifier.

On the rear panel are provided a phase reversing switch and a hum balance control, together with the inputs and outputs and a n.e. outlet. The phone preamp has inputs for magnetic or ceramic/crystal cartridges, and dual outputs are provided to feed the rear receiver.

Each amplifier channel employs two 6BQ5's (EL34's) (EL84's), half of a 12AX7, and one a half 12AX7's. Plate power is supplied by a 6AC1 (EZ81), while bias for the output stages is furnished by a germanium diode working in conjunction with a neon regulator tube to maintain a constant bias voltage. The effectiveness of this circuit shows up in the output figures.

Performance

The unit tested measured 3 per cent IM distortion at 19 watts, but up to 12 watts the figure was below 1 per cent. The two channels were well balanced, both as to output and frequency response. The phone channels were within 3 db of the exact XIA curve, and on the high-level inputs the response was flat within 1 db from 20 to 17,000 cps, according to our measurements. Sensitivity was sufficient to accommodate all but the extremely-low-output magnetic cartridges, and quite adequate for the ceramic. Hum and noise measured 38 db below 1 watt on the phone inputs, and 36 db below 1 watt on the high-level inputs.

One advantage of the completely separate volume controls in the two channels is that once the levels are set, the master loudness control operates on both channels simultaneously, solving the problem of non-tracking controls which has been encountered in some observers. Many users will find that the separate tone controls are somewhat of an advantage, although we would prefer to have them ganged so, and only if they were closely matched. Undoubtedly, there is a flexibility to be obtained from the separate controls than from a ganging combination, although for our own purposes, we have noted that we very seldom use a tone control at all. But that is why there are so many different "system philosophies" in the various amplifiers on the market—one likes them one way and some prefer them another.

The 20 watt outputs of the Mark XXIV would not be considered sufficient for some of the low efficiency speakers, since the amplifier would be working up into the higher distortion areas much more of the time, but with speakers of reasonable efficiency this unit would serve quite well.

Fig. 5. The LESA CD2/21—a new record changer from Italy.

LESA RECORD CHANGER
MODEL CD2/21

One of the newest record changers to reach these shores—meaning that it is an imported model—is the LESA CD2/21. This unit is made in Italy, and while it is not equipped with a host of features, it does a remarkably efficient job of record changing. However, while somewhat simplified, the LESA is fully automatic, runs at four speeds, intermixes 7-10-12, 12-inch records, can be operated manually, and works through its change cycle in six seconds regardless of the turntable speed. In addition, it has a four-terminal plug in head and two output cables, and the outputs are shorted when the last record is played and the arm returns to the rest, stopping the motor and retracting the idler wheel.

The changer is finished in two tones of grey, and has only two controls—the speed change knob, and the on/reject or stop knob. The latter retracts the idler whenever the unit is shut off, although it is permitted to shut itself off at the end of the last record it retracts its own idler. The mechanism which determines the set-down point consists of a feeder arm which raises from its housing alongside the arm pivot during the change cycle. When a 7-inch record drops, it raises the feeder completely so the arm sets down at 7 inches. A 10-inch record pushes the feeder down just a little, and a 12-inch record pushes it all the way down, thus setting the mechanism to make the arm set down at the correct point. At the conclusion of the change cycle, the feeder arm retracts. The record balance guide drops to its lowest position when no more records are on the spindle, and when the unit is shut off after the last record is played—thus it will play 7-inch records indefinitely if the balance arm is prevented from dropping completely by the insertion of a card, for example, near its arm to hold it above its resting point.

The change cycle operates through a set of Nylon gears completely independent from the rubber idler, which accounts for the constant cycle time, and this feature also removes the cycling drive pressure from the turntable idler. The motor is a heavy four-pole type; the turntable itself is quite heavy; the arm, metal, apparently has no resonances—at least, none in the important audio ranges.

One example of simplified construction is the method by which the stylus force is changed. The arm is spring-counterbalanced, and the adjustment is made by positioning a small removable metal punching into one or another of a number of slots milled into the underside of the arm. The spring is removed from the punching, and the latter is pulled out of one groove and put into another by means of a pair of long-nose pliers. Admittedly not as quick as a screw or nut type of adjustment, but who changes stylus forces daily, or even weekly? Once the user has decided what cartridge he is going to use, he adjusts the stylus force and then leaves it alone, probably for months in some cases. It is not difficult for such a device is considerably less than some other types of adjustment, and this is reflected in the east of the unit. The range of adjustment with a GE VE-22 cartridge is from well over 15 grams stylus force to less than zero, which indicates that the range is calibrated on 5 gram units. The heavier cartridges than the GE model.

Rumble level of the LESA measured at .2 db, in accordance with NABF standards, and this is only 3 db below the standard for broadcast reproducing turntables. Actually, the figure seems relatively low, but the method of measurement used uses a stylus velocity of 7 cm/sec as the normal maximum stylus velocity is nearer 20 cm/sec, so the signal-to-noise ratio is actually 10 db higher.

We would consider the LESA as a high-quality medium-priced changer which would be particularly ideal in an installation where the user had both a single-play turntable (and a changer) primarily using the latter for background type music or for those applications where a changer was especially desired. It works smoothly and quietly, and with nearly new carbide needles.

In other words, it is an effective work horse of a changer which does its basic job of changing records well. No tricks, perhaps, but a consistent performer.

G-27
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EDWARD TATNALL CANBY

1. BIG NAMES

D. Scarlatti: Tetide in Sciro (Thetis in Skyros). Soloists, Angelicum Orch. of Milan, Jones. Westminster OPW 1305 (3)

This quite lengthy classical opera is a fine lesson in music appreciation, never to be forgotten—especially for those who have dabbled in that somewhat old-fashioned kind of music history. Yes, that you say about the "old" opera! This opera is not written in Italian, but in the language of the original text. Scarlatti was a master of "old" opera! This opera was rediscovered only a few years ago and it is the only such work that is still extant.

Westminster, it seems to me, could have used a bit more imagination in packaging this music for home use. The opera, like others of its type, consists of a large number of single arias and ensembles, a stretch of recitative to the harpsichord. Each recitative introduces a new bit of the story, taken from the printed text, brings forward a bit, makes clear another slice of complication—and the arias furnish the musical commentary on the situation. Without an understanding of what is going on at the moment, you will find yourself listening to what amounts to an extended concert of Italian classical "songs." (Most of the old Italian music sung in solo voice recitals today originates in such operas.)

Very nice, but too much of a needle, in a haystack. Scarlatti himself was well aware of that. The libretto, of course, is what keeps you on the operatic track. With its help, you can enjoy the music for what it is, a proper sense. (No opera was ever composed, remember, to be heard and not understood.) Westminster gives us the complete libretto in Italian and English side by side. The only trouble is that the printed text is complete, the recorded opera is extensively cut in order to scale it down from the original evening-long entertainment to a mere three-record LP album. And each cut is its own hooby trap.

To be sure, the cuts are judiciously marked in the libretto by an X at the beginning and a very unobtrusive O at the end. But as you follow the music by ear and eye together, you are bound to be derailed at each X. The music jumps in a flash, while you bound over the columns of the text trying frantically to locate the end of the cut—and if you don't work fast, you'll be lost, since the music doesn't wait.

I did my best, but I found that the pay-off was too often rent asunder, the cut entirely concealed through the cut-out parts of the text if you are to make sense of the story. Some cuts are whole scenes—maybe you can't see it, but at least you can hear it.

This, you see, is a problem that needs an immediate solution, and it doesn't seem to be getting any better. Not easy, and I can only suggest that Westminster could have done something simple such as print the cuts in large letters in the libretto, for instant visibility. That's what I mean by imagination. Sure, it might cost a bit more, but why put the operatic cuts in the place? Yes, it's a fine cultural monument on

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Gesualdo: Canzonette, Madrigals, Galliards, Sacrae Cantiones, Psalms (Vol. 2). Conducted by Robert Craft. Columbia MS 6048 stereo

This second volume of music by the famed Italian eccentric nobleman of the early 17th century (he was a fine murderer) continues a movement towards a new kind of professional singing of today, that might almost be called anti-operatic. Unlike the others on these records, a kind of vocal chamber music, sung by perfectly balanced, well-voiced voices that blend as smoothly as a string quartet, the individual singers barely maintaining any personality at all—indeed, they are listed only in the small type on the record's back side. The singers alternate with a string quartet, for variety in the listening.

Though I enormously admire the finesse of these performances, the perfect blend, the absolute pitch accuracy, the careful diet. I still do not feel that they represent the sense of the music very well. They sing dead-pan, these people, where to me the music is almost violently, explosively eloquent. They stress a gentle, steady beat, in the modern way, whereas there should be no beat, but only the dynamic shape of the actual words themselves.

You'll pardon me this opinion—I conduct my own group of singers in music of this sort and we do it quite differently. With all deference to Mr. Craft, I think one of the most brilliant conductors of contemporary music now alive and an extraordinary musician, but I feel that he reads a twentieth century instrumental neo-classical into the music that is simply not there. It sounds like Stravinsky—which isn't all at surprising since Craft has been an outstanding interpreter of his music and a close associate of that master.

Ah! But the vocal tone quality, the perfection of blend, the organ-like harmonies! It's an experience to hear this group in Gesualdo's amazingly daring music, for only for the accuracy with which its actual pitch is reproduced for the listening ear.

The string quartet does produce unexpected instrumental bits by Gesualdo and does it with the most outstanding effect, with out style. Not a very happy contrast.

Brahms: Symphony #4. Boston Symphony, Munch. RCA Victor LSC 2297 stereo

Did I warm up to this record as it went along? I never does that, but here it ends! To be sure, the first movement opens quietly—but throughout I felt that the restrained classicism Brahm's was something else, a still more rarefied, simplified, pure expression. It is an "old" opera! This opera was rediscovered only a few years ago and it is the only such work that is still extant. Westminster, it seems to me, could have used a bit more imagination in packaging this music for home use. The opera, like others of its type, consists of a large number of single arias and ensembles, a stretch of recitative to the harpsichord. Each recitative introduces a new bit of the story, taken from the printed text, brings forward a bit, makes clear another slice of complication—and the arias furnish the musical commentary on the situation. Without an understanding of what is going on at the moment, you will find yourself listening to what amounts to an extended concert of Italian classical "songs." (Most of the old Italian music sung in solo voice recitals today originates in such operas.)

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first) simply bowled me over. If that man was a top man in the game of musical expression, then I’m an idiot.

One of the sorries you’ll have in listening to this music, nobody can say for you what your feeling will be. Either you hear it, or you don’t. Boulder, Colorado, is filled with tremendously poignant, moving, expressive lines of melody, the almost hystically eloquent romance, that never resolves you becomes harsh, rather—somehow—not a little bit too easy on the extraordinary ‘fine’ of these complex melodic shapes, leaving tones hanging, unfulfilled. In the mindless web of emotions, tension through melody itself, the marvelously simple harmonics, so endlessly right—all this is not always there. I don’t feel it, you can’t feel it, unless you can take it in.

You sure can’t try it and see. If your musical sense is experienced enough to catch onto Mahler’s language, you’ll never forget this piece. If not—then, I say, come back to it and try it again later. I don’t know what possessed the Cleveland orchestra and Mr. Szell here but to me they sound positively angelic. It is a superb performance and worthy to stand beside any recorded Mahler by such as the many famous Bruno Walter. Extraordinary team work, of a sort you rarely find.

The recent Prokofiev by the British, Walter was an unfortunate task on this record. It is a nice, bright, beautifully orchestrated piece, full of pop and color and not at all deserving of the kind of service that威廉·马利克’s excellent experience in writing movie music. By itself it is just fine, but after all, it is still a musical snapshot. I wonder if the whole thing was really utter and altogether a deservant. Better play it first?

Dvorak: Violin Concerto.


Capitol 5P 8382 stereo

Here are two big romantic concertos, rather high-class, a recording re-released of its stereo debut out of earlier Capitol material, and though the Dvorak is probably the most enduring work it is the Glazounov that makes the easiest listening.

It isn’t that Glazounov is superficial so much as he was a natural concerto man, whereas Dvorak was one of those composers who somehow found in his inner self the grand manner, where it would be better off in a simpler style. Oddly, it is in Dvorak’s music where we find the true romantic essence, the musical style that makes him so accessible to everyone who wants to escape from the daily, normal, world. There was a less formal, more congenial medium than the concerto—which had to wear full formal dress and ruffles for its wedding.

You’ll find plenty of good Dvorak hit and melody, but it’s all too obvious and easy to play. Then but perhaps after the tenth playing you’ll be utterly bored with the more set notions and coherent Glazounov, and delighted with Dvorak. Could be.

I almost left the performance and recording unmentioned; in truth, you can take it for granted as tops with these musical forces and Capitol’s big, natural Pittsburgh stereo would.

Chopin: Mazurkas (Complete). Nodio Reisenberg, piano.

Westminster XWN 18830/31/32

Reisenberg is one of those big, bright-faced ladies pianists who manage to combine the feminine attributes of sensitivity and allure, with the resources of strength, authority, massiveness—also speaking pianistically. (Don’t have to be a big pianist to play a big piano. You can see her title.) This is her second big set of mazurkas and it complements Nocturnes having been already released.

I expected, somehow, to find these a bit on the long side, but it was delightfully surprising. Without sacrificing any part of her authoritative strength, Miss Reisenberg has this sense of control that is lost to lesser pianists, poetic, alive. There is give, elasticity, where too many newer pianistic virtuosos hang and go away; there is songfulness but well-styled and well-spiced.

This set of records made me remember again that Chopin did want to have played in a fairly gentle style, all things considered, and I can’t help remembering, too, that when he wrote the mazurkas for the solo horn, the solo violin, it was because of the huge concert hall. It is stated that they were written on behalf of Vincenzo de Majo, a virtuoso horn player.

Westminster’s recording is superb, though it does not produce the effect, noted in Westminster’s standard blart of the listener’s arm being plied away, gratuitously, in the concert hall. Instead, it is close-up, fairly dry in sound but wonderfully intimate, and you feel you’re sitting right in the audience. A fine recorded effect any way you look at it, and right in your own home salon.

Bach: Brandenburg Concertos (Complete). Members of the Cento Soli Orch. of Paris, Scherchen. Omega OML 1039/40/41

These three discs (available separately) are the first non-c distorted Omegas I’ve received and I am satisfied that they are also available since all the earlier recent and excellent Omegas with this French orchestra have been recorded in this whole set.

Here, in the unpretentious, I should say—recording of the six Brandenburg Concertos, we have an entirely French orchestra and a noted, if somewhat eccentric, German conductor. The results are enervating. Scherchen is most likely to be noticeable in his often violently erratic tempo and dynamics. Here, the Scherchen touch, which I would in this case call the kiss of death, is seen as the touch of this great orchestra.

It is done in alarmingly slow time, straight through—even the normally buoyant movement at the end—and without the slightest trace of expression or phrasing, absolutely deadpan, listless, lifeless. But then, that’s Scherchen, All or nothing.

Most of the other works play along at normal sounding slowed and in fairly natural stylings, the orchestra management and relatively authentic, with harpsichord continuo, high trumpet and the rest. In listening to these works we ought to remember, I think, that these are essentially chamber music for a large “chamber” and do not require the acreage of a group of good musicians can play the stuff beautifully with our external help. Indeed, the only “composed” encore that could have been the man at the harpsichord, who would have merely given a helpful nod and bow at the end of the music, was never played in Bach’s time. he didn’t get a chance to accompany himself at the keyboard.

The French touch is evident here in two ways. First, Epi can play it bright, clear quality to the sound that comes in part from French ways of playing, as contrasted to the English, stricter German approach. Second, the French, it seems, are afraid of the winds, especially the wind instruments, the mere nasal noises, for example. And, of course, there are the French horns, which in France are played with a vibra and sound like saxophones—what do you think who knows Bach’s own didn’t do the same?

2. ANYTHING GOES

Music and Song of Italy. Collected by Alan Lomax. Tradition TLP 1030

If you like your folk music styled for night- club and restaurant settings. This is a real country crew, some from one of the primitive parts of existing Europe—racy, raw, often a bit raucous. For example, a typical song from alio that it sounds like some things, though they’d call it singing; the harmony varies from note to sound of the thethirds of every age since then, preserved ever since in these out-of-the-way isolated areas of Southern Italy and Sicily.

I rather that this material more or less left out of all the long series of folk recordings done by Lomax. It seems to fit in with that material, anyhow, and course Lomax made hundreds of hours of tape for each bit that ends up in the final discs. This, in any case, is fascinating, and on one complaint is one that can’t be answered—how to put each item down, and yet cover the ground. Two words: a trip to Italy. Most interesting. Some of these items would be good to hear the long night straight through, as they were probably heard in the original!


Epic LCP 3536

Flamenco España. Bernardo Pico’s quartet (with other guitars, mandolin, dancers).

Hisforic 5117 stereo

These two came in together and I was intrigued to find that what I had thought it would be, a student of the first. Not being a flamenco expert, I can’t tell you which of them plays the better music. But the two records are interestingly different.

The Epic recording of Niño Ricardo is much closer into, with no liveliness at all—it is in effect an absolute recording, the instrument itself without acoustic room coloration. The single guitarist plays alone, minus microphone (though at this close range he can be heard perfectly). So you sit right along with his playing. For my ear, there is an uncomfortable feeling of restraint. We are too much, perhaps, for pleasure’s sake, to have perhaps to be out of his element, playing not mere music but a sort of mix of impressionistic microphone in some dead and formal studio.

But the Pico experts won’t mind this a bit and I expect the music itself is spontaneous enough. But the rest of us will find this Epic recording easiest to listen to, you can hear the instrument in another room or around the corner, rather than face to face. And, at least a hint of atmosphere and space to the sound, even if it is only our own home’s acoustics.

We have here a fine example of another one of absolute recording itself (I coined the term for my own convenience) long while back) but, even more important, good music! And for our universal need for non absolute recording—i.e., some species of it and the atmosphere built into the recorded sound and reproduced along with it. Absolute recording is clinically revealing but less convincing.

The Hisforic stereo adds just this element, in a number of useful ways. First, it is clearly made within an audible space, as you listen, and something of the feeling of the effect. Second, the extra guitars (spaced out) and the hand of the single man into the music, plus the crackle of the mandolin and the other guitar, the electric guitar, the electric mandolin, the electric violin, the electric guitar. The recording of a group of dancers is heard in the background, sometimes a loud electronic accompaniment, sometimes, in the excitement, the tonality of their dancing. Their statement of their actions is beautifully conveyed, and seen to be the result of their dancing.

Exact coordination of dancers and instruments in many of the shifting flamenco rhythms shows us, too, how these dance-and-music patterns are known traditions, shared by all the performers.

Both records are of excellent quality. The Hisforic is one of the best stereos I’ve heard in about sound perception, with superb string and footwork, treatments and simple, momentarily quiet, rumbling background.

African Jazz. Les Baxter & His Orch.

Capitol T-1177

If Les Baxter is African, then I guess this is African music but it sure isn’t recorded elsewhere. More likely he was recording this one by accident; it was resting demurely in his cabin at the label’s “Five Centuries of Spanish Music” label. As I write this, Les Baxter is to be heard and here in the U.S. in the exciting (“Fifteen! Reisenberg, though perhaps I might be termed a “great” man, who had a feeling that the Capitol had tricked me in stereo. Instead of none. Very nice music, come to think of it.
Five Centuries of Spanish Song. Victoria de los Angeles. Capitol-EMI 67155

I wrote right back to Capitol and got them to send me another Five Centuries worth, this time with the right disc inside. If I am right, this is a reissue of the recording that was once available on RCA Victor (from before the demise of the RCA-EMI hook-up), refurbished and improved in sound.

De los Angeles is not only a superbly musical singer but also an unusually widely versed musician. Interested in more than the mere sound of her own voice. This collection is done in a somewhat old-fashioned way (with a neutrally modern accompaniment and a good deal of arranging) but it doesn't matter; what counts is the superb quality, the gentle accuracy, of this voice. This was a collectors' item at RCA and it surely will be again, just as soon as it goes out of print—when and if. Better grab it, anyway.

Anything Goes. (Hi-fi on the Harpsichord). Bruce Prince-Joseph and His Group.

RCA Camden CAL 416

I only mention this one because (a) the guy with the funny name, Prince-Joseph, happens to be one of the best Baroque-style organists around and has presided at numerous important concerts in Carnegie Hall and the like (he's the only man who can make Carnegie Hall's organ sound live Bach's); (b) he has an organ recording on the Hill label on which he plays, a species of modern jazz, as hehe.

Multiple threat, like so many younger musicians, breaking down the old barriers.... Cool (3), sophisticated stuff again, cultivating old favorites, including "Anything Goes" as well as "Zazou Swall" and "Shame with the Fringe on Top." Some organs Betelhe could do a Giant Wurlitzer recording or any wanted at, or maybe the entire works of J. S. Bach.


RCA Victor LM 2270

RCA Victor stops at nothing when it comes to figuring ways of using the same old pieces and the same line recordings over and over again. Old wine in new bottles! The Boston Pops in particular has practically run out of titles for its dozens and dozens of ever-cfresh, ever-best-selling records, and this one must have won a prize in the RCA man office. Let's hope it doesn't stop the Pops—at any chance.

I won't even bother to list the Pops Stoppers items; you know what the Pops sounds like, sir, you'll go for this, in broadway bird, if you go for the rest. (I do). As for the Frustrated Conductors item, I must have been the outcome of an especially torturous repertory discussion. The idea is fine in theory but slightly dizzy in practice. It won't get you far on the way to being a conductor.

Of course RCA didn't know that I am a conductor, at least of choral music, and that I was just dying to try out a baton on my small choral group. I got two—one for stereo and the other for mono—and the very next singing session we had, I practically poked out the eyes of my front row of singers with my new baton. Lovely white plastic coated grip on one end—you won't drop it even in a tornado without it.

As for you, well, you can beat away to your heart's content as this record plays, but even dooms, Taylor's admirable and slightly vague helping footnotes, you won't get far. Such is the policy to beat theories and two and fours (with pictures) and writes a running comment on each piece; but if I know you'll take more than Deems Taylor to put you on the beat in these excerpts. Diabolically difficult, several of them. I expect you'll settle quickly for Dooms emergency beat, the "one . . . . one . . . . one" system when things get complicated; but even this is going to be hard, for RCA and Mr. Taylor forget that most of us tend to (Continued on page 58)

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STEREOPHONIC

Bud Shank: Holiday In Brazil World Pacific Stereo 1018
The Mastersounds: Ballads & Blues World Pacific Stereo 1019

A hot summer evening is one time when West Coast jazz definitely deserves a place in the more listener's cooling influence is most agreeable and relating under such circumstances. The two newest items in this label's ever-growing series of stereo releases contain these elements in varying degrees of intensity. Laurinda Almond provides a show of Brazilian themes for Bud Shank and they work over them together with considerable success. On Shank's part, this is "Mood Salut" a style on which Shank plays fine instead of alto sax and dromedary next he pairs the hues of rhythm and melodic line. This includes a rhythm of tabla drums between two channels. The standards are Rodgers and Hart's "I Didn't Know What Time It Was," and "Little Girl Blue." The bassist is Gary Peacock, and Almond's guitar is both unaccompanied and unechoed.

The Mastersounds move closer to the area occupied by the Modern Jazz Quartet in this outing, playing Milt Jackson's Blueology, and John Lewis' Ponderous. The usual composition, between two groups of life introspection becomes even more inevitable. But Monk Montgomery, playing Ponderous, gives his tunes a whole new direction. Blending the baritone sax, and the other soloists move to the front in turn. Drummer Benny Green starts up a comfortable breeze on Gillespie's "The Chang," and Miles Davis' "Sober."

"The King and I" (World Pacific Stereo 1017) the first venture into the field of show tunes by the Mastersounds, is still one of their best. The Siamese feeling of the dances, the beauty of the ballads, and the gaiety of the production are all splendidly conveyed, and the recording is excellent. "Amie Rose Sings a Song with Mulligan" (World Pacific Stereo 1020), our purely personal nomination as the most satisfying jazz vocal album in years, sounds even greater in stereo. It also confirms a conviction that the two sessions required, the one attended by Art Farmer and Bill Crow turns out more rewarding. Crow's bass seems better placed than favorably, both musically and in the re tracks that by Henry Grimes. "Ellington Suite" (World Pacific Stereo 1016) is a mid-century composition that contains the original theme, the main theme, plus three others. The arrangements by Donald Smith offer subtle and colorful ensemble work and solo. "The Sound of Big Band Jazz In Hi-Fi" (World Pacific Stereo 1015) a gathering from previously released the most, among those in the label's catalog. The stereo effect varies from track to track. Most are picked for a dancing band, and the leaders are Dick Evans, Johnny Mandel, Gerry Mulligan, Chet Baker, Horst Jankowski, and Bud Shank. Art Pepper, Bill Perkins, and Cy Touff.

The Thelonious Monk Orchestra At Town Hall Riverside RLP1138

This February Thelonious Monk made his entry into Town Hall in a concert divided between two groups of nine tepece orchestra. The portions preserved here consist of originals recorded by the composer in collaboration with Hall Overton, for the larger group. Always a figure of controversy, Monk enters a new stage in his career to the familiar chorus of voices in dissent. From some published reviews, even the modern side jazz seems to have traditionalists who resent change. Be that as it may, an important contribution is that the step was taken before an audience in lieu of Monk's personal preference for a darkened studio. The entire program was too much to handle in an evening, especially from the confines of a theatre seat, and a sense of strain could easily develop. The recording permits a more leisurely approach and fully defined stereo reveals the parts (for parts there are) of each instrument.

Of six tunes, the most extended is Friday the 13th, with a long characteristically Monk piano passage. The tenors are Donald Byrd, Charlie Rouse, Phil Woods, Eddie Jefferson, and Pepper Adams.

Mundell Lowe: TV Action Jazz! Camden CAS522

The second low-priced stereo production by Mundell Lowe and assembly of the Lows may bring the musical backgrounds of seven television productions into sharp focus. Besides a fresh version of "Peter Gunn" themes, the guitarist enlarges upon the essential motifs which serve to identify "Mike Hammer," "Jerry Mason," "The Thin Man," and "Naked City." His most skilful effort of the day is in the TV "Strip" of the "T7 Sunset Strip" score. That heady night, enlivened by a Tony Scott chorus on baritone sax, receives its best performance yet. The sextet's offerings find an onside bar in the gold rush, playing on TV by Count Basie's crew, and Eddie Costa wraps it up with an arresting piano interpolation.

Costa is heard also on bass and vibraphone, while Scott plays clarinet and an amused clarinet, probably Herbie Mann, doubles on tenor sax. Variety is added to the instrumentation thereby, without impeding the free flow of ideas. The quintet, and Don Payne, and Ed Shaughnessy pursue their quirk on a straight jazz course, an ideal way to handle such material. Those that its must be a frequent occurrence and to employ their services.

Benny Golson And The Philadelphians United Artists UA55020

As the title indicates, all members of the quintet are of Philadelphia United briefly under the banner of Benny Golson, a brilliant tenor saxist whose skill as a composer and arranger makes him an acknowledged leader. Included is Sal Timbalion, one of his first tunes to catch attention as a new leader, along with two of more recent vintage which offer proof positive of his star is continuing to rise. They are the warm and eloquent Blues On My Mind, and Thursday's Theme. The presence of John Lewis on piano, Shakin' the Scales) prompts an arrangement of John Lewis' After Paris. Paul Bley contributes Calgary, in a setting for Gigi Gryce, and that one adds You're Not The Kind. The drummer, to be sure, is the one.

Golson can speak with the lingering tenor harshness of Coleman Hawkins or the brassy urgency of John Coltrane, and he and his perfect foil is trumpeter Les Morgan. Before had his last appearance on this label, under Art Farmer, was made some years ago. As containing the "most" attributes of any LP of the year, not much is left to be said for this album. But it is at least as good, and considerably better in stereo.

Ellington Jazz Party In Stereo Columbia CS8127

Duke Ellington: At His Very Best RCA Victor LPM1715

Since the success of Ellington's Newport 1955 festival album, interest seems well-convinced that the applause between tracks sells the Duke. Although portions of his Newport concert are available from studio, crowd noises are retained via dubbing. Now, on the pretext of rolling you to a jazz party, all the same, the procedure seems excessive. As is close of each number and the beginning of some other songs, a musical aura is created, calling to mind Iodice Pope, the title of one of his records. It is one of those records.

Where stereo is concerned, the other is his nine-piece percussion section added on two of the leader's new works, introduced last summer at Lews and Festival. Finding the conga is not for the garden, they strike a happy medium between sounds of contemporary writing in the field and the super-charged improvisations of Art Blakey's Four Deuces, two xylophones, a glockenspiel, and a marimba occupy the center, with the full band on one side and individual on the other. Opening with a new band on a rush album, the original recording of Black, Brown, and Blue. No stereo, but the playing time totals more than 15 minutes.

Shearing On Stage Capitol ST1187

Don Shirley: Audio Fidelity AFSD5897

A concert held at Claremont College in Southern California some time ago, and the recording is contained. The first live performance from the group, it reflects the power and stamina of the leader's ability to entertain. The best of respectable jazz at the same time. Several standards long identified with his sound style catch fire in this recording. All the best they have received. His friendly interaction with the audience, and one that made the town known as the "Street Where You Live," is accurate and amusing. With Armando Peraza added on conga and bongo drums, the group's efforts to wander at will through Nothing Down and Gomorrah, the guitarist Jean Thelma switches to the guitar, an instrument he maneuver some noise. The stereo one is a full view of the unit while maintaining its fine ensemble sound. Comments from the
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Les Baxter: Jungle Jazz Capitol ST1184
Markko Pola Adventurer RCA Victor LSP1919

Off for South America on his latest stereo exploration of exotic sounds, Les Baxter stops over at Caribbean ports on the way. His companions again are again his frequent associates, pianist and composer Joe Johnson, and the dance of beauty on sax and flute. Here also make their mark on the adventures of the late judge. This time a full complement of strings brings them through the tropical, winding landscape; around the rushing waters of Ama Sante, and leads finally to the caraveling of One Thousand Clocks. The pace of the music is backed by a gaucho's tribute to the usual reeds and brass; plus a percussion section with the rhythm of the sequence. Carnival, Fling, and Voodoo Dreams. Liner diagrams show how each group is seated to achieve optimum depth as well as breadth.

The Markko Pola Adventurers also set up in Havana. Baxter led by Gerald Fried, they cross the Pacific with a full of twenty-five percussion instruments to visit Madagascar Blue Girl, and Girl Friend of a Whirling Devil. Here the tendrils respond on Iain in Rangoon, written for the group by Vernon Duke. In San Francisco, while Leonard Breslow, Andrea Fontana, Sissle, and Runway Edwards. In addition to the rhythm of the dance, and revives Raymond Scott's Mountain High, Valley Low. There are stereo effects go, here, many humorous and some more serious.

Mark Murphy: The Story Of Something Capitol ST1177
Jack Smith: You Asked For It Bell Canto SR1015

Two personable young Californians, backed by arrangers and conductors of the most important, and recorded in L.A., the stereo album. Conducted by Gerald Fried, the studio groups, and the group is seated to achieve optimum depth as well as breadth. The Markko Pola Adventurers also set up in Havana. Baxter led by Gerald Fried, they cross the Pacific with a full of twenty-five percussion instruments to visit Madagascar Blue Girl, and Girl Friend of a Whirling Devil. Here the tendrils respond on Iain in Rangoon, written for the group by Vernon Duke. In San Francisco, while Leonard Breslow, Andrea Fontana, Sissle, and Runway Edwards. In addition to the rhythm of the dance, and revives Raymond Scott's Mountain High, Valley Low. There are stereo effects go, here, many humorous and some more serious.

The Weavers: Travelling On Vanguard VSD2022
Ralph Hunter Choir: The Wild Wild West RCA Victor LSP1968

The Weavers journey far and wide on their current tour of America. Two of the group's leading vocalists, Mollie O'Brien, and her original, Waltz Away, might be from four. All of the group's members, but her piano is sings in unison and blends well with the guitar in stereo.

A Party with Betty Comden and Adolph Green Capitol SWAO1119
Pat Suzuki's Broadway Dream RCA Victor LSP1965

Seldom do all seven New York critics indulge in the pleasure of attending on this production last December when it opened at the Golden Theatre. Brought there by the Theatre Guild, Mr. Green's Village's Cherry Lane, it affords audiences an intimate stage picture which has lasted more than fifteen years. As show business teams go, Betty Comden and Adolph Green are the same. But their last performance by a large crucifixion, and female chorus. The Most Beautiful, and Eddy Mann, and other songwriters. Smith at his best, but he does almost as well on Gäste La Gostra, and Have You Ever Been Lonely? Perhaps the fortunes of recording will lead him exchanging roles and arrangers with Murphy if all wood instrumentation. Both voices occupy the center of the stereo stage.

Johnny Pineapple: Hawaii Audio Fidelity ASFD5830
Wesley Edwards: Hawaiian String Orchestra Capitol ST1152

A steel guitar is far from being our favorite instrument, but when freed from distortion and nestled among others of its ilk, as in both local and stereo recording. Wes Edwards' Columbia recording is, of course, undeniable. Johnny Pineapple leads his Hawaiian String Orchestra in a series of 18 pieces, and in their welcome as entertainers in top hotels across the country. A light mixture of the exotica of Hawaiian music comes through, and is not intended to be a full-scale stereophonic release. For anything less than a direct immersion in the stereo, this performance is the most satisfying. Of course, Wesley Edwards, for the third in his "Hawaiian Strings" series, chooses his material from the programs of the films made by the Hawaiians. It is a wonderful performance, and there is not much that can be said about the recording technique. Both are fortunate in their partners in time and space to get out of hand even in stereo.

Recorded at an actual performance, the enthusiasm of the audience is evident. Written for "The Hawaiians" in the early 40's indicates that the Caddens and Green brand of human wears well. As part of their art is to stand in front of the group and conduct, and the group would be in a little more than words and music, less of the human factor is lost. It is a very nice choice from Broadway to discus, especially when stereo starts you front row center. It is an album that is sure to be a hit.

Pat Suzuki's Broadway Dream, RCA Victor LSP1965, is a musical representation of the Broadway shows. It features a variety of musical styles, from Broadway classics to contemporary hits. The album is a tribute to the timeless魅力 of Broadway, capturing the essence of its iconic shows and performers, and is a must-listen for fans of Broadway music. It features a diverse range of artists, including Betty Comden and Adolph Green, who are renowned for their contributions to Broadway. The album is a testament to the enduring popularity of Broadway, and is sure to delight audiences with its blend of classic and contemporary tunes.
albums. Surprisingly, none of the titles is duplicated, not even *Aloha Oe*, as Edwards concludes with an old Polynesian farewell song from Tahiti.

**Ron Goodwin: Music In Orbit**
Capitol ST10188

**Esquivel: Exploring New Sounds In Stereo**
RCA Victor LSP1978

Stereo space is utilized in opposite ways on these two interesting examples of music in motion. Ron Goodwin, who leads nearly fifty musicians in EMI's London studios, examines the broader aspects in a dozen celestial sketches inspired by the quieter portions of Handel's *The Planets*. Contrary to the impression conveyed by the soaring rocket on the cover, there are few sensational noises inside. A melodious waltz is dedicated to Venus, instead, and the composer launches witty exchanges between sections on *Fally the Forest Fire*. Those earthbound mortals who enjoy light mood music on a high plane will be suitably transported.

Esquivel runs the gamut of instrumental sound, from anke bells to theremin and back by way of jew's-harp and buzzsaw, a singular animal which emits low, resonant tones when struck with mallets. The electronic Mexican piano wizard may focus on the intricate timbre of a harpsichord, an agile Latin-American percussion section, or the powerful blast of nine brasses. These last not only bounce well to wall but from floor to ceiling as well. It all could turn out hortomative if his arrangements were less clever. Standouts in any language are Oscar Simr's "La Ronde" and *The Third Man Theme*. His own original joins Mexican rhythms and the ondoline, a French pedal piano that is similar in sound to a highpitched organ.

**MONOPHONIC**

**Claude Hopkins: Music Of The Early Jazz Dances**
20th Fox 3009

The idea for this enlightening program originated in the survey of jazz dance given by Albert Minns and Leon Janes. The hit of the 1958 Newport Jazz Festival, their demonstration was repeated on television and is currently scheduled for other concerts. But where the dancers perform steps first made popular in the 20's and after, Claude Hopkins combines his researches with Original Black Bottom, a Perry Bradford composition of 1919 which illustrates an early incidence of what is now generally referred to as shuffle rhythm. The pianist takes as his point of departure *The Alabama Wallow*, written in 1891 to accompany the minstrel tableau which evolved into the cakewalk, and embarks on an engrossing resume of three decades of dance history.

Julia Steel sings those tunes with descriptive lyrics, offering Rules and Regulations, and giving instructions for *Scratchin' the Grasp*, *Watchin' the Dog*, and *Messin' Around*. Those written after the dances gained wide acceptance are apt to show the refining influence of Tin Pan Alley, variations on Hokey Pokey which are still popular today.

**Bob Scobey: The Scobey Story**, Vols. 1 and 2

**Good Time Jazz** L12032, L12033

Some day these recordings will take their place in the archives as an important part of the San Francisco jazz revival. Among the most danceble sides ever made, they are still fresh and too much alive to stay on the shelf for long. The twenty-four selections trace Bob Scobey's career during the three years after he left the Watters in 1950, and...

(Continued on page 64)
NEW PRODUCTS

- "Surround-Sound" Speaker System. This system has an 8-in. driver mounted in the top of the cabinet and a matching 4-in. tweeter mounted in the front, distributing sound in a 360-degree pattern. In addition to providing realistic sound reproduction, the system also provides the answer to the problem of what to do with the cabinets—they double as handsome end tables. With stereo, the listener benefits from the full range of the system and the improved consciousness of speaker placement. Cabinets are made of heavy wood, finished with Formica, and are available in walnut, mahogany or oak finishes. Further information and literature are available from the manufacturer, ALPHA-audio Manufacturing Company, 414 Fourth Ave., Osseo, Minn.

- H-K Stereo Amplifier. Priced essentially for the budget-conscious user, this new Harman-Kardon amplifier incorporates many of the features normally found only in units which cost considerably more. Known as the Lute, Model A227, it is a 20-watt stereo amplifier with dual prongs and two 12-volt output channels all on a single chassis. It is supplied complete with a car ergo-wrase without cost at normal listening levels, the frequency response of the Lute is 20 to 20,000 cps. Four Type 7020 output tubes are employed to insure minimum distortion. Inputs are provided for both magnetic and dual ceramic cartridges. A highly effective volume balance control will compensate for any speaker system, regardless of variations in efficiency. There are also separate ganged bass and treble controls, a band loudness control. For full description of the Lute, write Harman-Kardon, Inc., 520 Main Street, Westbury, N. Y. G-8

- G-E Stereo Cartridges. Major improvements in the essential areas of stereo performance—response, separation, compliance, and linearity—have been achieved with the new VR-22 series of stereo cartridges recently announced by General Electric. The VR-22 series comprises the VR-225 with a 0.3-mil diameter stylus for professional turntable systems, and the VR-227 with a 0.7-mil diamond for record changers and other turntables. While both units are similar in appearance and basic design, the VR-225 is superior in some performance areas. The VR-225 has 20-10,000,000 cps frequency response within 2 db, up to 12-db channel separation, and recommended tracking force of 2 to 4 grams. The VR-227 has a frequency range of 20 to 17,000 cps within 3.0 db, up to 35 db channel separation, and recommended tracking force of 5 to 7 grams. Replacement stylus for the VR-22 series are not interchangeable with previous G-E stereo cartridges. In addition to the new series, G-E will continue to market its "Perfecta," including the VR-11 monophonic models. General Electric, Specialty Electronic Components Division, West Genoa St., Auburn, N. Y.

- Sherwood Amplifier. This latest Sher-wood development, Model S-4400, is a 36-watt add-on basic amplifier and stereo preamp on a single chassis, for converting monophonic music systems to stereo. Matching the other Sherwood units in style, it's 10-in. depth permits bookshelf mounting. To make a dual 36-watt stereo system in conjunction with the Sherwood T-166, a small basic 36-watt amplifier. When used in this fashion, only the S-4400 need be accessible. The S-4400 offers the important control features essential to stereo operation. There is also a volume control, stereo normal/reverse switch, and phase reversal switch. The four modes of operation—stereo, stereo-reverse, mono 1, and mono 2—are determined by a stereo pickup on a monophonic record associated with the vertical rumble and scratch components are blocked by the function switch, which also operates a dual-limiter circuit for lights. In addition the unit incorporates the controls found on all Sherwood amplifiers. Frequency response is 20 to 20,000 cps within 1.5 db at full rated output, with 0.5 per cent intermodulation. Preamp controls are designed for complete technical specifications with Sherwood.

- Precise AM FM Tuner. A newly-developed dual-limiter circuit designed to improve selectivity is featured in the Per- fecta, an AM-FM tuner recently added to the line. New Golden-Arms speaker unis and chassis, manufactured by Precise Development Corp., Oceanside, N. Y. Also featured in the tuner is variable automatic frequency control. Coupled with the dual-limiter circuit, the tuner is capable of high sensitivity, as ability to bring in even weak stations and "lock" them. An output meter assists in tuning by giving visual indication on both AM and FM. Other features include an enhance follower output, Poster-Seeley discriminator, synchonizing tuning, ferrite loop antenna, and 3-gang variable capaci- tor. A rich white-and-gold front panel harmonizes pleasingly with a handsome charcoal grey case.

- Efficient Stereo Headset. The SP-3 Stereo headphone is unique in that it reproduces full frequency range of 20 to 10,000 cps by means of 35-in. dynamic re- particular speakers incorporated in each earphone. Specially constructed to overcome the congested sound found with headphone listening, it presents the full dimensional effect of stereo. Since

- Tape Conditioner. A convenient, com- pact attachment which applies a newly- developed tape conditioning fluid to tape in any player or recorder is now being marketed by the Electrical Chemical Special- ties Company, St. Paul, Minn. Built to fit all tape machines, the Tower applicator applies a measured amount of Long Life tape conditioning fluid to magnetic tape as it is run through the recorder. The conditioner removes dirt and other contaminants from the tape and reduces friction on leads and guides. The applica- tor is included as part of a new Master kit, containing Long Life cleaner, lubricant and conditioner, packed in 2-ounce squeeze-feet plastic bottles.

- Floor Speaker Systems. Two new speaker systems, engineered by the Moore Manufacturing Company of England, are now available to music lovers of this country. The Model TP-1, illustrated, is a compact cabinet type utilizing dual horns. Middle and treble horns are dispersed uniform- ly by a radial horn of unique design. In the bass range, the driver unit is efficiently coupled to a flat baffle of a folded horn utilizing the corner of the room as a prolongation of the horn struc- ture. The PM-3 driver system comprises in the TP-1 is an unusual 8-in. twin-cone unit with a large magnetic structure which provides a gain flux of 25,000 gauss. Developed specifically for the TP-1 enclosure, the PM-3 has a frequency range of
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RECORDS
(from page 52)
do a jazz beat—double speed—when we’re asked to “keep time” with any music. Just watch any handy foot tapper. At double speed you’ll turn purple and gasp for air long before the music ends.

If you ask me, you’ll better forget the whole thing and go buy the original discs from which these assorted excerpts were taken. Just listen; it’s easier.

Steel Drums. Hifirecord RB17 stereo

This unprintable recording of the great steel drum phenomenon is a wha-wa, made on-the-spot in the best recording tradition with assorted semi-native singers doing solos off-mike here and there, plus assorted shouts and exclamations in the background suggesting the proper crowd of local folk, clustered around. Good, and superbish, my only question being WHO ARE THEY? What name? What Island?

I’m just wondering why a steel band should have to be anonymous, even as to geography. Maybe the musician’s union has got around to oil drums.

OSCILLATOR CIRCUITS
(from page 26)
tween emitter and ground and 75 ohms from emitter to negative supply were tried. Some improvement was evident, but the circuit was still too critical for comfort.

The next step was to use a positive supply. This would be good if a separate positive supply were available and can be used quite readily with the circuit at Fig. 10. But it was appreciated that such a positive supply might not always be available as a separate entity. Consequently another possibility was considered, that of using a portion of the main supply and bucking out the effective external resistance in the emitter of the gain stage.

This was achieved by making the collector resistance of the gain stage equal to both collector and emitter resistance of the phase-inversion stage. To avoid the emitter follower currents interfering, their resistors were returned to supply positive so that their current did not pass through the common resistor. This gave the additional feature of allowing the emitter followers to operate at a more realistic current value so as to achieve their full current amplification, which was particularly difficult in the case of the first one, when the emitter-to-ground voltage was only of the order of one or two volts.

By making the fluctuating component of current in the gain stage and the phase inverter equal, due to the fact that the voltage swing on both is the same, results in virtually zero swing at the negative end of the dropper resistor, which is the bottom end of the emitter coupling resistor of the phase inverter and the emitter itself of the gain stage. This point also becomes the
The preamplifier has been in use at the author's home (north of Schenectady, N.Y., elevation 400 feet) now for over eight months and has been most helpful in increasing the enjoyment of FM listening. During this period of time 58 stations have been logged. Consistent reception of stations 150 to 200 miles away has been the reward for installing this little gem. Stations have been heard using the preamplifier that were literally buried in the noise otherwise. The greatest distance logged while using it was close to 300 miles. Almost any time, day or night, 20-30 stations can be tuned in that are of listenable quality. The antenna used is a six element Yagi, mounted about 25 feet above the ground. The tuner is one of outstanding reputation and of excellent design. The preamplifier has been used with several other dissimilar receivers with a variety of antenna systems, and located in diverse places. Not in one instance did the preamplifier fail to show either some or marked improvement. The improvement was most impressive when the preamplifier was used in conjunction with tuners of poor noise figure or marginal over-all gain.

Because of the lack of high selectivity preceding the first stage of the preamplifier, there may be some ghost signals of "birdies" from a local FM station. Although the receiver, a trap tuned to the local station and inserted in the transmission line from the antenna as close to the preamplifier as possible may help minimize this difficulty. Some receivers have no tuned circuit preceding the first r.f. amplifier stage (often the grounded-grid type) and a local FM or TV station may cause similar trouble. In this case best rejection of the ghosts may be accomplished by inserting the trap between the preamplifier and the tuner. This latter method of providing extra selectivity prior to the tuner may minimize ghosts due to too high a signal level being delivered to the FM set from the local station.

The author would like to thank Henry W. Griffin, Jr., for his help in the design and testing of the preamplifier.

**References**


**FM-BAND RECEPTION**

(from page 21)

d.e. plate voltage to the first tube. Compress or expand $L_1$ to get maximum signal at the output. Then compress $L_1$, to reduce the output voltage by about 20 per cent. This completes the alignment. The correct adjustment of $C_S$ and $L_1$, which is necessary to get the lowest possible value of signal figure, can be made more rapidly with a noise generator, quite a rare item among most experimenters. Details on using a noise generator are given in chapter 14 of reference 2b. However, good results can be realized using the method outlined above. An Fig. 1 illustrates, the knob which controls $C_S$ is provided with a paper scale calibrated in megacycles (80-100) and glued to the panel.

**Performance**

The preamplifier has been in use at the author's home (north of Schenectady, N.Y., elevation 400 feet) now for over eight months and has been most helpful in increasing the enjoyment of FM listening. During this period of time 58 stations have been logged. Consistent reception of stations 150 to 200 miles away has been the reward for installing this little gem. Stations have been heard using the preamplifier that were literally buried in the noise otherwise. The greatest distance logged while using it was close to 300 miles. Almost any time, day or night, 20-30 stations can be tuned in that are of listenable quality. The antenna used is a six element Yagi, mounted about 25 feet above the ground. The tuner is one of outstanding reputation and of excellent design. The preamplifier has been used with several other dissimilar receivers with a variety of antenna systems, and located in diverse places. Not in one instance did the preamplifier fail to show either some or marked improve-
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ABOUT MUSIC
As The Expression Goes...
HAROLD LAWRENCE

During the reign of Louis Philippe, an amateur choral society founded by
the Prince de la Moscova gave some eccentric performances at the Church of
Palestrina. "It was their custom," wrote Saint-Saëns, "to sing the greater parts
of these pieces pianissimo and with extreme slowness, so that in the long-
held passages the singers had to be divided, some of them carrying on the
sound when others had exhausted their breath, and although a few
musicians grumbled at the absurd treatment, the mid-19th century public as
a whole accepted it complacently. Palestrina, after all, had left nothing for
discovery; the music is too ulterior for the modern interpreters but
the notes themselves; and the Prince, determined by no indications of
pace, dynamics, and phrasing, gave free reign to his "imagination."

Had Palestrina been born half a cen-
tury later, the Prince might not have dared
to turn the line of composer's music into
a breathing marathon. But it was not until
the middle of the 19th century that the
expression mark became universally
adopted. The verbal notations which musi-
cians employed constituted a simple lan-
guage; speed was indicated then as now by
such terms as adagio, allegro, allegretto; vol-
ume by piano, forte, etc. Italian went over
French and English as the language of
"expression" due to the wide distribution
of Italian madrigals in the early part
of the century.

There was no reason for the
Baroque composer to sprinkle his music with
addition of expression marks. Apart from
the essentials of tempo and intensity, his
music clearly dictated its own expressive
course. Expression marks were therefore utilized
only to avoid possible ambiguity. (Bach
dispensed with them altogether in the
Tritt Tempus Clavic.) Even tempo mark-
ings were often omitted when the composer
felt their inclusion superfluous. The modern
interpretor need only follow J. S. Bach's
sound advice in his book, Essay on the
True Art of Playing Keyboard Instro-
ments, to do the right thing by the Baroque
repertoire: "The pace of a composition...

is based on its general content as well as
the fastest notes and passages contained in
it. Due consideration of these factors will
prevent an allegro from being rushed and
an adagio from being dragged." Choice of
tempo is also dictated by the place in which
the work is performed—and this applies
obviously to all forms and periods of music.
To secure the utmost clarity, one must
adjust the speed to the hall's acoustical
properties. One of the reasons church per-
formances are generally unsatisfactory is
that the performer rarely takes into con-
sideration the long reverberation period.

The vocabulary of "expression" grew
along with the development of instrumen-
and orchestral music. Where, for example,
and for a piece of a keyboard work by Bach
might contain such indications as Allegro, piano
and forte, a page of Beethoven might be
filled with the following markings: Fière,
ma non troppo, sempre legato, p dolce,
adagio expressivo, and a liberal assortment
of pianos, fortis, crescendo and diminu-
endo. Note the embellishment of certain
terms: vivace shoe troppo p dolce, adagio expressivo. In a letter writ-
ten in 1817, Beethoven spoke of these
"headings, inherited from times of musical
barbarism, by which we describe the tempo of
a movement. What, for example, can be
more absurd than 'allegro' which, once and
for all, was unfortunately adopted? How far removed we often are from the
meanings! How often a piece of music expresses the very oppos-
itive of its heading! . . . I have often
thought of giving up all those absurd words
allegro, andante, adagio, presto."

Beethoven never carried out his threat
to abandon Italian terms, though he
broadened the headings with such words as "appre-
sionato, molto cantabile, expressivo, and so
on. The linguistic revolution he hoped for
was brought about instead by the Romantic
composers who, spurred on by nationalistic
impulses, reverted to their native tongues.
An outcome of this movement was greater
freedom of expression and more detailed
indications.

In more recent times, one of the most
colorful of expression marks is one of the
"expression mark is Percy Grainger. Virtually
all of Grainger's indications are written in a
sort of open-air English that turns the
standard Italian markings into vapid sym-
ols. Here is a partial list of Grainger's
expressions with their traditional counter-
parts:

Grainger	Italian

louden	crescendo
loudly	expressivo
soften and alenèk
dim. e rit.
louden lots	moto crescendo
dim. e rit.
slow off
dim. non rit.
slow off lots
tutti rit.
sharply
accelerando

Not content to substitute his own expres-
sions for the Italian, Grainger has also
focused his attention on the names of
instruments. In his orchestral scores, viola-
s are "biddles," violins "middle-fiddles,
"cellos "bass-fiddles," and percussion instru-
ments of definite pitch "tuneful percu-
sion."

There are only remote Italian transla-
tions for the following Grainger instruc-
tions: "With Healthy and somewhat fierce
go", and "wrenchen forte."

Few composers have displayed as much
consideration for the lowly instrumentalist
as did Grainger in his Lincolnshire Posy.
At the bottom of one page he wrote, "The
flugelhorn or soprano saxophone soloist
may, if he likes, use his own expression
marks, in place of those printed."

Along with the flowering of the Romantic
Era came a certain verbal extravagance,
which often confuses the performer with
some rather interesting musical challenges.
A case in point is Moussorgsky's Pictures
at an Exhibition. One particular phrase is

* 86 W. Ninth St., New York 11, N. Y.
marked poco ritard con dolore. As R. W. Wood pointed out in his article on expression (Music & Letters, Oct. 1930), "If the pianist duly regards the poco ritard, the piano, the <>, and the slurs it virtually impossible for him to do anything further. If one does it (dubiously) with suitable, well and good, if not, the performer is not to blame." Other examples mentioned by Mr. Wood include Holbrooke's "Moving comically, grim, and piously," Debussy's "this rhythm must have the sonorous value of a sad and frozen landscape." Wagner's many sorts (tender), and Elgar's nobilitantes (nubly). "All they actually convey," concludes Mr. Wood, "is how the passage in question always sounds to the composer himself.

But is it that simple? According to this line of reasoning, of what possible value to the player in the unscientilc nobilitantes? Would the conductor approach the score any differently if it were not there? What specific ingredient does it call for? Logically speaking, it is a superfluous marking. Can we dismiss it however because it fails to concern itself with isolated points of tempo, dynamics, touch, phrasing, bowing, and other technical details? It is true, of course, that a sensitive performer will probably forego the expression inherent in a given musical work, with or without the "guidepost." But what Mr. Wood calls the "loose thinking" expression mark nevertheless serves a thoughtful and far from loose purpose. The appearance of a sort or a nobilitante at a certain point in the score might suggest a restating of a phrase or accompanying a sudden shift in dynamic values. Should the performer and suggest to him that the composer attaches a special meaning to the passage in question, one that could not be conveyed by the traditional marking. In plain words, the composer hopes to put the performer in the sound. No one blames the conductor who supplements his stick technique with a large repertoire of facial expressions, gestures, and even choreography of a sort, so long as the ultimate result is a great performance. Why then should not the composer employ unusual verbal means to obtain a deeper understanding of his intentions?

The inevitable outcome of the growth of the expression mark in the 19th century was its abuse, not only by composers, but by publishers of older music. Editions of Beethoven, Schumann, and Wagner appeared in pre-attack markings in such profusion that it was sometimes difficult to see the notes for the marks. Early 20th century Erik Satie satirized the "over-expressive" score in his own music by filling his pages with such whimsical instructions as:

Ne forcez pas (Don't turn) Gratter (Scratch) Monner (Smile)
Ne prenez pas (Don't speak)

Igor Stravinsky, whose own scores are models of clarity, has some cogent thoughts to offer on the subject of the expression mark. "No matter how seraphically a piece of music may be notated, no matter how carefully it may be rendered, no many possible ambiguity through the indications of tempo, slurring, phrasing, accentuation, and so on, it always contains hidden elements that defy definition, because verbal dialectic is powerless to define musical dialectic in its totality."

This, of course, is where the interpreter takes over; it is his task to respond to all directions implied in a musical work, using the expression mark merely as a valuable guidepost.

---

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LOUDSPEAKER DISTORTION
(from page 28)

The question arises now as to what can be done to reduce this type of distortion. Fortunately there are several relatively simple means to minimize the condition. The most effective is to employ a two- or three-way speaker system. Examination of the distortion factor equation shows that the distortion is a function of the modulated frequency. Therefore, instead of employing a single speaker to generate both 40 and 10,000 cps, it is advisable to employ two emitters and a cross-over network designed for, say, 250 cps. In this case, then, the highest modulated frequency would be 250 cps instead of 10,000 cps, and the resulting distortion would be approximately 1/40 as large.

To gain some idea of the amount of distortion involved in the case of a single speaker emitting both 40 and 10,000 cps, simultaneously, consider a 16-in. speaker radiating 1 watt at both these frequencies. The cone amplitude at 40 cps, as shown on Fig. 1, comes to 0.289 in. The distortion factor, then, amounts to

$$D. F. = 0.033 \times 0.289 \times 10000 = 93 \text{ per cent.}$$

Figure 2 shows this graphically.

In the case of the two-way speaker system with the 250-cps cross-over, which radiates 40 and 250 cps simultaneously at 1 watt, the frequency modulation distortion will be only 1/40, or approximately 2.4 per cent.

Another means for still further lowering this type of distortion consists in using more than one large woofer. The reason for this, of course, is that the distortion is dependent on the travel required by the cone in emitting the low frequencies. This travel, for a given sound output, is in turn dependent on the cone diameter (actually the projected area of the cone, which is a function of the cone diameter).

Still another means of distortion minimization consists of employing a horn for the low-frequency speaker, because this device assists in reducing cone travel for a given acoustic output power requirement.

The writer has made many qualitative evaluations of this type of distortion. It should be noted that the distortion is not dependent on the amplitude of the modulated frequency, but on the amplitude of the modulating, or low, frequency. In the absence of other forms of distortion, frequency-modulation distortion appears in the form of a flutter, and is most easily recognized during the reproduction of sustained low-frequency piano tones, while a high-frequency note, possibly from another instrument, is also being reproduced. As noted above, however, other forms of distortion, especially intermodulation distortion, should be at a minimum when such a listening test is made. Possibly the best way to conduct a test of this type is to make an A-B test, using a single speaker and a two-way speaker system during the reproduction of sustained music tones, switching quickly from one to the other system, so as to be able to hear the same signal from both types of emitters.

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Circle 64B

Jazz
(from page 55)

published in the record business since
the advent of stereo and this is one of the
indirect benefits passed on to the listener.
The death of Sidney Bechet left only one jazz
musician whose main instrument is the so-
proach sax. In a perfect preparation for the
work of Thelonious Monk, as both present difficulties immenurable by
having less than a disciplined and infallible
spirit. In accepting the challenge, Steve Lacy
plays some of his pieces from the early 50's,
only one of which was recorded before by any-
one but the composer. Zoot Sims did Bye-by,
and the others have drawn more than res-
pect, despite the increased attention they are receiving since Monk's rise to
fame.
In transferring the pianist's style to soprano
sax, Lacy retains its important qualities and
proves to have a dedication as strong as one of
the tenor men associated with it. By assum-
ing many of Monk's thematic duties in the
quartet, he leaves the drink for his own gir-
l and Waldrin, who is left with consider-
able freedom for individual comments. Kurti
Nendinger, bass and drummer Elin Jones
round out the group. A young man to watch.
Lacy is to be congratulated for keeping
the distinctive sound of the soprano sax alive in
modern jazz.

Carlos Montoya: Presents Porrina De Badajoz
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Two imports from Spain offer different ap-
proaches to the flamenco tradition. During his
search for new talent last year, Carlos Mon-
toya came upon one personality he believes to
be outstanding in the field of pure flamenco.
They met in Madrid for the intimate collabora-
tion which occurs when a great guitarist im-
piares a world with a singer or a player
is a master of the art. Porrina de Badajoz, a fellow
gypsy from the company of Conchita Pieger, is
fitted with a masterful voice that is flexible
enough to encompass the dynamic range de-
manded of it. The gipsy girls are intense and
full of moly vigor, yet finely shaded.
The recording is close and defines each detail.
Los Macareno live and perform at Serre Monte,
the hills and caves of Granada, but they have
to a Barceloq studio to present a group of
type my music. It comes complete with castanets, rhythmic
beats, and spontaneous outbursts from the singers. Join-
ing them all together are the continuing patterns
set by the guitarists. Here a more
distant recording accommodates the entire
panorama.

Interference
(from page 27)
on the input cable, a physical position of
the cable can usually be found which
will eliminate pickup of the r.f. signal.
Perhaps moving it away from power
leads, or running it under a corner of
the amplifier will remove the signal.
In some cases an earth ground for the
amplifier will remedy the disturbance.
One of the above suggestions, or a
combination of them should prove effec-
tive in the reduction or removal of
radio frequency interference.
**Industry Notes**

**LING ACQUIRES UNIVERSITY,** Acquisi
tion of University Loudspeaker, Inc., was recently announced in a joint state
ment by James J. Linn, board chairman of Linn Electronic, Inc., and Sidney Levy,
president of University. The company was purchased for a total of $240,000, $12,000,000 of which was in cash. University will be a wholly
owned subsidiary of Linn Electronics, Inc., and its production will complement those of
Altec Companies, Inc., also a Linn sub-
sidy. University will continue to operate
under its existing name and will not be
changed as a product and brand identification.

**RANK ACQUIRES WHARFEDALE,** The
Rank Organisation, Ltd., London, Eng-
land, has taken over Wharfedale Wireless
Works, Ltd., Bradford, Yorks. A Briggs
remains as managing director of the firm
which manufactures and markets Wharfe-
dale loudspeakers on a worldwide basis.
Wharfedale speakers and systems will
continue to be distributed in this country
by British Industries Corporation.

**MRIA ELECTS OFFICERS,** Herbert L.
Brown, vice-president of Ampex Audio, is
the newly elected president of the Mag-
etic Recording Industry Association.
Other officers newly chosen are: vice-
president, Ken Bishop, general manager of
Bell Sound Systems, Inc.; treasurer,
Charles Murphy, president of Michigan
Magnetics, Inc.; treasurer, George Kor-
brodt, sales manager of Audio Devices,
Inc. Elected to serve as members of the
board of directors are: Harvey Diny, gen-
eral manager of Magnecord, Inc.; Victor A.
Miller, president of Magnecord, Inc.; Charles
Hopkins, president of K & K Magnetics,
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**RIGO FALL SHOW SCHEDULE,** Eight
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November 16-17; Philadelphia, November 23-24; Los Angeles, October 30-November 1.

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**Industry People...**

Oliver Berliner, author and sound sys-
tems authority, has been named a direc-
tor of Studio Electronics Corporation, Bur-
bank, Calif., where he will serve as sales
and advertising manager. ... Off on a
combination business trip to the capitals of Free Europe is Harry
Ashley, president of Audionic Instrument
Co., Inc., makers of RICO hi-fi equipment.
A. J. Romano has been appointed sales
manager of the Radio Division of Audio
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is buyer for the new E. J. Korey & Co.,
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