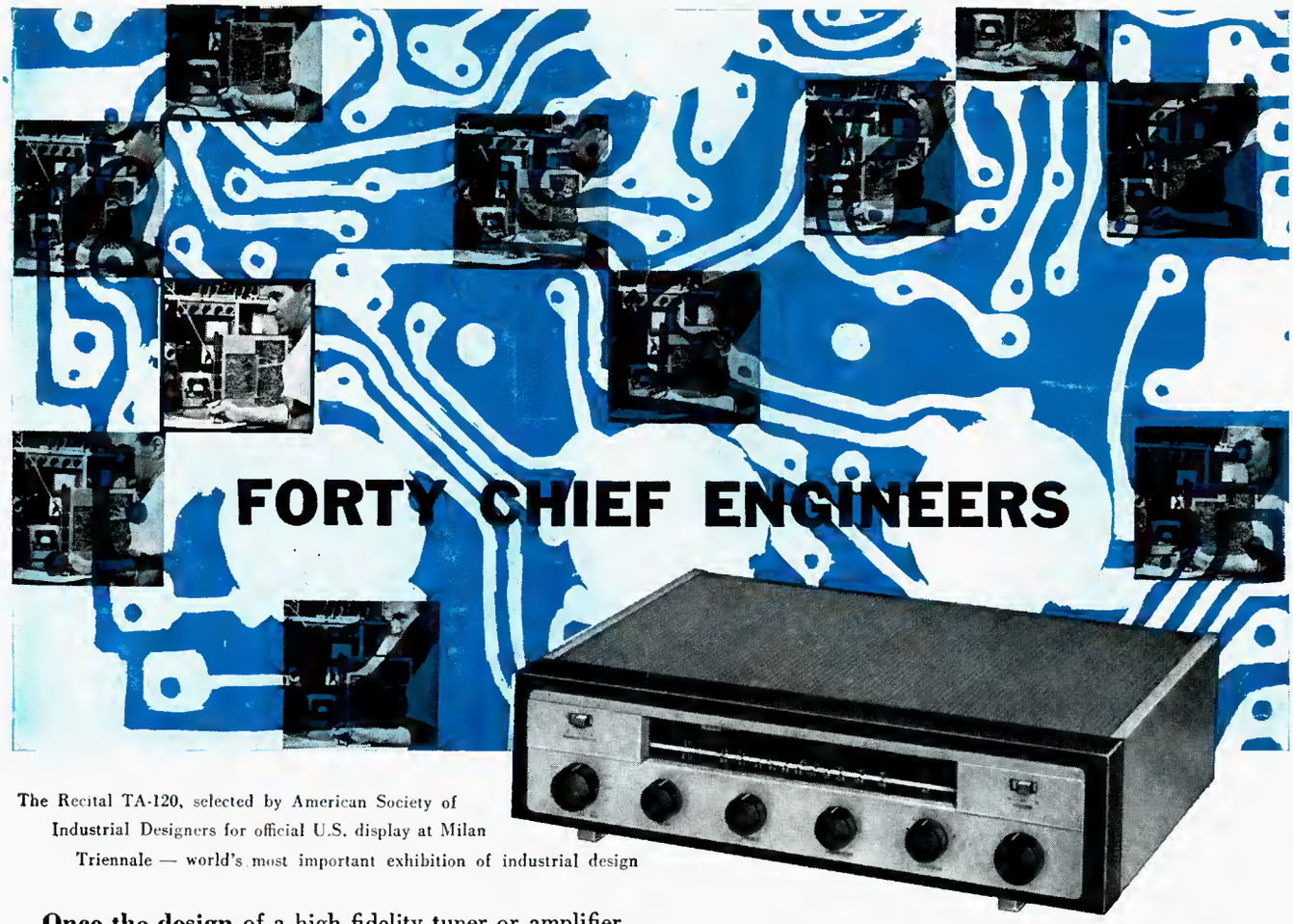
AUDIO

SEPTEMBER, 1957
50¢



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The Recital TA-120, selected by American Society of Industrial Designers for official U.S. display at Milan Triennale — world's most important exhibition of industrial design

Once the design of a high fidelity tuner or amplifier has been completed, the chief engineer is entirely dependent on how well the factory can reproduce it.

In a sensitive high fidelity instrument, the location of its component parts is extremely important. As little as 1/32 of an inch can make the difference between routine and superb performance. This critical relationship can often be compromised by the conventional production method of hand wiring. Subtle wiring variations, unintentionally introduced by production people, can result in wide variations in performance between sets produced on the same production line.

Were it possible to place the chief engineer at each of our forty final test positions, he could undoubtedly correct those compromises and make each instrument the perfect translation of his design.

Harman-Kardon has, in effect accomplished this objective by the creative application of printed wiring. Its use in every Harman-Kardon tuner and amplifier has virtually eliminated human variables in production. In each instrument every part is in its one best position with respect to every other part and all the interconnecting wires are of precisely the correct length and in precisely the correct place. This is one of the reasons why the Harman-Kardon tuner or amplifier you buy is certain to equal the performance of the original engineering design.

Printed wiring *is the technique which can effect perfect reproduction of the engineer's design every time. The process literally prints the interconnecting wiring of the instrument by etching it on a laminated phenolic sheet. Electrical components are fastened to the sheet by automation equipment and the sheet is then dipped into a bath of solder. In this manner each element is locked into its one best position.*

This process has been perfected and proved in the U.S. Guided Missile and Earth Satellite programs—and in the production of radar and the new computers. Here, where emphasis is on precision, reliability and quality—and where cost is not a factor—printed wiring is the *production choice.*

Typical product of the marriage of creative engineering and ideal production technique is the new Harman-Kardon Recital Model TA-120. It combines a highly sensitive AM-FM tuner, a complete preamplifier and a 20 watt hum-free, distortion-free power amplifier. It features: magnificent Armstrong FM with Automatic Frequency Control to insure accurate tuning automatically; sensitive AM with automatic volume control and built in ferrite antenna; dynamic loudness contour control to provide precise balance for your own hearing characteristics; enormously effective bass and treble tone controls to adjust for the acoustics of your room; selectable record equalization; remote speaker selector switch and rumble filter.

The Recital's "Controlled H" circuit operates so efficiently that it creates less heat than conventional instruments which deliver only half its power output. The enclosure and control panel are finished in brushed copper, the knobs and control panel frame in matte black. The Recital is 14-3/4" wide by 3-5/8" high by 10-15/16" deep. Simply plug in a suitable loudspeaker and record player and a high fidelity system of incomparable performance and unique good looks is yours. **The Recital Price is $189.95**

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3-SPEAKER SYSTEM
Model SFB-3

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(For details, please see other side.)



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SFB/3
Windsor Deluxe
$249.00

The Sounding Board

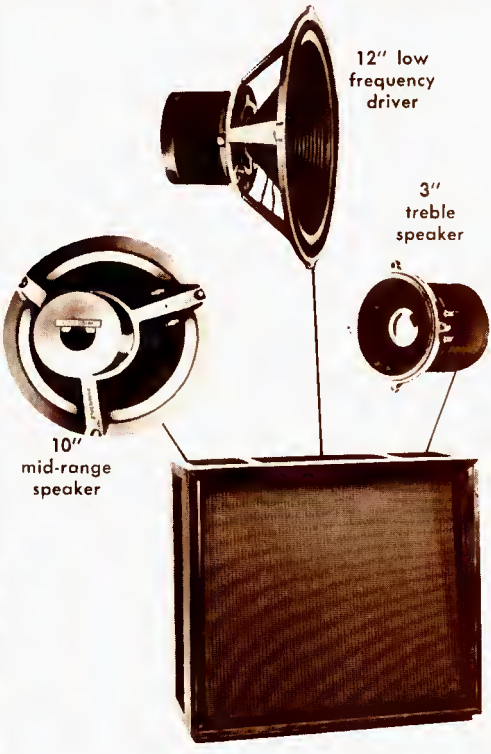
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- **OMNI-DIRECTIONAL**
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- **MODERATE PRICE**

Speakers:
Specially built, 12" low frequency, 10" mid-range and 3" treble, tuned and integrated for optimum reproduction.

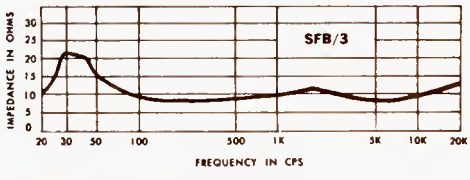
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Impedance:
System impedance 15 ohms.

Weight:
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Size:
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SEPTEMBER, 1957 VOL. 41, No. 9
Successor to RADIO, Est. 1917.

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CONTENTS

Audioclinic—*Joseph Giovanelli* ... 2
Coming Events ... 4
Letters ... 6
About Music—*Harold Lawrence* ... 8
New Literature ... 9
Editor's Review ... 14
The Violin and Its Hi-Fi Analogies—*Antony Doschek*—Part I ... 17
A Transistor Playback Amplifier—*F. E. Wyman* ... 20
The Third Dimension in Sound—*The Engineering Department of Radio Craftsmen* ... 22
Auditorium Acoustics and Control Facilities for Reproductions in Auditory Perspective—*E. H. Bedell* ... 24
Transistor Tone Control Circuits—*F. D. Waldhauer* ... 27
Equalizer Design—*Norman H. Crowhurst*—Part II ... 34
Two-Channel Transistor Remote Amplifier—*Donald K. Haahr* ... 46
Equipment Review ... 52
—*Miracord phono equipment—Acoustic Research AR-2 speaker—Grado magnetic pickup—Audette Sr. loudspeaker*
Record Revue—*Edward Tatnall Canby* ... 58
Audio ETC—*Edward Tatnall Canby* ... 68
Jazz and All That—*Charles A. Robertson* ... 72
New Products ... 78
Industry Notes and People ... 95
Advertising Index ... 96

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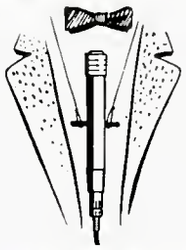
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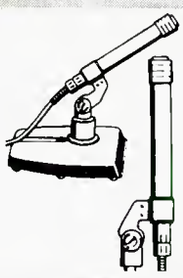
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AUDIOCLINIC??

JOSEPH GIOVANELLI*

Conversion to Stereo

Q. I am a musician and as such wish to hear music reproduced as realistically as possible. I should like to convert my present tape machine to stereo in a way which will be simple and easy, as I am not a good technician. Please explain the steps necessary for such a conversion. Douglas B. Hagen, N.Y.C.

A. Before describing the conversion procedure, I shall briefly review the operation of stereo equipment. Most stereophonic tapes available for home use are intended for two-channel operation. With the shiny side of the tape facing the viewer, the upper half of the tape is intended for the left speaker, while the lower track is intended to feed the right speaker. There are two possible head placements. One makes use of two separate heads, one to reproduce the upper, the other to reproduce the lower track. These heads are placed side by side with a definite distance between their gaps. In order that the tracks bear the proper relationship to each other, the master recorder is equipped with heads similarly placed. This system is known as the *staggered head* system. This arrangement has the drawback of making tape editing virtually impossible. Further, if the tape breaks and is then spliced, the effect upon the listener will be that of having two splices, rather than the one actually made. This is caused by the splice having first to pass one head and then, a fraction of a second later, having to pass the other.

In the other, and preferred, system the heads are made in the form of a single unit about the size of the conventional monaural head. This unit consists of two heads, each of which is slightly less than half the width of the tape, and are spaced apart so as to hold down inductive coupling between them. The gaps into which the magnetic flux variations from the tape enter are so arranged that one is directly above the other. For this reason, the system is called *in-line* or *stacked*. Editing is as easy as for monaural tapes.

Regardless of which system is used, each head feeds its own properly equalized preamplifier, which in turn feeds its own power amplifier, which in turn feeds its own loudspeaker. The effect is that of having two tape recorders in perfect synchronization, each complete in itself from input to output.

If your tape machine is one of the half-track models, you may wish to use staggered heads. However, it may be impossible to mount the head for the second channel at exactly the right spacing on the recorder chassis, because of other parts. If you intend using stacked heads, the normal procedure is to remove the existing head from the machine and insert in its place the stereo head. If your machine is one wherein the erase, record, and playback functions are all combined in one head, the recording function would be lost. This is an undesirable state of affairs. It is for this reason that I avoided stereo until recently.

My problem was solved by a new, ingenious little package marketed by Dactron. It consists of a stereo head and adapter, together with a transistorized tape preamplifier. One stereo channel is fed into the tape recorder's own amplifier, while the other channel is fed into the transistorized preamplifier. Of course, their respective outputs are channeled into proper speakers and/or amplifiers.

The head unit itself is designed to mount to the case in which the tape machine is housed. In normal operation, threading proceeds through the stereo head, through the capstan-pressure roller combination, to the take-up reel, completely by passing the machine's own head(s). Since this head need not be removed, the tape recorder can still be operated in the conventional manner. Of course care must be taken to insure that the tape travels as directly as possible. The more devious the path, the greater is the chance of wow and of damage to the tape. If possible, the heads should be positioned for minimum hum, although a compromise in favor of a good tape path may have to be made. By using *dual conductor shielded cable* AND IN ALL OTHER WAYS FOLLOWING INSTRUCTIONS, excellent operation will be had. The only tools we needed were a soldering iron, a screwdriver and a pair of diagonal cutters. (If you haven't any, you can use your wife's scissors when she isn't looking.) In addition, you will need two wood or machine screws and a half dozen skirted plugs. There is no need for head alignment, as the guides on the adapter are positioned so that the tape is automatically placed at the proper azimuth. The path of the tape must be such that the edge is parallel with the motorboard. Final positioning can be done by moving the bracket in the screw slots after the screws are in. In order to maintain the required tape path, the head must not be very high above the motorboard.

Distributed Capacitance

Q. What is meant by distributed capacitance? Jerome Capuano, Otis, Mass.

A. Distributed capacitance is capacitance introduced unintentionally. The reasons for its presence are obvious when one realizes that a capacitor is made up of two conductors separated by an insulator. A vacuum tube contains a grid separated from all other elements by a vacuum. Since the vacuum separating the elements is a fine insulator, the conditions for the creation of a capacitance are fulfilled. The capacitances within the tube are small, but at ultrahigh frequencies and, quite often, even at much lower ones, these capacitances between elements can be serious shunts to the r.f. Because of their importance, these capacitances are listed along with other pertinent data in tube manuals.

Shielded cable is made up of an inner conductor and an insulated covering with a metal shield concentrically woven around the insulation. This also forms a capacitor. The longer the piece of cable, the greater will be the capacitance. This is very important even at the high audio frequencies and is one reason why high impedance microphones cannot be connected to excessively long cables. When this is done, the capacitance of the line will equal and surpass the impedance of the microphone at high audio frequencies, with the result that these frequencies will be attenuated.

An inductance possesses some distributed capacitance. An inductance is made by coiling wire. Some are space wound, so that insulated wire is not needed; others are close wound, so that the wire must be in-

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12 Noiseless Main Spindle: Rotates on specially designed bearing.

13 Automatic Start and Stop: Move tone arm to start; shuts off at end of record.

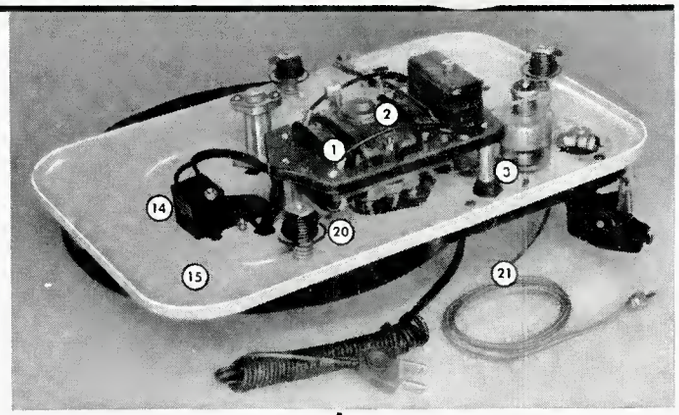
14 Shielded Condensor-Resistor Network: Pioneered by Garrard. No startling "plop" noise through speaker when player shuts off.

15 Heavy-Steel Unit Plate: A husky, rigid support for entire mechanism.

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17 Convertible Tone Arm "Safti-Rest": Supports tone arm—ready for play . . . simple snap locks it for safety in carrying.

18 Interchangeable Plug-In Heads: Accommodate users' personal choice of magnetic, ceramic or crystal cartridges; turnover, twist or simple plug-in types.



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sulated to prevent the turns from shorting. Although such a device is made up of one continuous conductor, it may also be thought of as being composed of many conductors, each of which is represented by its own specific turn. Regardless of the method of winding, each of these conductors is separated from the others by some kind of insulator, and hence we have distributed capacitance between one turn and every other turn making up the inductance. If the unwanted capacitance is great enough, it will seriously impair the functioning of the inductance over the band of frequencies on which it is used. This holds true not only for radio frequencies, but also for audio frequencies. It is a major problem in the design of transformers for high quality audio work.

A further problem arises when an inductance is housed in a metal can which is grounded to the chassis. Capacitance exists between the inductance and the can, whose effect will be to shunt out frequencies above a given point.

The fact that two wires are located near each other in a circuit can lead to trouble. In an r.f. stage their proximity may add sufficient capacitance to cause the stage to oscillate.

Not all distributed capacitances are undesirable. For example, certain oscillator circuits make use of the distributed capacitance between the grid and the plate of a vacuum tube to obtain the feedback necessary for oscillation.

Hum Reduction

Q. I am getting considerable hum in the output of my phonograph, despite the fact that my cartridge is not supposed to be susceptible to hum pickup and that I am using shielded cable. Can you explain what is going on? Robert Bravin, Hartford, Conn.

A. First, short the input to the phonograph stage. The hum should disappear. If it does not, then you will have to check such things as filter capacitors, faulty grounding somewhere in the circuit, and the like. The chances are, however, that the hum stems from the fact that you are using the shield to carry the signal from the pickup back to ground. This practice should be avoided whenever possible. Instead, dual-conductor cable should be used. One conductor serves as the ground return. The shield is grounded at the preamplifier's input, and nowhere else. A separate ground is run from the turntable assembly to the ground lead on your preamplifier. When the shield is made to return too many circuits to ground, the a.c. it carries will be of sufficient strength to cause electrostatic induction of this voltage into the hot lead, and then hum results. In the arrangement just described, however, the shield carries no signal, but serves as a Faraday screen against external hum fields.



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COMING EVENTS

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Sept. 12–15—Portland, Ore.: New Heathman Hotel (*Independent*).
Sept. 13–15—Sixth Annual Chicago High Fidelity Show, Palmer House, Chicago, Ill. (*Int. Sight & Sound Exposition*).
Sept. 17–21—High Fidelity Show, Morrison Hotel, Chicago, Ill. (*IHFM*).
Sept. 27–29—San Diego: Lafayette Hotel (*ACRA* and *IHFM*).
Oct. 7–12—New York High Fidelity Show, Trade Show Building, New York City (*IHFM*).
Oct. 18–20—Miami, Florida: McAllister Hotel (*Rigo*).
Oct. 25–27—Mexico City (*Independent*).
Oct. 30–Nov. 2—Toronto: Park Plaza Hotel (*Independent*).
Oct. 31–Nov. 3—Habana, Cuba: Copacabana Hotel (*Independent*).
Nov. 8–10—Seattle: New Washington Hotel (*Rigo*).
Nov. 8–10—San Juan, Puerto Rico: Normandie Hotel (*Independent*).
Nov. 22–24—St. Louis: Statler Hotel (*Rigo*).

OTHER EVENTS

Sept. 18—Chicago Acoustical and Audio Group. 7:00 p.m., Universal Studios. Subject: "New equipments and methods for magnetic recording on 16-mm film" by John S. Powers and Herbert T. Perkins, both of Bell & Howell Co.
Sept. 27–28—7th Annual Fall Symposium, Professional Group on Broadcast Transmission Systems, IRE. Willard Hotel, Washington, D.C.
Oct. 7–9. National Electronics Conference, Hotel Sherman, Chicago, Ill.
Oct. 8–12—Audio Engineering Society, 1957 Convention. Trade Show Bldg., New York.
Oct. 16–18—IRE Canadian Convention, Exhibition Part, Toronto.

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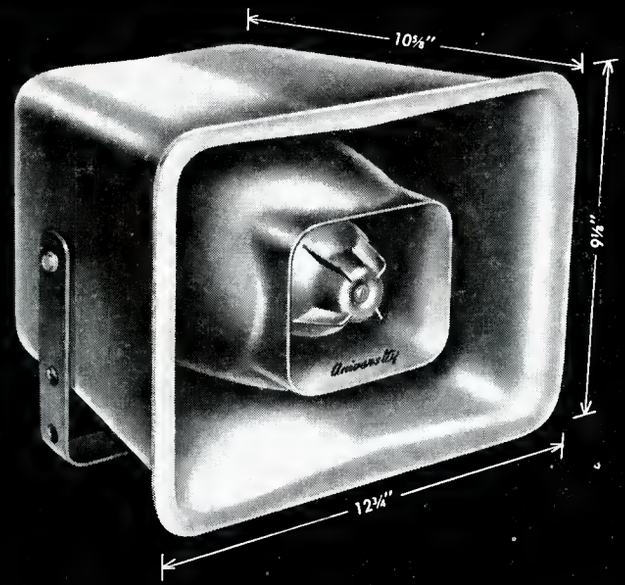
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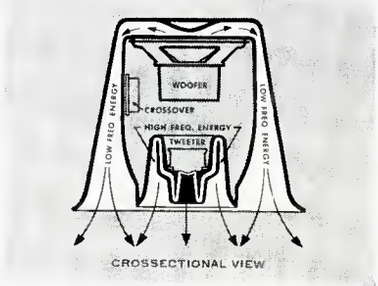
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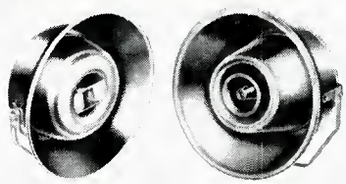
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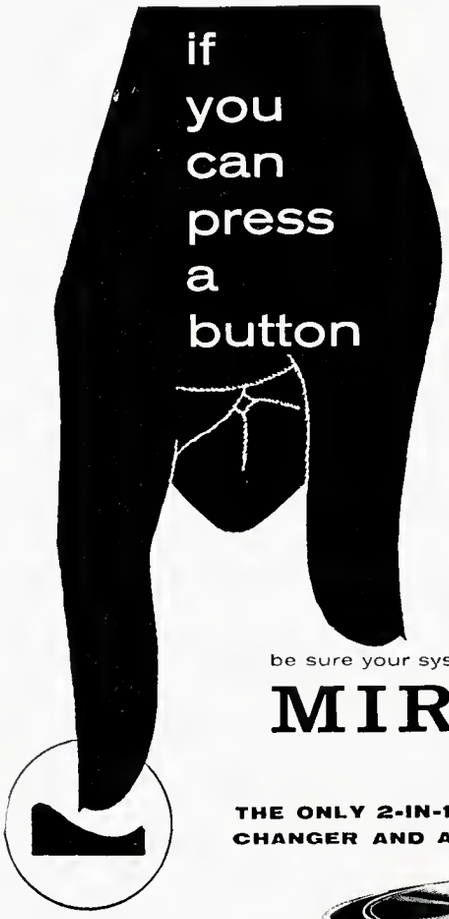
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LETTERS

Loudspeaker Enclosure

SIR:

It was with the greatest interest that I read Mr. E. de Boer's article, "The Aperiodic Loudspeaker Enclosure." Such a new approach to enclosure design is rare.

I take the liberty of drawing attention to one of Mr. de Boer's references to the article "Loudspeaker Enclosure Designs" (*Wireless World,* February, 1957) where he refers to the difficulty of damping several resonances by means of one resistance R′ in the analogue, connected in parallel with the inductance L′ representing the port mass. Whilst agreeing with Mr. de Boer, I would like to point out the system described in *Wireless World* uses two resistances, one in series with the inductance and one in parallel, right across the impedance representing the enclosure. The first represents the frictional viscosity at the edges of the port, and the second an area of acoustical dissipation formed in the enclosure walls. The port and the dissipation area form quite separate acoustic components and may be located in different parts of the enclosure. For convenience, however, an acoustical panel has been marketed embodying both components.

The advantage of the parallel resistance lies in the fact that at frequencies away from resonance, the over-all enclosure impedance is lowered, resulting in a higher cone velocity for a given input, and therefore higher efficiency. The problem of excessive cone amplitude does not arise, since in any good loudspeaker this condition only occurs at isolated frequencies due to resonances incurred by unsatisfactory enclosure design. If these are eliminated, then it is quite safe to raise the over-all velocity over a wide range of frequencies with consequent increase of bass power.

However, I would like to compliment Mr. de Boer on his ingenious design, and I am sure it will give excellent performance.

E. J. JORDAN,
Goodmans Industries, Limited,
Axiom Works, Wembley,
Middlesex, England.

Record Damage

SIR:

An experience of twenty five years in the retail record business enables us to recognize a serious problem in public relations. An increasing number of customers are bringing back microgroove records with the complaint that they are defective because "they skip" or are "scratched and keep repeating."

When this happens here, we immediately put the record on one of our players, and it plays perfectly. Some customers will then realize that their own player can be corrected to play properly. But the majority are unconvinced because "the other side plays all right" or "all my *other* records play all right" or "it's a new *HI-FI* and I know nothing could be wrong with *it.*" These statements are stereotyped; we know in advance the phrasing, the emphasis, and the attitude.

These obdurate individuals want one action only, and no talk—they want "a new, fresh record." We know from experience that giving it to them is no solution. If they are given one (and the record *with its groove walls broken down on their player* is put back into stock to resell as new, or returned to the distributor as defective—both vicious dodges) they find that the new record "repeats" in exactly the same places on their player.

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They are then more incensed and of the opinion that we sell only "worn out records." Worse still, these potential purchasers in their anger and frustration may stop buying records. This would be detrimental to the entire industry.

Who is responsible for the state of mind of these consumers and for the conditions which cause it? Is it the record dealer, who sold only the record and not the player? (We do sell record playing equipment, but we are careful to sell only such equipment as we know and can guarantee will not skip or repeat.)

Is it the record manufacturer?
Is it the player manufacturer?
Is it the cartridge manufacturer?
Is it the tone arm manufacturer?
Is it the stylus manufacturer?

An unco-ordinated industry is selling some incompatible components to the public, and the retail dealer gets the resulting blame, and often vituperation. The retailer also takes the direct loss of business. This is a rotten situation—entirely unnecessary.

As a dealer I protest and resent being the scapegoat who takes the brunt of the blame and the loss of good will. For the benefit of the public and the industry as a whole I ask that adequate measures of standards be established and thoroughly publicized.

I ask the record industry to support its product, and to establish measures which will exonerate and protect the retail record dealer from this abuse. And this it is possible to do by defending a product that is relatively uniform, usually made to close tolerance, and which *will perform properly on the majority of equipment.*

No "check your needle" operation, but an intelligently investigated and planned program is needed to recognize the real cause of the trouble and to correct it once and for all. The prevalent passive acceptance of normal merchandise as "defective" is no solution. Thousands of customers are *still mad.*

CHARLES W. FARRINGTON,
Farrington's Record Store,
649 Massachusetts Avenue,
Arlington, Mass.

Imitation Stereo

SIR:

Stereo, what sins are committed in thy name!

It is time someone spoke out against the faked-up recordings that are being sold to the public in the name of true stereo. Caught with a backlog of monaural masters, some companies are trying to capitalize on the swing to stereo by recording two identical monaural tracks and then using cross frequencies and similar devices to disguise the deception.

More and more of this ersatz stereo is being dumped on the market. This is a form of out and out cheating. The unsuspecting public is paying the full price for these releases under the delusion that they are buying true stereo. Their disappointment may well disillusion them with this new form of listening altogether. As a result, the stereo field is in danger of losing a great many friends.

An influential magazine such as AUDIO can do a great deal to alert tape buyers to this practice. In fact, all of us with a sincere interest in the field have a duty to warn them. Probably the best piece of advice is for the buyer to purchase his tapes through well established hi-fi and stereophonic dealers. Then he can be sure that the recordings represented as true stereo will be just that.

RICHARD CARLSON,
3727 Harriet Avenue,
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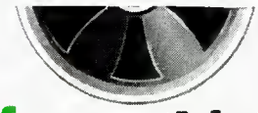
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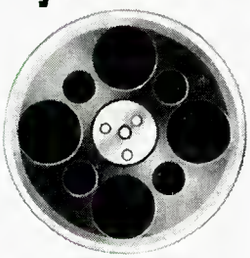
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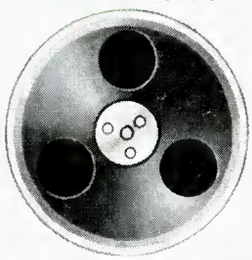
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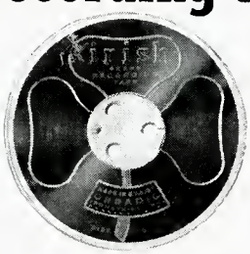
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ABOUT MUSIC

HAROLD LAWRENCE*

LP Repertoire—Nuggets and Fool's Gold

In 1923 not a single complete Haydn, Mozart or Brahms symphony had been recorded; music lovers could not obtain recordings of three of Beethoven's symphonies; and major works of any kind were hard to come by. Faced with these meager pickings, a group of intrepid English discophiles took the bull by the horns (or rather, the H.M.V. dog by the tail) and formed their own recording society. The members of the National Gramophonic Society, as they called themselves, voted for the works they wanted recorded, and pledged to buy them when they were issued. What an exciting moment it must have been for a society member to receive his copy of the great C Major Quintet [Op. 163) of Schubert—a recording which he helped finance, and which none of the record companies would record!

Microgroove techniques and the record boom have made recording societies obsolete (although the word "society" may still be found in the names of certain record firms, it no longer bears the same connotation). Without having its arm twisted, the record industry gladly turns out multiple versions of the "standards." Furthermore the LP catalogue is bulging with off-the-beaten-path repertoire from the complete set of *Concerti a Cinque* (Op. 9) by the 18th-century Italian composer, Albinoni, to the entire output of the contemporary miniaturist, Anton Webern.

In the frantic search for virgin musical territory, scores of works by minor 18th- and 19th-century composers have been roused from a deep slumber and trotted out for display. A number of these compositions deserve hearing, as Sir Thomas Beecham demonstrated in his recordings of Méhul overtures, Balakirev's Symphony in C, Bantock's *Fifine at the Fair*, and others. More often than not, however, many of these neglected pieces fade like colored display cards in a sun-baked shop window, when held up to modern light.

Conductors of international repute naturally give a wide berth to this repertoire, and the job of recording consequently falls to lesser known musicians and orchestras. In the case of a worthless score, no serious damage results. A piece of some value, on the other hand, urgently needs the strong hand of a creative musician to expose its virtues. An indifferent interpretation might perform the coup de grâce that would bury the work for good.

The theory that a famous composer's name will attract sales has accounted for some rather odd releases, including the dreary piano music of Wagner, Dvořák's melodramatic *Midday Witch*, Richard Strauss' early Brahms-tinted Symphony in F Minor, and Humperdinck's lurid *Moorish Rhapsody*, among others.

Such free-ranging activity in the field of recorded repertoire, however, can have real value. New insight into the creative evolution of a great composer may be gained by a study of the works which led up to his mature style. In the historical sense, the piano music of John Field and Johann Hummel gives us a fresh perspective on the era that produced the genius of Frédéric Chopin. And let's not forget the weary record critic who is deluged with duplicated versions of Tchaikovsky's *Pathétique* and the Beethoven Fifth; the interspersion of a totally unfamiliar symphonic poem by Chausson or an oratorio by Handel provides a welcome listening contrast.

Shortly after World War II, the Maharajah of Mysore, an arden music lover and discophile, formed a one-man recording society. While in England, the Indian potentate had come across music of a shy and retiring Russian émigré named Nicolai Medtner (1880–1951). In looking around for recordings of Medtner's output, the maharajah made the discovery that nothing but a tiny handful of piano pieces by this composer had been recorded. To remedy the situation, he founded the Medtner Society in 1948 and began to record the major works of the Moscow-born composer. Three volumes of discs were issued, containing all the Medtner piano concertos (3), and a large number of songs and piano works. That none of these works have survived in the microgroove age (the LP catalogue lists only one piece of Medtner) is an indication, if any is needed, of their perishable nature.

If the Maharajah of Mysore had begun his recording venture a few years later, he would surely have followed the trend of the times by issuing the "Complete Works of Nicolai Medtner." Until now, the popularity of the "complete edition" in LP discs has largely been confined to truly significant works and composers; e.g., the piano music of Ravel and Debussy, the symphonies of Mozart, the *Well-Tempered Clavier*, Sibelius' orchestral music, the Beethoven string quartets, etc.—all worthy projects.

But think of what might happen if, in the quest for new repertoire and complete editions, the record industry plunged head over heels into uncharted musical waters. Artist and repertoire directors would have their work cut out for them. They could lose themselves indefinitely in the 16th and 17th centuries going through the thousands of motets, masses, chansons and cantatas of Lassus, Josquin, Dufay, Byrd, Dunstable, and Palestrina. Alessandro Scar-

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

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latti alone composed some 500 cantatas, in addition to scores of other works. Only a fraction of Liszt's 700-odd compositions have been recorded. Reger's staggering output has barely been touched; nor has that of Sir Granville Bantock. And as for Bantock, the enterprising recording executive should know that a Bantock Society was formed in 1946 to promote that composer's music, with Sibelius as President, and Beecham as one of its members. With their help, he could make rapid progress in recording the half hundred orchestral works, 9 operas, and numerous pieces for band, piano, voice, and other media by this neglected English musician. The Mannheim School should also prove a repertoire gold mine, with its leader, Johann Stamitz, the composer of 50 symphonies and a dozen violin concertos. Bach's contemporary, Telemann, wrote 40 operas, 170 concertos, 600 overtures, 44 Passions, and countless other church and secular works. Among present-day composers, Villa-Lobos is easily one of the most prolific, with a total production past the two-thousand mark.

Certainly no one would suggest that all of the works mentioned above should be recorded. At the same time, a careful examination of the vast areas of unrecorded repertoire will reveal the LP repertoire well has not dried up. While such musical driftwood as Dittersdorf's *The Rescue of Andromeda by Perseus* and Nicodé's *Carnival Scenes* are bound to turn up regularly, we can also look forward to such rewarding "discoveries" as Handel's *Sosarme*, Boccherini's String Quintets, Warlock's Songs, and Liszt's *Christmas Tree* Suite.

Æ

NEW LITERATURE

● **Magnetic Products Division, Minnesota Minning and Manufacturing Co.,** St. Paul 6, Minn., devotes the current issue of "Sound Talk" to an article titled "Various Aspects of 'Tape Noise'." Written by R. A. Von Behren, the division's research and development manager, the article is entirely practical in approach and will be found of distinct value to engineers and recordists alike. Requests for copy should specify Bulletin No. 34. **J-1**

● **General Transistor Corporation,** 91-27 138th Place, Jamaica 35, N. Y., is distributing a new free wall chart which shows at a glance applications, maximum ratings and typical characteristics of 56 types of germanium junction alloyed transistors. Also contained on the chart is a handy interchangeability table, outlines of five different transistor cases, diagrams of various circuits and standard IRE symbols and definitions. Users of transistors may obtain a copy of the chart without cost by writing in care of the Promotion Department. **J-2**

● **Stereophonic Sound League, Inc.,** Steinway Hall, 113 W. 57th St., New York 19, N. Y., has recently released an 8-page booklet titled "Starting a Recorded Tape Library." Included are listings and reviews of outstanding stereo and monaural tapes of many major labels, based on quality of recording as well as on performance. Also incorporated in the publication is a reprint of the article, "Stereo, New Adventure in Recorded Sound," which appeared originally in The Carnegie Hall Program. Copy will be mailed free upon written request. **J-3**

● **Argos Products Company,** 310 Main St., Genoa, Ill., has available a handsome new folder which pictures and describes the complete line of "Californian" speaker enclosures. Sold either factory-built or in kit form. Californian models range from small corner enclosures suited essentially for sound reinforcement in audiotoria, restaurants, and the like, to full-size cabinets for home music systems. Copy of this catalog will be mailed upon request. **J-4**

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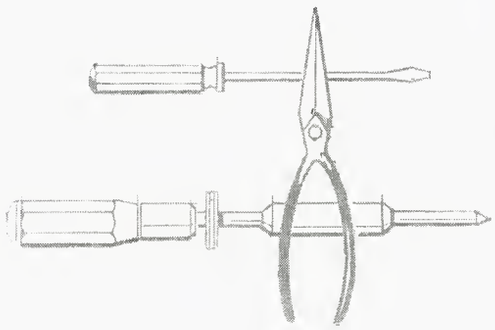
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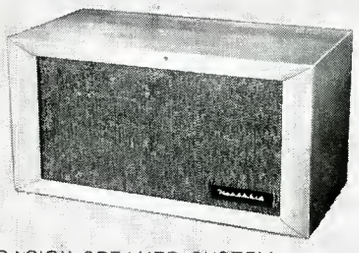
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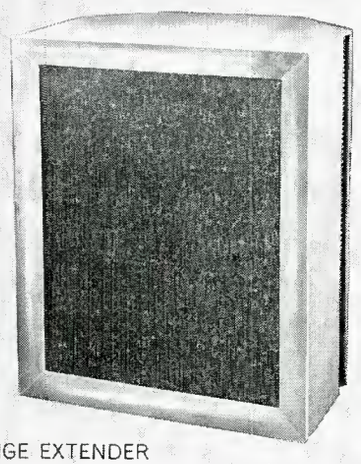


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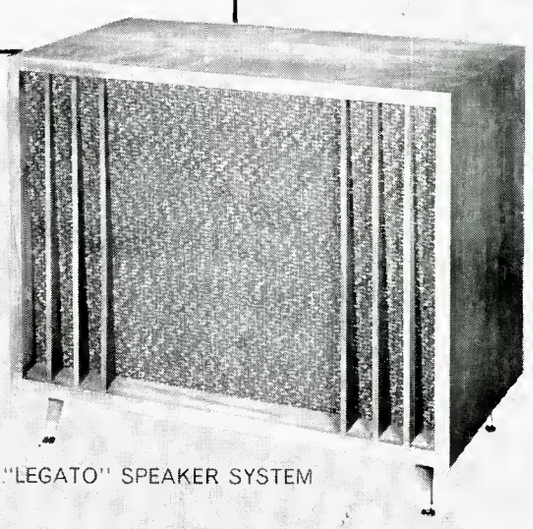
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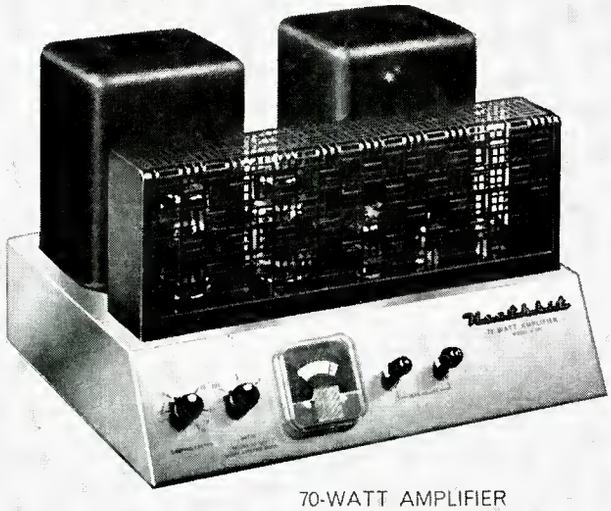
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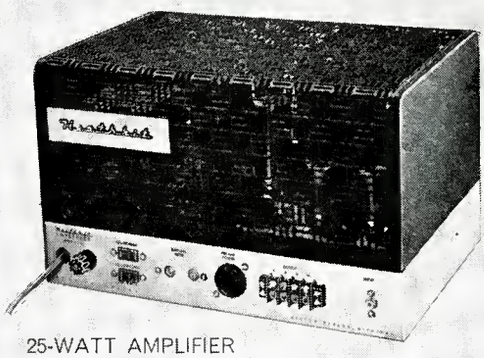
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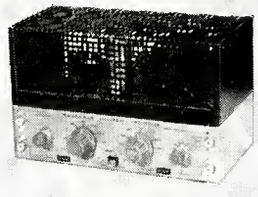
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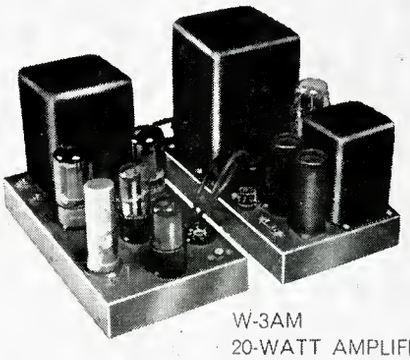
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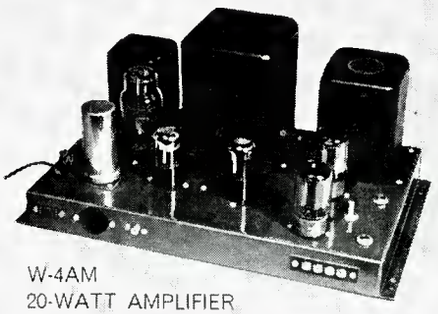
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A true Williamson-type circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can give you fine listening enjoyment with a minimum investment. Uses 5881 tubes and a Chicago-standard output transformer. Frequency response is ±1 db from 10 CPS to 100 KC at 1 watt. Less than 1.5% harmonic distortion and 2.7% intermodulation at full 20 watt output. Hum and noise are 95 db below full output. Transformer tapped at 4, 8 or 16 ohms. Designed to use WA-P2 preamplifier. Shipped express only. Shpg. Wt. 28 lbs. **MODEL W-4AM $39.75**

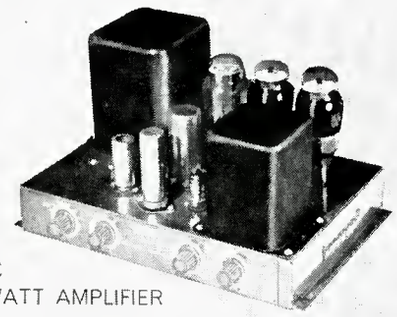
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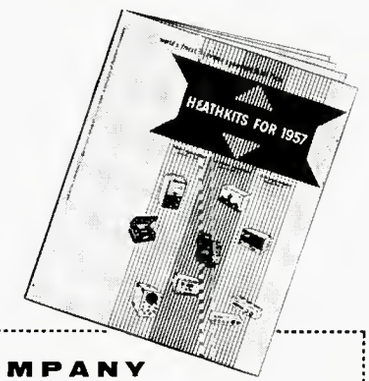
This amplifier incorporates its own preamplifier for self-contained operation. Provides 20 watt output using push-pull 6L6 tubes. True high fidelity for the home, or for PA applications. Four separate inputs—separate bass and treble controls—and volume control. Covers 20 to 20,000 CPS within ±1 db. Output transformer tapped at 4, 8, 16 and 500 ohms. Harmonic distortion less than 1% at 3 db below rated output. High quality sound at low cost! Shpg. Wt. 23 lbs. **MODEL A-9C $35.50**

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EDITOR'S REVIEW

SYMBOLS

SPOKEN, this word means something to the hi-fi *aficionado*—the proper reproduction of the sounds of the cymbals indicating satisfactory high-frequency performance. Written with an S, however, it means something else—and in this case one thing about which we should like comments from readers. The symbols, that is.

Readers will note that there are three separate articles in this issue relating to transistors. In two of them we have used the symbols which have already had general acceptance—although somewhat grudgingly, it must be admitted—throughout industry and the technical press, both here and in England. For some months past, readers of *Wireless World* have been suggesting alternates which they considered more satisfactory than the one most commonly used—one which really is a pictorial diagram of a point-contact transistor.

In Mr. Waldhauer's article we have used another type of symbol for the transistor—one which he (with some justice, it seems) feels is more indicative of the junction transistor. In the first place, the suggested symbol comes closer to being a pictorial diagram of the junction type, but even more important, it comes closer to the standard symbol for the vacuum tube, and is thus more familiar in function than the more common diagram. The base, which in most circuits is connected in much the same manner as the grid of a vacuum tube, is in the same relative position in the diagram as is the grid of a triode. The emitter, still an arrow, indicates the direction of current flow through the transistor so that it is still easy to differentiate between the representation of *n-p-n* and *p-n-p* types. The collector, which serves essentially the same function as the plate of a tube, is represented by a sign which is similar to that of the tube's plate.

It would appear to us that the old symbol should still be retained as representative of the point-contact transistor, while the newly suggested one should be adopted to represent the junction transistor. The question, then, is: "Which symbol do our readers prefer for the junction transistor?"

We would, in all seriousness, like an expression of opinion. The old symbol is fairly well established, to be sure, but it would still be retained for the point contact types. The new one would be used only for junction transistors—which are the most common in any audio applications anyhow. We realize there would be some confusion from any change, but if a change were to be made five or ten years from now it would be far worse. Even yet many users still employ the zig-zag line for grids, even though the American Standard Graphical Symbols for Electrical Diagrams (ASA Y32.2–1954), which was adopted in 1954, portrays grids as dashed lines. Transistors were too new to be included in this Standard, and considering how long it usually takes to get a Standard through to final approval by all agencies concerned, it is not likely that the symbol will be finalized for a few years yet.

While we wouldn't like to be the only magazine using a "non-standard" symbol—and we *wouldn't* use a maverick symbol if there were a standard—we do believe that we should lead in the adoption of what we consider a good idea—perhaps, we suggest blushingly, we might influence others to follow our example.

And we would still like to know your choice of symbol, as well as the reasoning which influenced your selection.

OH, OUR ACHING FEET!

Looking over the projected hi-fi show schedule for the coming twelve months, it appears that practically any town with suitable audio show facilities is going to have its own exhibit—something like forty are indicated. To take in all of them—as we used to be able to do—we would have to build your favorite magazine on the fly, which is just slightly more than impossible. Therefore, on the theory that the longest journey starts with just one step, we shall discuss this month only those events scheduled for this month—two major shows, both in Chicago, and two regional shows, one in Cincinnati and one in San Diego.

The Cincinnati show, under the management of Rigo Enterprises, is scheduled for the Sheraton-Gibson Hotel, September 6–8. The Rigo shows have already established themselves so there is little more to say. Anyone who has ever attended one of them knows that they are well run and that they have been consistently successful.

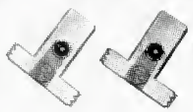
The San Diego show is being presented by the Audio Components Representatives Association with the joint sponsorship of the IHFM, and is the first regional show in California under ACRA, although that organization has long been a factor in the Los Angeles shows. This show is scheduled for September 27–29, and will be held at the Lafayette Hotel.

The Sixth Annual Chicago High Fidelity Show will open at the Palmer House on September 13 and run for three days, under the sponsorship of International Sight & Sound Exposition, Inc. In addition to many of the country's leading component manufacturers, this show will present the products of the packaged hi-fi manufacturers, whose sales have been increasing tremendously during the past year.

The Morrison Hotel is the site of the Chicago show of Institute of High Fidelity Manufacturers. This exhibit begins on September 18 and runs through the 21st, and shows the products of the members of the IHFM.

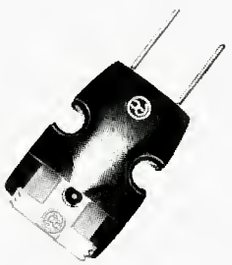
We are looking forward to attending both of the Chicago shows, and anticipate meeting many of our midwest acquaintances there. Have a good time at both—see and hear everything that's there—and *do* wear comfortable shoes.

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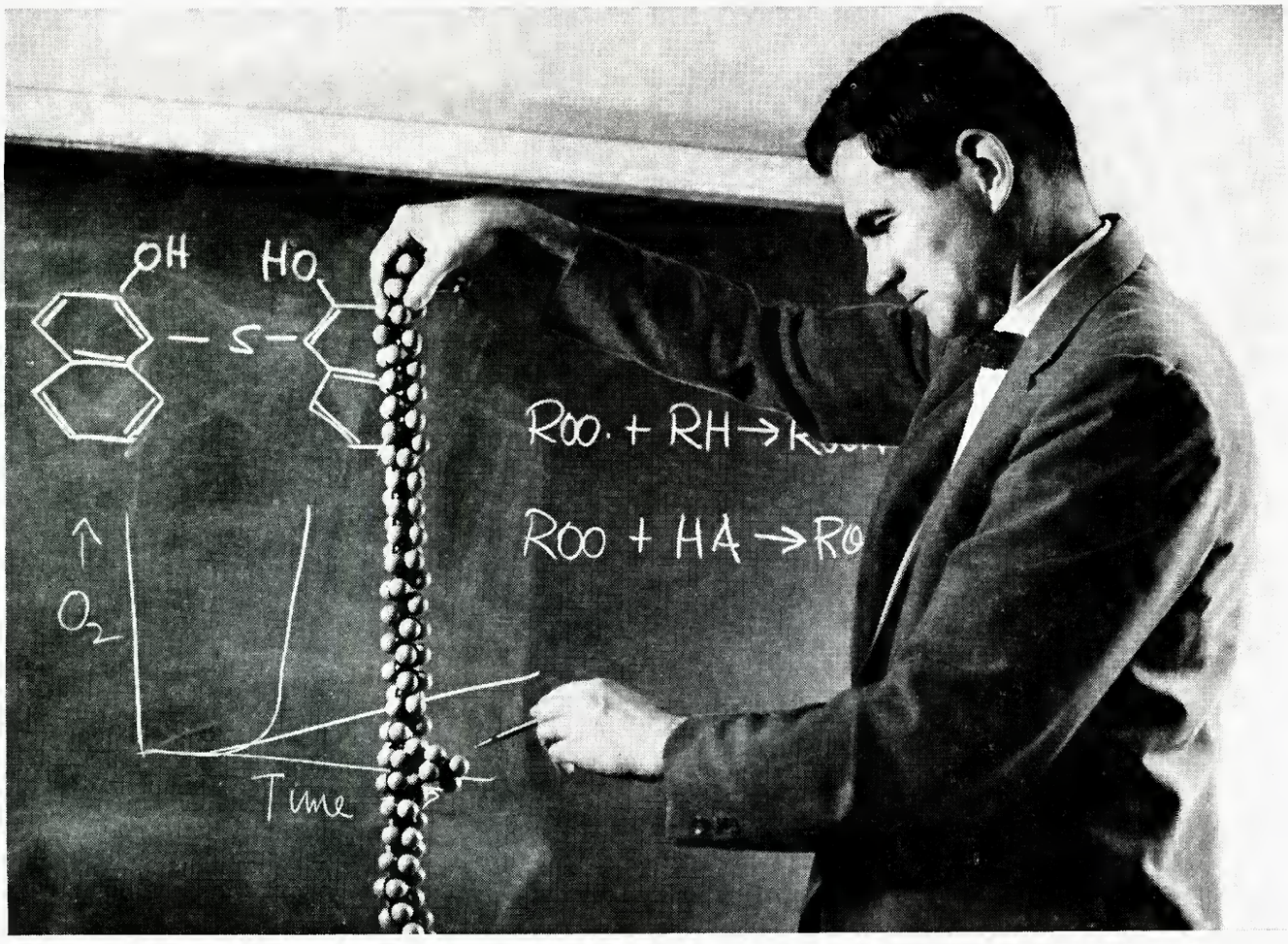
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Bell Laboratories chemist Field H. Winslow, Ph.D., Cornell University, with a scale model of a small section of a polyethylene molecule. Branch formation indicated by pencil is vulnerable to oxidation. Dr. Winslow and his associates worked out a simple way to protect long polyethylene molecules needed for durable cable sheathing.

THE DILEMMA OF GIANT MOLECULES

Solution: 2 plus 2 equals 5

Polyethylene is used to protect thousands of miles of telephone cables. It is tough, light and long lasting. Its strength lies in its giant molecules—a thousand times bigger, for example, than those of its brittle chemical cousin, paraffin wax.

But polyethylene has a powerful enemy: oxidation, energized by light and heat, shatters its huge molecules to pieces. This enemy had to be conquered if polyethylene was to meet the rigorous demands of cable sheathing. Paradoxically, it was done by making the whole better than the sum of its parts—just as though 2 plus 2 could be made to add up to 5.

To check the ravages of light, Bell Laboratories chemists devised the simple yet highly effective remedy of adding a tiny dose of carbon black. Then antioxidants, such as those commonly used to protect rubber, were added to check attack by heat. But here the chemists encountered a dilemma: although the carbon black protected against the effects of light, it critically weakened the effectiveness of the antioxidants.

To solve this dilemma, Bell Labs chemists developed entirely new types of antioxidants—compounds not weakened by carbon black but which, intriguingly, are very much more effective when carbon black is present. The new antioxidants, plus carbon black, in partnership, provide long-lasting cable sheath—another example of how research at Bell Telephone Laboratories works to improve your telephone service.

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The Violin and its Hi-Fi Analogies

ANTONY DOSCHEK*

Considered by many to be the most difficult instrument to reproduce properly, the violin and its construction may be compared to high-fidelity equipment. After reading this, it would seem that success in the construction of the instrument must be due to a combination of lucky accidents—almost.

"For him was lever have at his beddes hed
A twenty bokes, clothed in black or red,
of Aristotle and his Philosophie,
Than robes riche or fidel *or sautrie."*

I QUOTE this from the "Prologue" not because I have a very clear idea of what Chaucer had in mind but because it lends a refined "tone" to this paper, and, furthermore, does mention the word that we have come to know as "fiddle." On the other hand, I fail to understand why one so fond of writing as Chaucer must have been should misspell so many words. In any case, the word "fiddle" is used here as pertaining to the musical instrument called the "violin" and not what we do with a speaker system after we are supposed to have designed (!) it.

The instrument which is now called a violin originally came from Persia and its date of conception, even approximately, is entirely unknown. We do know that it was a one-string instrument at first, having a vaulted back attached directly to the top without benefit of intermediary ribs. In this form it resembled a member of the latter day lute family; until some Persian edison provided it with a bow. The result became the Arabs' "rebab," and they added up to three strings. The rebab, with dubious tonal improvements, then became the Medieval "rebec." The tonal characteristics of the rebec must have been horrid indeed, being described in the literature as "nasal," "screeching," "hard," *et cetera*. Under various names and in various forms the rebec was known as the "tromba marina," the "crwth" (no typographical error), the "rabé," and the "vielle"; a highly mechanised form was known as the "organistrum" or the "chyphonie." This ancestor was equipped with a crank at one end which rotated wheels in frictional contact with the strings—tuned in 5th and octave relationship, probably. Hence its name, "organistrum," from the earlier part-writing discovery called organum. One side of the neck of the instrument was provided with levers or push-buttons which stopped, or fretted, the strings at different lengths. Two players were required; these sat side by side, holding the instrument across their laps; while one cranked, the other fretted. I am not sure, of course, but I will bet that the crankers were unionized. An interesting feature of this acoustical machine should be pointed out. Since no means of applying more or less wheel pressure was provided for, the output level of the organistrum must have been quite monotonously uniform. The speed of wheel rotation would not change the level by much, except that insufficient or excessive speed would fail to energize the strings properly. This is what put the crankers into the "skilled workmen" classification. However, since the strings were fretted from beneath, stopping them "short"—high on the neck to produce a higher pitch—relieved the pressure on the wheels more so than stopping them "long" and hence the output level would drop. Thus the first HI-FI ANALOGY: Treble rolloff.

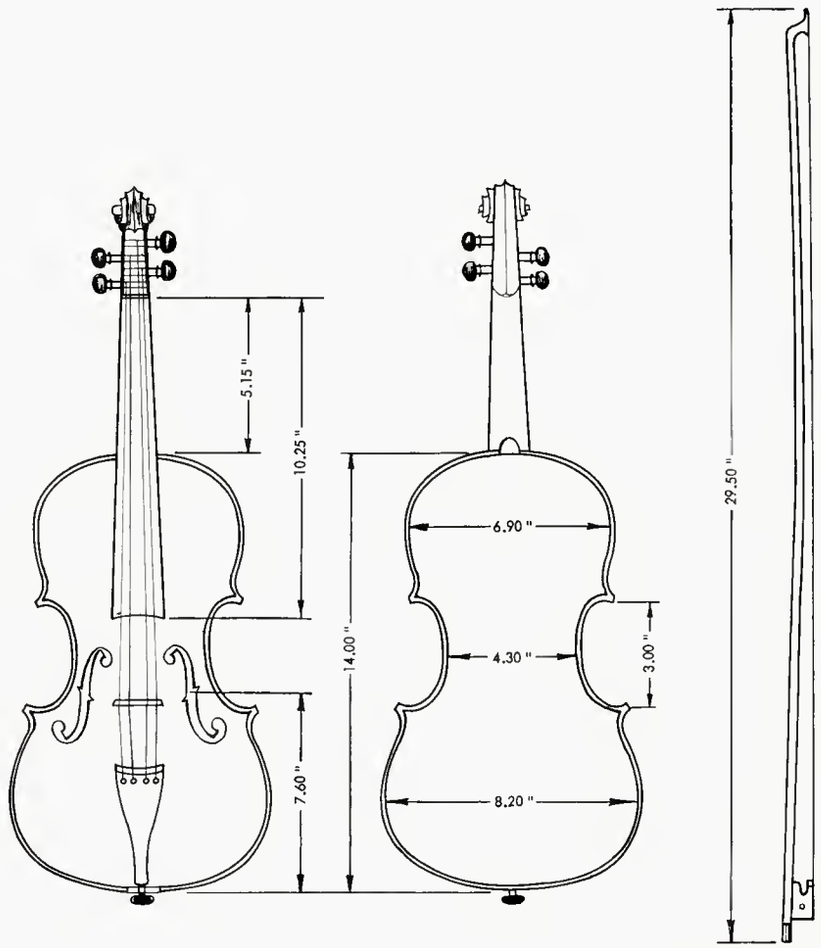


Fig. 1. With the dimensions shown here, it should be possible to work out most of the acoustic formulas to determine performance. Needed are the heights of the sides—at upper and center bouts, 1.20 inches; at lower bouts, 1.25 inches.

While rebecs were being used generally throughout Europe, certain virtually unknown makers such as Testator the Older, Kerlino, Kolitzer, and Gaspar Duiffoprugear—all circa 1400–1500—were seriously working at improvement of the tone quality of bowed string instruments of the viol class. We are living through the applicable HI-FI

* *Pro-Plane Sound Systems, Inc., 1101 Western Ave., Pittsburgh, Pa.*

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ANALOGY. This family of instruments, of which the viol da Gamba was the closest predecessor of the modern violin, consisted of a full choir called by somewhat confused names peculiar to the specific type of instrument and locality of its manufacture. One family choir was called, for example, the "panduras" and "tanburs" (for the treble), the "lutes" (for the alto and tenor registers), the "barbitons" and "theorbos" (for the bass), and the "chitarrone" (for the double-bass register). Another HI-FI ANALOGY: The tweeters, midrangers or squawkers, woofers, and boomers. The lute had already advanced to such a high degree tonally that Bach wrote a Partita for it; and in the meantime the Paris government took official action to prevent the playing of any of the viol family of instruments in "—— taverns and places of ill repute," relegating the happy rebec to this joyful task.

The First (?) Violin

Although justifiable contention exists, it is generally conceded that Gaspar Duiffoprugcar made a violin d'amour model which prompted Gasparo da Salo to make the first violin; the final form of which, as relative to basic measurements, was then established by the Amatis and Maggini. But all this took place a very long time ago—the dates are about 1500 to 1650—and some further confusion is caused by the circumstances that there were five Amatis, that Mr. Duiffoprugcar was also Herr Tieffenbrucker—no, not junior—that Maggini sometimes signed Maginni, and that Gasparo da Salo wasn't: he was one Gasparo Bertolotti. The real red herring was dragged across the trail by Jean-Baptist Vuillaume, a superb French maker ca. 1850 who loved to make fine imitations: and he made some with Duiffoprugcar's name in them so realistically that no one can tell whether old D. ever made any real violins at all. As a matter of fact, Vuillaume also made a few "Strads" which keep the casualty insurers in a tizzy. After these men came the *avant garde* of master makers in the persons of Stradivarius, the Guarnieris, Montagnana, Bergonzi, Lupot—and the grand army of master pupils and imitators composed of such shining names as Guadagnini, Vuillaume, Landolfi, Testore, Stainer, Banks, and even a Johnson and three Smiths: but no Jones. All of these, of which there are almost exactly one thousand recorded in Europe alone contributed outstandingly fine concert instruments, many of which are in daily use and some for over 300 years. The fragile fiddle, therefore, so often exposed to the ravages of corrosive perspiration, accidental knocks and pressures, thousands of assorted abrasions by tissue and textile, and thousands of billions of vibratory cycles, leads us to a further HI-FI ANALOGY: "—— 90 Day Unconditional Guarantee." Indeed!

The Giovan Paolo Maggini that I use was made in 1615 and I only wish that I could exude the affluence of ownership: but, alack aday, the fiddle belongs to Mr. and Mrs. S. P. Kinney of Pittsburgh and the insurance company issued a special rider so that I might carry it around. Physically and musically the fiddle is in first rate condition, which is more than can be said for the fiddler.

At this point it would be an ingratiating move on my part to include one or two anecdotes regarding the man conceded to be the greatest of the master makers. However, there has been so much unprovable lore about him attributed to historical fact that I hesitate to put pen to paper in this respect. Rather, the interested reader might look into the authoritative and honestly written Stradivarius Monographs by Hill & Sons, London.

Although it may come as a surprise to us that there were so many notable violin makers in the past—not including a host of modern European and American makers, many of whom will be acclaimed for their work and recorded in the archives of musicology—it is even more surprising when viewed from the subjectively restricted outlook of our present sphere of existence that the world has produced well over seven hundred concertizing violinists: virtually all of them, in their time and place, accorded the same public idolatry given to our Heifetz, Milstein, Stern or Oistrakh. Nor are the better sex among us to be slighted, since, from the day of Lady Hallé—Norman Neruda by birth, a compatriot and near equal to the god-like Joseph Joachim—many women violinists have attained great stature. It is possible that there have been so many more men violinists only because, as Shaw puts it, some women delight in "—— fawning over a fiddler," while most men are inclined to be slightly apprehensive of any woman who can knock out a first rate performance of Ravel's "Tzigane."

Measurements

Everyone knows what a violin looks like but few have a good idea of the actual measurements to which it is built. These have been rather closely defined but are amenable to slight alteration for individual models and tastes only if the maker takes several other factors—which will be discussed later—into account. This brings up another HI-FI ANALOGY: "—— a variation of plus or minus 15

Left: B. F. Phillips, Pittsburgh violin maker, examining one of his new instruments. The clamps are typical in the trade—as is the appearance of the workbench. In spite of the disarray, it is said that a fiddle maker doesn't know his trade unless he can make a fiddle in total darkness. Right: Close-up of the f-holes and bridge of a typical instrument.





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per cent from the optimum internal cubeage of a bass-reflex enclosure is harmless." Or is it?

Many expensive and exhaustive (to the investigators) studies seeking explanations for the acoustical behavior of a violin have been made and a great deal has been learned. Yet, relatively little of the actual data has appeared in print. And what has been learned is still not sufficient to satisfy a general engineering expression, or to enable an artisan to construct a violin with exactly predictable tone and "speaking" qualities. By way of HI-FI ANALOGY: The same is nearly true for the design of fine loudspeakers. It is so that master violin makers, modifying one of the basic patterns by their own experience and experiments, generally produce fine instruments; much as a good painter ends up by painting a good picture. But, by and large, the instruments themselves are the products of individual artistry and intuition, and are not subject to exact resynthesis. The making of first-class violins, unlike the development of logical scientific experiments, requires a special kind of tutelary genius. In all modesty, we will herewith omit the applicable HI-FI ANALOGY. For the most part, violin makers are a reticent, introverted lot and little can be learned from them without hard digging: not because they do not know their profession thoroughly but because they either can not explain most of the involved factors in terms an engineer would appreciate or because they often refuse to divulge their personal arts and trade secrets in order to preserve and prolong their individual livelihoods. And who can blame them in this day of "do-it-yourself" kits. For example, a maker rarely uses sandpaper to smooth the belly or the back of the instrument. Instead, he breaks a sheet of glass into a number of random sizes and shapes, then, choosing a piece which has an edge of the right contour for the curve that he is working on, he *shaves* the wood smooth. The purpose of this is to avoid filling the pores and interstitial cavities of the plates with wood dust so that—as one theory has it—they may act as aggregates of tiny resonators. But another school of thought teaches that the purpose of this procedure is simply to bring out the patina and "blaze" of the generally beautiful wood grain. Whichever purpose shaving serves is debatable since I have played unvarnished, new violins which displayed lovely tone quality, and have heard some well made shaved and varnished fiddles which would have turned out as well had they been made with a Do-All sander and smeared with Kem-Tone.

Acoustic Qualities

HI-FI ANALOGY: The bowhair and strings of a violin are its driver (loudspeaker), along with the muscle power needed to move the bow itself, and the body is a ported Helmholtz resonator which shows a primary peak around 270 cps and a smaller secondary peak at about 450 cps. These peaks may be excited easily by blowing across one of the "f" holes with an embouchure similar to a flutist's. Also, by holding the back of the instrument close to the ear, but not in contact, and facing the "f" holes toward a piano on which a chromatic scale is being played, one can hear an entire series of weak resonances aside from the sympathetic ones generated by the open strings. However, the fundamental volume resonance of about 270 cps is common to all violins, whether good ones or bad ones—both the Stradivarius as well as the Stephanjac Calaboobas. Therefore this HI-FI ANALOGY: All phase-inverter enclosures designed by purely engineering methods for a given speaker characteristic have the same principal resonances; whether good ones or bad ones!

The resonant body cavity is excited by the vibrations of the strings which are energized by thousands of resin stiffened projections along the bowhair. The disposition of the energizing force is in the form of a sawtooth wave in that the bowhairs suddenly tension the string in the direction of bow travel to its elastic limit, whereupon its natural restoring force overcomes the pull of the bowhairs and the string tries to return to its normal position; but it can only do so slowly because of the opposing friction of the bow. Nevertheless, this sets the string into vibration in accordance with its intrinsic resonant frequency, which is determined by its length, tension, thickness, density, elasticity, and viscosity. And, in keeping with the laws of vibrating strings, an entire series of even and odd harmonics is generated but with decreasing amplitude toward the higher orders. These are modified—if not exactly modulated—by the sawtooth component of the bowhair force, but start life out as sine waves. If the reader can find a HI-FI ANALOGY for this condition in his own system, he had better get rid of the decentered magnet or voice coil, or the sneak-circuit from rectifier to output tubes in his power supply: but this is what makes violin tone. The composite of sawtooth-stimulated sine-like vibrations is then conveyed to the belly of the violin via the bridge.

(To be concluded)

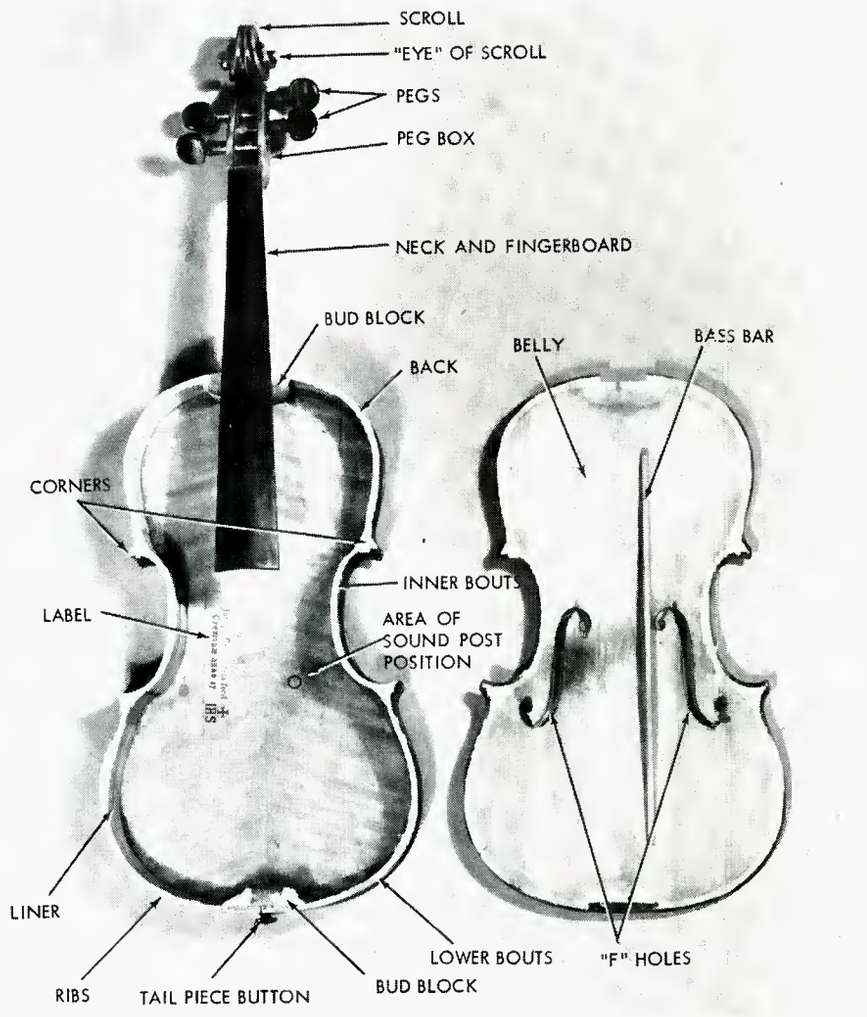


Fig. 2. A Guarnerius—of dubious authenticity—with its belly off to show internal construction and nomenclature.

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A Transistor Playback Amplifier

F. E. WYMAN*

The author describes a new approach to the method of equalization for a tape amplifier along with the complete unit which—when constructed in duplicate—serves as an ideal stereo playback "front end."

THE PROBLEM OF magnetic tape playback amplifier design is one of the more challenging problems encountered in the audio field. The present state of the art contains some very satisfactory vacuum tube playback amplifiers as exemplified by the performance of several very expensive professional recorders now in production. It is the purpose of this paper to demonstrate that the performance of these amplifiers can be matched by the application of transistors to the problem.

The acquisition of one of the popular tape transport mechanisms with its stacked stereophonic playback head offered the author the opportunity of indulging in a growing desire to attempt to design a satisfactory transistor playback amplifier. The particular unit at hand was complete with the manufacturer's single channel record and playback amplifier, but in this unit the playback electronics possessed an intolerable amount of 60-cps hum. In addition, the location of the power transformer in proximity to the pickup head added an additional amount of hum.

The most desirable course of action appeared to be the design of a two-channel battery-operated transistor preamplifier that would be small enough to fit in the storage space to the rear of the transport deck. The unit shown in *Fig.* 1 is the result of the successful conclusion of this project. The design allows the inexpensive unit to function as a single channel or stereophonic tape playback device with performance characteristics closely approximating the much more expensive professional machines. In addition, the arrangement is such that the normal single channel record function, by means of the original electronics, is retained.

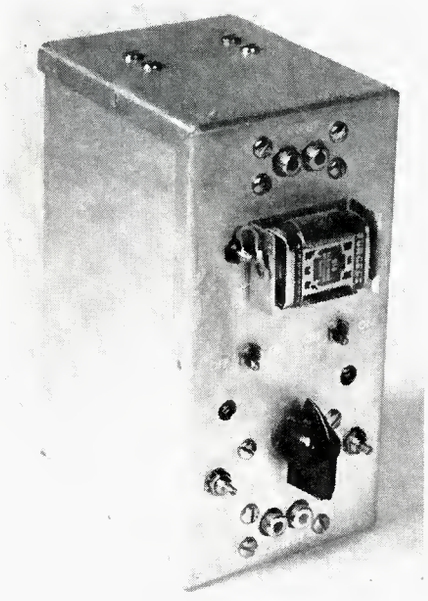


Fig. 1. The completed two-channel transistor playback amplifier.

Specifications and Design Considerations

The specifications set forth at the outset were severe and admittedly a bit arbitrary in view of the fact that the possibility of attainment was unknown. It seemed unwise to set the goals lower than the performance of the best grade vacuum tube amplifiers and to this end the following initial specifications were used as a target:

1. Signal-to-noise ratio, measured from the 3 per cent tape distortion signal level to amplifier noise, of at least 55 db.
2. Output level, for zero level signal, of one volt.
3. Equalization to allow playback flat to ± 2 db from 50 to 15,000 eps from a pre-equalized tape.
4. Distortion low enough that the 3 per cent distortion point due to the magnetic process could be established in all cases.
5. Low output impedance to accommodate a practical length of cable without loss of high frequencies.

Having defined a goal it is well to examine the parameters that must be dealt with. The playback head in this case was a Dynamu stacked stereophonic model and therefore it was possible to do all the design work and testing with an available Dynamu 8001 single track head. This procedure kept the new tape recorder free for normal use until design and construction were complete. *Figure* 2 shows the published frequency *vs.* output characteristic of this head in curve (A). It is typical of almost any head likely to be encountered and shows the characteristic 6-db-per-octave rise from low frequency to a point near 3000 eps where various losses take over and reverse the rising trend.

The over-all electronic system of any satisfactory tape recorder must operate on this characteristic and produce an output characteristic that is flat as nearly as possible over the desired frequency range. When extending the NARTB standard into the field of home recorders, it is customary to follow the practice of compensating for the region above the peak output in the record amplifier. Thus it remains for the subject amplifier to provide a characteristic falling at the rate of 6 db per octave from the lowest frequencies to about 3000 eps and a flat characteristic on to the highest frequency desired.

Figure 2 also shows, in curve (B), the published frequency *vs.* head impedance characteristic for the same head. Again this is typical of all heads, varying only in value and the exact location of the peak. The important fact is that heads that are of the class available to

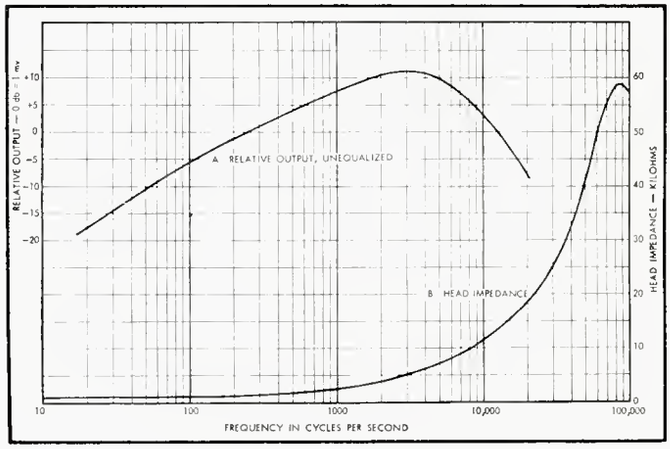


Fig. 2. Curves of typical Dynamu 8001 head. (A) Relative output level vs. frequency, and (B) impedance vs. frequency.

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home constructors are of relatively high impedance. They must work into an amplifier of even higher input impedance or suffer a serious loss at the higher frequencies. When one uses conventional vacuum tubes for the input stage, the input impedance will automatically be high and only with the highest impedance heads will simple precautions have to be taken. The input impedance situation is alarmingly different with transistors. The flood of transistor articles in recent literature has made users aware that transistors are essentially low-impedance current-sensitive devices. In any transistor configuration that will give voltage gain, the input impedance will be somewhere in the range of a few ohms to a few thousand ohms. Furthermore, any given parameter is dependent on all other parameters. In the particular case at hand if the output loading is modified for some design consideration of the second stage, the input impedance of the first stage will change, usually with embarrassing results in the downward direction.

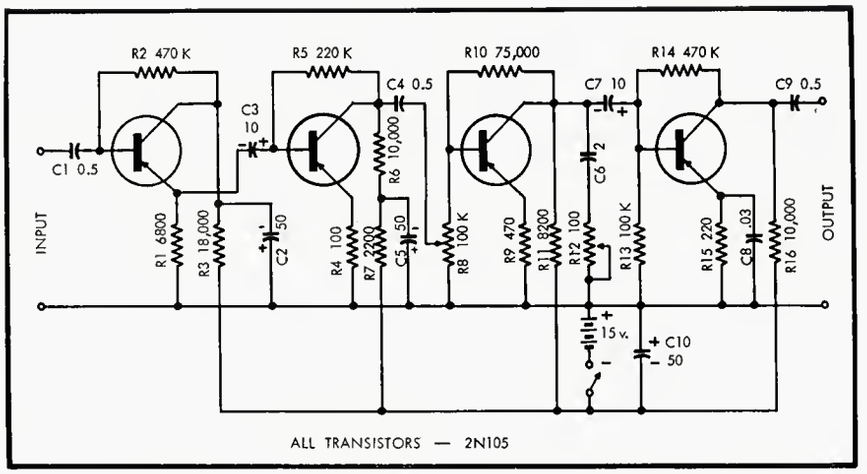


Fig. 3. Schematic of a single channel of the transistor amplifier.

The Circuit

The circuit shown in *Figure* 3 is that of one channel of the complete stereophonic amplifier. As in so many developments considerable experimentation and adjustment of component values took place until the desired performance was obtained. At this point the device was put to work and no further effort exerted to further optimize the circuit. Two copies of the amplifier have been made and were found to perform essentially the same as the original, hence it would appear that sufficient stabilization has been incorporated to render the circuit relatively free of individual transistor variation.

RCA 2N105 transistors were used throughout simply because they were readily available and appeared to possess satisfactory characteristics. A review of all manufacturers' data would indicate that there were other transistors with even lower noise figures which could be used to advantage. Nevertheless, using only the one type and picking the individual transistors at random gave very satisfactory results.

The first stage, *Fig.* 3, is the common collector configuration. It has an input impedance of 0.15 megohms and hence does not load the playback head or cause any attenuation of high frequencies. As a result of this circuit configuration the voltage gain is slightly less than unity but the output impedance is low, thus this stage has the effect of performing an impedance transformation. This is perhaps the most satisfactory means of transforming the high impedance of the head to the low impedance of the second stage, but the use of a second transistor operating at low level contributes to a greater noise output. R_1 in the emitter circuit is the load resistor, R_2 sets the base current and the operating point, C_1 blocks an additional d.c. path and thus protects the operating point, and C_3 couples the output to the next stage. It is essential that the designated polarity of this latter capacitor be observed.

The second stage is the more conventional self-biased common-emitter configuration operating at a source voltage of about −8 volts obtained by means of the bypassed dropping resistor R_7. Resistor R_4 in the emitter circuit is common to the input and output circuit and thereby introduces considerable degeneration and reduces the voltage gain of the stage to about eighteen. At first look this seems to be wasteful of gain but it is by the use of degeneration that the low second and third harmonic distortion is obtained.

The third stage is again a common-emitter stage operating from the full 15-volt battery supply. It is biased by the combination of R_8 and R_{10}. Equalization for the characteristic 6 db per octave rise of the playback head is accomplished in the output of this stage by means of R_{12} and C_6. This method is typical of vacuum tube amplifier applications but the value of resistance may seem alarmingly low. In fact, when the amplifier is adjusted for the playback characteristic shown in *Fig.* 5, R_{12} has the value of about 40 ohms and C_6 has an equal value of reactance at the turnover point of approximately 2000 cps. Due to the low impedance property of transistors the 40-ohm value is in order. R_9 is an Ohmite miniature potentiometer and serves as a volume control. Readers accustomed to volume controls in voltage operated devices such as vacuum tubes are almost sure to feel that a mistake has been made in the circuit diagram, though the proper use of a current divider in a current-operated device is designated.

After the application of equalization,

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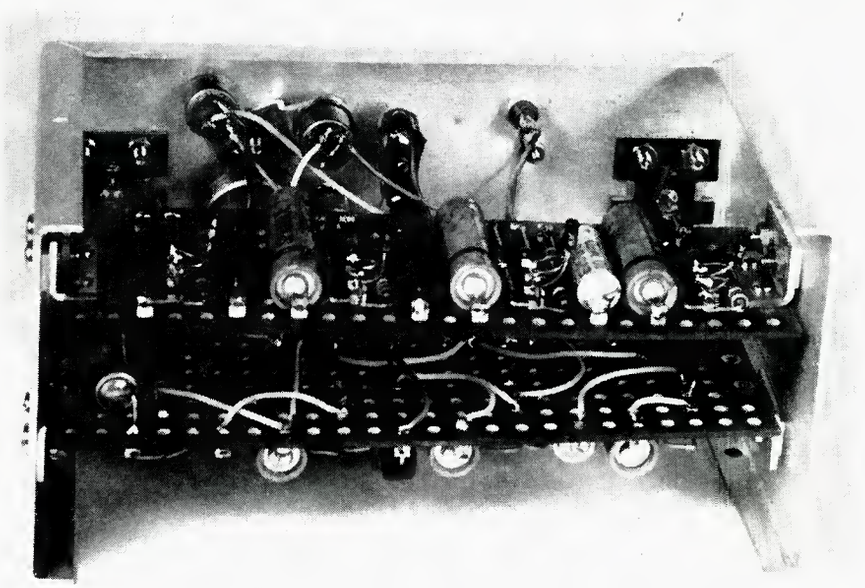


Fig. 4. Internal view of the amplifier. Each channel is constructed on its own "chassis" —assembled from Alden perforated terminal boards.

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The "Third Dimension" in Sound

The Engineering Department of
RADIO CRAFTSMEN

A practical reverberation chamber for the home — comprising a conventional type of acoustic delay line followed by its own amplifier and reproducing loudspeaker—that enlarges your listening room acoustically at a comparatively low cost.

FOR MANY YEARS the public has been seeking a means for reproducing music in the home equal in quality to a live performance. This demand has created the current intense interest in high fidelity. However, Hi-Fi has come to mean many things to many people. Today it can mean anything from a very high quality sound system to a brand of lipstick. Audio engineers have explored many paths in the search for realistic reproduction.

In the early 1930's work was done by the scientists of Bell Telephone Laboratories to improve the realism of electronic music reproduction, and to increase the understanding of the factors which determine the listening quality of reproduced music. Nearly all aspects of the problem of reproducing music electronically were investigated, but one of the greatest contributions to the art and science of music reproduction was the exploration of the spatial effect or "third dimension" in sound. The scientists reasoned that any musical group, whether full orchestra, dance band, or jazz combo, occupies a certain physical space, and sound is produced by the entire group. The reproduction of this by a single loudspeaker is analogous to the group playing through a small window into the listening room.

An experimental investigation was made of the use of a number of sound pick-up and reproducing sources to remedy this "window effect." Multiple channel recording equipment was not used for these initial experiments and demonstrations, but rather music performed in Philadelphia was transmitted immediately by wire to Washington, D. C., for the public demonstrations.[1] Three separate electrical "channels" were used to transmit the signals with three microphones in the hall where the musician performed and three sets of loudspeakers in the listening auditorium. The reaction of witnesses to the demonstration on April 27, 1933, created great interest in this technique.

Even before this revelation in the improvement of music quality, the motion picture industry had noted for the relatively high quality of the sound on motion picture sound tracks, and the character of the equipment used in the better movie houses to reproduce that sound. It was only logical, therefore, that it would be the movie industry which would first exploit these discoveries which indicated the importance of this "third dimension" in music. Several years after the Bell Laboratories' experiments, a motion picture was released to the public which took advantage of this principle to enhance the music on its sound track. This picture was Walt Disney's "Fantasia," and its sound track was recorded on photographic film by multiple-channel recording techniques. In its original release the sound was reproduced over three separate systems. The complexity of the reproducing system was exceeded only by the complexity of the recording apparatus, and a traveling van was sent over the country with the release prints of "Fantasia" to furnish the necessary electronic apparatus for the theatres where the feature was exhibited. Suitable equipment for the home was still a long way off.

"Fantasia" has not been followed by a second similar release, but the impact of this pioneer feature is still heavily felt in the motion picture industry today. Many new techniques have been developed which simplify multiple-channel recording, and the use of magnetic tape materials has helped revolutionize motion picture sound recording, as well as disc recording. One of these new systems which utilizes multiple channel recording is the "CinemaScope" system which uses four channels. Also, the sound quality of the "Cinerama" and "Todd-A-O" systems increases their entertainment value greatly.

* *4223 W. Jefferson Blvd., Los Angeles 16, Calif.*

[1] Originally reported in *Bell Laboratories Record*, June, 1933, and reprinted by permission in AUDIO, June, 1957.

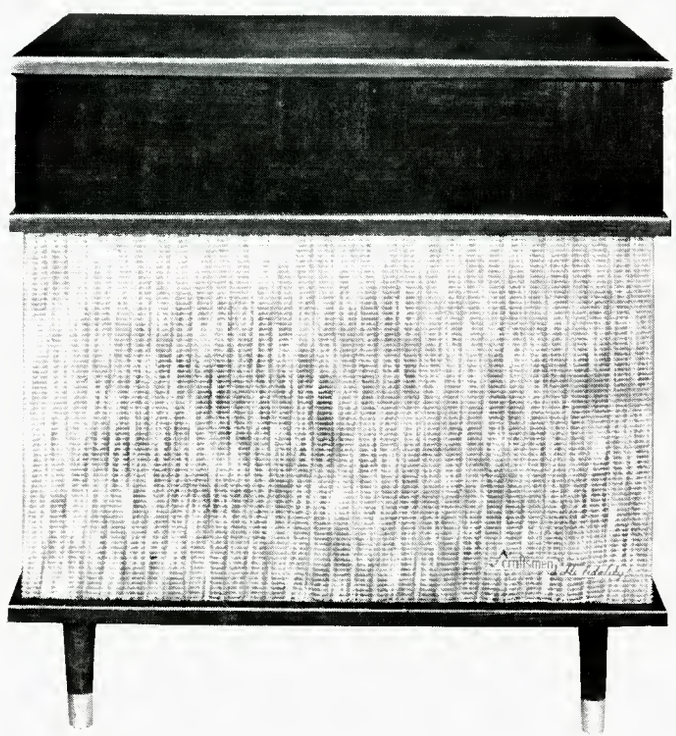


Fig. 1. An example of 360-deg. radiation. Four speakers provide sound output in all directions.

Stereo for the Home

These motion picture systems have helped make the public aware of the inherent defect in the single loudspeaker system of television, radio, and phonograph, whether "Hi-Fi" or run-of-the-mill. Engineers in the home-music profession have naturally spent considerable time studying the methods available to bring the "realism of the concert hall" into the home. One method is via stereophonic sound. Several "stereotape" machines are on the market and their sound quality is excellent. Stereo broadcasts are also transmitted regu-

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larly in some areas, and those fortunate enough to live in those cities and who can afford two tuners and associated audio equipment praise the realism of this technique.

However, the financial obstacle to enjoying stereo is considerable to most music lovers. Stereo tape players are costly, and stereo tapes are quite expensive when compared with high-fidelity phonograph records. Stereo broadcasts are certainly more economical than tape, but these broadcasts are made on an extremely limited time schedule and are available only to residents of our largest cities. There is the necessity for the broadcast stereo enthusiast to purchase each item of his music system in duplicate to enjoy these broadcasts, just as the stereo tape user must purchase two separate amplifier and loudspeaker systems in addition to the tape playback mechanism.

Stereo utilizes *two* sound pickups, each of which drives a loudspeaker through its own recording or broadcasting channel.

Multispeaker Arrangements

An alternative approach to spatial distribution is to utilize only one pickup and recording channel, but to reproduce this in a number of loudspeaker enclosures so located as to disperse the sound around the listening room. This is far more economical for the home than a stereo system as it eliminates the most expensive stereo components; that is, a stereo tape player and/or dual tuner-amplifier systems. Even more important, it can be used with any source material, such as ordinary disc recordings or normal commercial AM or FM broadcasts.

Dual speaker systems are a great improvement over a single speaker system if ideal utilization of the dual speakers can be achieved. Unfortunately, conditions in the home are seldom ideal. We cannot always arrange dual speakers properly relative to the listener, nor can we rely on the listener remaining stationary during the entire reproduced performance. Either action will greatly diminish the effectiveness of a dual speaker system. On the other hand, the effectiveness of a number of loudspeaker enclosures connected to the same source does not depend to any great extent on the placement of one or two of the loudspeakers, nor to the position of the listener in the room.

For this reason, and also because of the adaptability to any source material and the relative economy, we find the growing use of multiple loudspeakers and enclosures for Hi-Fi reproduction. Of course, this method does cause the listening room (which in most households must serve other functions of family life, such as a living room or den), to somewhat resemble a dealer's show room, with various loudspeaker cabinets exhibited in different areas of the room. Recent design work has been directed toward solving this problem.

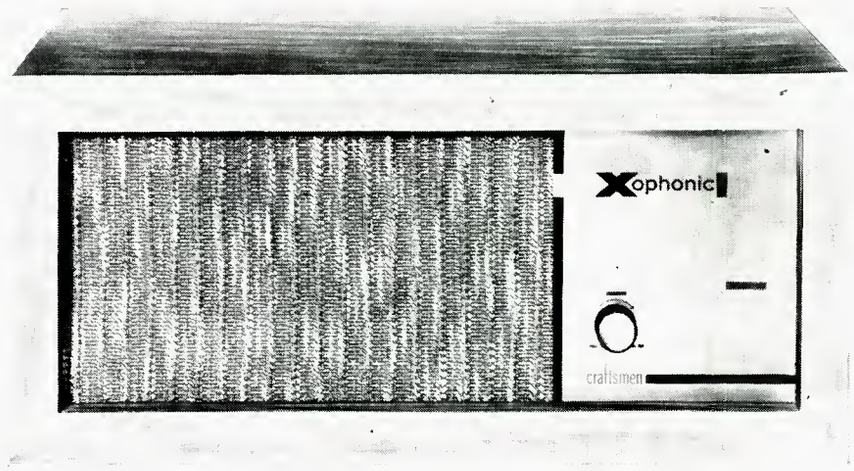


Fig. 2. The "Xophonic"—a complete home-type reverberation chamber.

In order to achieve a "third-dimensional" spatial effect, it is actually not necessary that the sound originate in various corners of the room; what is necessary is for the *listener* to feel that he is "surrounded by sound." To do this, we may utilize the initial reflections of sound by the walls and ceiling of the room, driven from a central sound source that projects not in only *one* direction, but in *all* directions simultaneously. Such a source will represent only one enclosure which can be attractively styled and still fulfill its function of circular sound dispersal. This dispersed sound is then reflected from the walls of the room to the listener. The effect of a device of this type is remarkably similar to that of the multiple speaker system.

An example of a commercial instrument which includes this 360° sound principle is the Radio Craftsmen Model CP21 "Serenade" pictured in *Fig.* 1, which radiates sound to the front from a "woofer" and a tweeter," to the rear through the acoustically-relieved back, and to the sides by two midrange loudspeakers, one mounted in each side of the cabinet.

Artificial Reverberation

In addition to the "spatial effect," another major factor which detracts from the realism of recorded music in the home is the lack of *reverberation* which results in the sense of "bigness" which one perceives in a large auditorium or concert hall. In a large auditorium, there are two kinds of sound which are mixed and blended together—the direct sound which comes from the performers, and the echoes or reverberated sound which is reflected from the walls and ceiling of the auditorium structure. The reverberated sound, because of the greater distance which it must travel from the performer to the listener, arrives later than the direct sound.

The natural reverberation time in most living rooms is very short, both because of the relatively small size and because of the upholstered furniture, drapes, and carpets which prevent repeated reverberations. Adding reverberation to home music reproduction is a great step forward in duplicating the realism of the concert hall. Engineers and inventors for many years have sought a device which would be simple enough to be used in the home and be able to produce the wanted reverberations, for such a device

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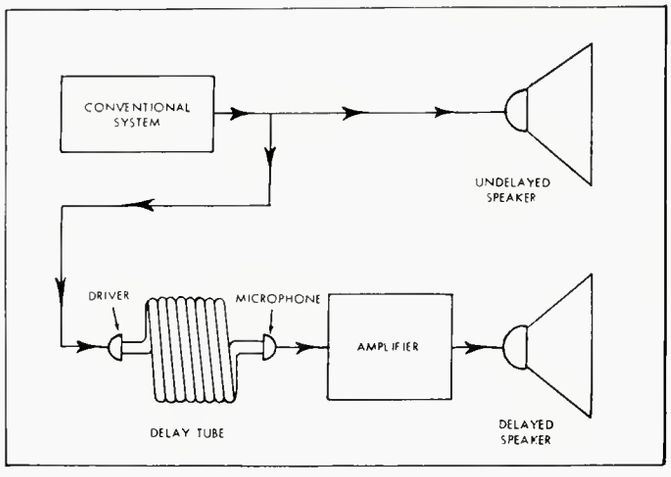


Fig. 3. Function diagram of the "Xophonic" reproducer.

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Auditorium Acoustics and Control Facilities for Reproductions in Auditory Perspective

E. H. BEDELL

WHEN MUSIC IS TO BE reproduced in auditory perspective before a large audience, there are many requirements that must be met, and much testing and adjusting that must be done, which are not directly related to the basic problem of reproducing the complete frequency and volume ranges. One of the most important groups of adjustments is concerned with the acoustics of the halls where the music is being picked up and where it is being reproduced. The importance of the acoustic properties of an auditorium are probably not generally appreciated. Unless they are so bad that they actually spoil a reproduction or an original rendition, their existence is not usually recognized. That they play an important role under all conditions, however, could be inferred from the fact that 90 per cent of the sound energy reaching a member of an audience may have been reflected one or more times from the various surfaces in the auditorium.

The acoustic characteristics of a hall are of particular importance when music is to be reproduced in auditory perspective, because the illusion of the actual presence of the orchestra, which it is desired to produce, depends to a large extent on the characteristics of the two halls involved. The system must be set up and adjusted to give the desired illusion under existing conditions, and in general these adjustments will differ for various auditoriums. Imperfect adjustment for the acoustics may destroy the desired illusion and be improperly ascribed to the reproducing system itself.

One of the important factors is the reverberation time of the auditoriums, and as a first step in preparation for the auditory perspective demonstration of April, 1933,[1] it was necessary to procure the reverberation times under various conditions of both the Academy of Music in Philadelphia, where the music was picked up, and Constitution Hall, where it was reproduced. Although in neither hall were the reverberation times for the various frequencies ideal, in both they were sufficiently satisfactory so that modifications of the halls themselves did not seem required.



Fig. 1. For the New York demonstrations, the orchestra was in a room two floors above the auditorium. The three microphones were spaced across the room in line with the conductor.

In an ordinary reproduction, not in auditory perspective, one usually has the choice of reproducing the acoustic characteristics of the pick-up hall or studio—and thereby in effect transporting the listener to the pick-up location—or of allowing the acoustics of the place where the music is heard to color the reproduction, which has the effect of transporting the orchestra to the location of the listener. In an auditory perspective reproduction this choice is not possible because the objective is to give the illusion of the actual presence of the orchestra, and this requires that the acoustic coloring of the hall where the reproduction is taking place be represented, and not that of the hall where the music is picked up.

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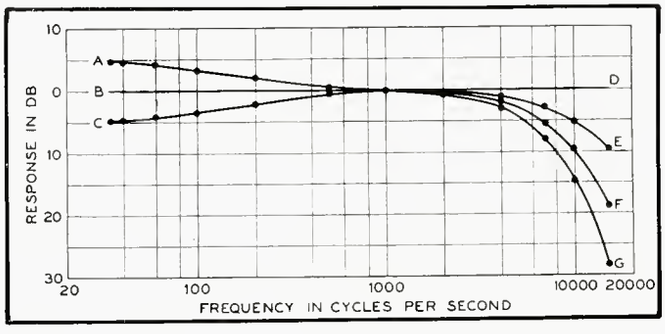


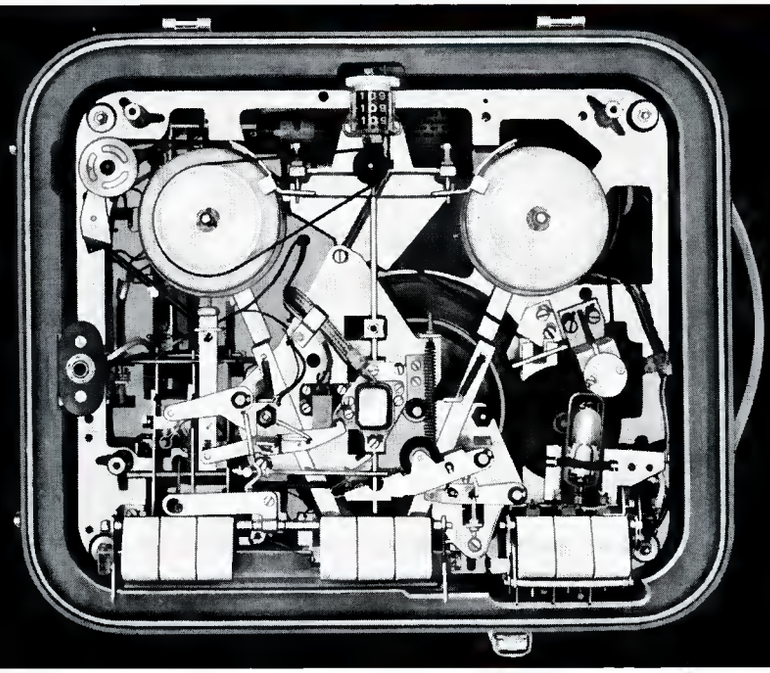
Fig. 2. Quality control networks permit the high- or low-frequency components to be modified as shown.

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[1] *Bell Laboratories Record*, May, 1933, p. 254.

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THIS IS THE WAY A GREAT TAPE RECORDER IS BUILT...



THE NEW IMPORTED Norelco 'CONTINENTAL'

world's most advanced all-in-one portable tape recorder

engineered by Philips of the Netherlands, world pioneers in electronic design

precision-crafted by Dutch master technicians

styled by the Continent's top designers

three speeds . . . twin tracks . . . push-button controlled

lightweight . . . easily portable . . . rugged

can also be played through external hi-fi system



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what the name "Norelco" means in a tape recorder



The three-speed dual-track Norelco 'Continental' was specifically designed by Philips of the Netherlands, world's largest electronics concern outside of the United States, to be the finest self-contained, single-case, portable tape recording and playback system ever offered to recordists, high-fidelity enthusiasts and music lovers.

Nothing has been spared by the world-renowned Philips engineering teams to make the 'Continental' the most advanced and versatile instrument of its kind in mechanical design, electronic circuitry and construction. Three speeds, rather than just the conventional two, have been incorporated to insure maximum versatility and economy in both speech and hi-fi music recording. At each speed – 1⅞, 3¾ and 7½ inches per second – the Norelco 'Continental' compares favorably in performance with other machines operating *at the next higher speed.* This is due primarily to the special Philips magnetic head with an air gap of only 0.0002 inches, which makes possible extended high-frequency response even at the slower speeds. The built-in loudspeaker is of the world-famous Norelco twin-cone, wide-range design, with extra-powerful magnet.

Impressive as its specifications may be, the Norelco 'Continental' was designed, however, to be used and to be listened to – not to be read about. Its actual numerical specifications were determined by measuring it *after* it sounded good enough, handled tape gently enough, and ran smoothly and reliably enough to satisfy the uncompromising Philips engineers.

The data below are therefore offered as examples of factual description and painstaking, conservative laboratory measurement, rather than advertising claims. Read them, if you are interested –but better yet, operate and listen to the Norelco 'Continental' for a while, and forget about specifications. Five minutes of actual use will demonstrate to you more forcibly than five pages of decibel figures and intermodulation percentages *how a Norelco tape recorder is built!*

Norelco® 'CONTINENTAL'

(Model EL3516)

Tape Speeds:	7½, 3¾ and 1⅞ inches per second
Tracks:	Dual
Frequency Response:	40 to 16,000 cps at 7½ ips; 50 to 8,000 cps at 3¾ ips; 60 to 4,500 cps at 1⅞ ips
Signal-to-Noise Ratio:	54 db
Wow and Flutter:	0.2% at 7½ ips; 0.3% at 3¾ ips; 0.35% at 1⅞ ips
Volume Indicator:	Magic eye (Type EM-81)
Loudspeaker:	5-inch twin-cone
Controls:	Piano-key pushbuttons
Fast Forward and Reverse:	Less than 2 minutes for 1200' of tape
Automatic Stop:	At end of reel with metalized tape
Program Indicator:	Built-in
Inputs:	1 radio/phono; 1 microphone
Outputs:	1 for external speaker; 1 for external amplifier
Microphone:	High-impedance dynamic
Tubes:	EF-86, ECC-83, EL-90, EZ-90, EM-81, (one of each)
Line Voltage:	117 volts AC @ 60 cycles
Power Consumption:	55 watts
Dimensions:	15¾" x 13" x 8"
Weight:	Approx. 30 lbs.

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Transistor Tone Control Circuits

F. D. WALDHAUER*

The author describes a circuit thoroughly and discusses its derivation in a manner which should increase understanding of transistor circuit operation.

IT IS NOW A PRACTICAL MATTER to utilize transistors in all of the audio circuits of a high fidelity system. In addition to the advantages of small size and lack of heat brought about by the high efficiency of the transistor, excellent long-term reliability, low noise, and ruggedness coupled with complete absence of microphonics may be obtained. In power amplifiers, the absence of an output transformer permits a much greater amount of feedback than is usable in conventional vacuum-tube amplifiers for a given stability margin. Hence, feedback, in conjunction with the intrinsically low distortion characteristics of transistors, may be used to produce power amplifiers having low distortion at power levels exceeding 50 or 100 watts. At the other end of the system, where noise limits the dynamic range, transistors may be advantageously employed in preamplifiers for tape playback heads or low-output phonograph cartridges with noise characteristics closely limited, as in the case of only the best vacuum-tube amplifiers, by thermal noise itself. The lack of a heater with its required rectifier and filter makes possible this high-quality performance even in relatively low-cost equipment.

We shall discuss both low-level and high-power circuits in future articles. At present, we shall be concerned with control circuits, and, in particular, a dual-tone-control circuit employing transistors. Dual-tone-control circuits, in which the bass and treble signals are boosted or attenuated relative to mid-frequencies by two separate controls, have long been used in vacuum-tube control amplifiers. An early transistor tone control circuit described by the present author[1] has recently been given some attention[2]. The circuit to be described here offers several distinct advantages over this early transistor circuit.

Objectives

Aside from the usual audio-circuit objectives of low noise and distortion, reliability and stability with respect to environment, several further requirements may be imposed upon a transistor tone-control circuit to secure practical, economical, and functionally desirable characteristics. The total range of treble and bass boost and cut must be large and, what is more important, the way in which the frequency response varies with bass and treble control setting must be carefully controlled. From both the economic and functional standpoints, continuously variable controls are desirable. Inductors are to be avoided on the basis of economy, hum pick-up, and possible transient response (by virtue of parasitic capacitances usually accompanying inductors). The tone-control circuit should be capable of being set accurately to the flat response position, and should operate smoothly with respect to rotation of the controls.

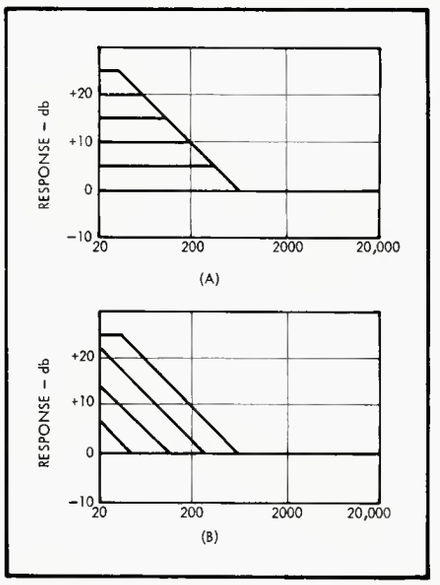


Fig. 1. Frequency response asymptotes for bass-boost characteristics illustrating (A) variable shelving, and (B) variable turnover frequency characteristics.

Response Characteristics

Two basic types of response characteristics are possible in a simple dual-tone-control circuit. The first type, termed *variable shelving* is illustrated at (A) in *Fig.* 1 for a series of asymptotic bass-boost curves. This type of response is characterized by a turnover frequency which is fixed for any position of the control. The response flattens off at a value determined by the control setting. The second, or *variable turnover* type of response is illustrated at (B) in *Fig.* 1, and is characterized, as the name indicates, by a turnover frequency which varies in accordance with the control setting. The two types of curves may have the same maximum boost or cut characteristics, but the operation for intermediate positions of the controls is markedly different. With a small amount of boost, the variable-turnover characteristic emphasizes the extreme frequencies while the variable shelving characteristic, at the same control setting, emphasizes the middle high or low frequencies.

The variable-turnover type of control appears to be the more desirable of the two, and is coming into increased favor as its characteristics become more widely known.

Advantages of the New Circuit

The advantages of the new circuit over both the author's early transistor circuit and the more common vacuum-tube circuits may be summarized as follows. First, the present circuit may be arranged to give a variable-turnover type of frequency-response variation. As a direct result of this, an accurately flat position of the tone controls may always be achieved even without use of close tolerance components. This comes about by virtue of the fact that in the flat position, the turnover frequencies are moved out of the audio-frequency range entirely. This is to be contrasted with the variable shelving control in which variation in standard tolerance components may produce irregularities of response in the maximally flat position of over 3 db. Another advantage of this circuit is the reduction in the number of components as compared with conventional circuits. In addition, the circuit is readily "designable"; that is, individual components may be altered to secure a desired result without adversely affecting the operation of the remainder of the circuit. Finally, a considerably greater range of control may be obtained with this circuit than with the previous one.

A Practical Circuit

A practical version of the tone control circuit, with circuit values for obtaining somewhat more than ±20 db

* *Glacier Drive, Morris Plains, N. J.*

[1] Lo, Endres, Zawels, Waldhauer, and Cheng, "*Transistor Electronics*", Prentice Hall, Englewood Cliffs, N. J., p. 187–189.

[2] H. R. Lowry, "All transistor hi-fi amplifier", *Radio News*, Nov. 1956.

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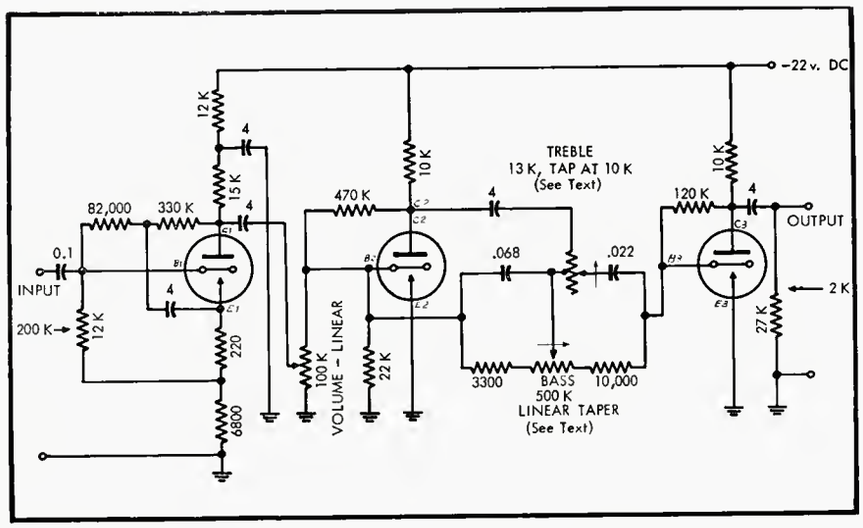


Fig. 2. Circuit schematic of amplifier incorporating, in the second stage, the new tone-control circuit. The first and third stages provide amplification as well as suitable impedance levels for both the tone-control stage and external circuits.

range of bass and treble control, is shown in *Fig.* 2. The second stage is the tone control, while the first and third stages provide amplification as well as suitable source and load impedances for both the tone control and externally connected circuits. The transmission characteristics of the entire circuit for various settings of the bass control are shown in *Fig.* 3, and similar curves for the treble control are shown in *Fig.* 4. The bass and treble characteristics are completely independent. The total response for any condition of the bass and treble controls thus may be obtained by adding the curves of *Figs.* 3 and 4.

It is noted in passing that the volume control located between the first and second stages has a logarithmic or audio attenuator characteristic even though it is itself a linear tapered potentiometer. This will be explained in the subsequent article, in which the present tone control circuit will be incorporated in a complete preamplifier and control circuit, having, among other things, record equalization for both magnetic and FM type pick-ups. The over-all circuit shown in *Fig.* 2 is designed to provide 1 volt output with 0.25 volt applied to the high-impedance input, and is thus suitable for use with a tuner or other fairly high level audio source. For those who may wish to construct the circuit of *Fig.* 2, it is noted that all parts are standard except possibly for the 4-μf coupling capacitors which may be either tantalum or aluminum electrolytic capacitors, and the treble-control tapped potentiometer, which has a total resistance of 13,000 ohms, 3000 ohms on the clockwise side and 10,000 ohms on the counter-clockwise side of a tap located at the midpoint of rotation[3]. The transistors should have common emitter-current gains, α_{cb}, of 100, 50, and 50, ± 33 per cent for the first, second, and third stages, respectively, with noise factors of 10 db or less. Several transistor types normally meet these specifications, such as the 2N109, 2N175 of RCA, the 2N190 of G.E., etc.

The output impedance of the last stage is about 2000 ohms, which is suitable for feeding a fairly long output cable. Distortion is reduced by virtue of local negative feedback on each of the three stages. These and other features will be discussed in the subsequent article.

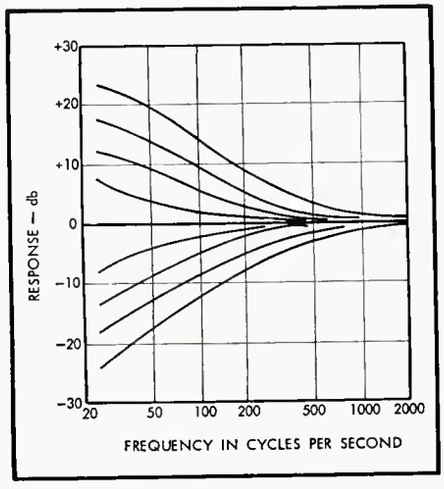


Fig. 3. Measured response of circuit of Fig. 2 for various bass-control settings.

Principles of Operation

The manner in which the circuit of *Fig.* 2 achieves the results shown in *Figs.* 3 and 4 will now be described. At (A) in *Fig.* 5, a transistor feedback circuit is shown in which d.c. collector current is supplied by the resistor R_D, and d.c. stabilized base bias current is supplied through the resistor R_B. If Z_F is low in impedance compared with R_B with which it is in parallel, and Z_L is small compared with R_D, with which *it* is in parallel for audio signals, we may approximate (A) of *Fig.* 5 with the circuit of (B). A signal current flowing into the base of the transistor will be amplified and a much larger current will flow into the collector of the transistor. This current will divide at the junction of Z_F and Z_L. The manner in which this current divides depends upon the fact that the signal voltage at the base is negligibly small, so that the ends of Z_L and Z_F remote from the collector are essentially at ground potential. Thus the voltages across Z_F and Z_L are equal and the currents are in inverse ratio of the resistances; in other words, if I_L is the load current and I_F is the feedback current, I_L/I_F is equal to Z_F/Z_L. If the gain from base to collector of the transistor is high (e.g., 50 times) the base current may be small relative to the feedback current. The input current, which is equal to the sum of the base current and the feedback current, is then essentially equal to the feedback current. Hence, the current gain, K_i, from injut to load of the circuit of (B) is given approximately by I_L/I_F, and

$$K_i \approx \frac{Z_F}{Z_L} \qquad (1)$$

This relation holds if there is appreciable feedback.

The above relation is the essence of the transistor feedback-tone-control stage. In order to produce a tone control, we must now find a resistor-capacitor configuration which allows us to vary the ratio of Z_F/Z_L as a function of frequency. Note that the current gain is what is sought here. The reason for this is that the impedance of the input circuit of a transistor, in particular that

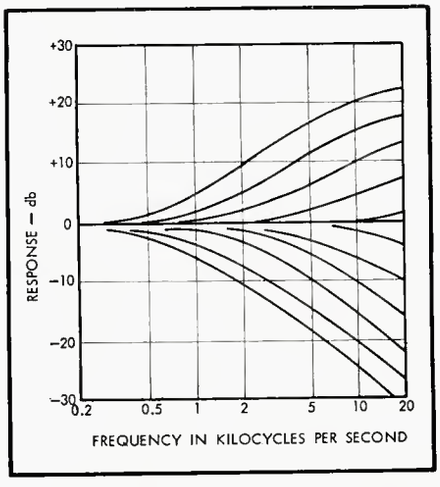


Fig. 4. Measured response of circuit of Fig. 2 for various treble-control settings.

[3] A standard IRC potentiometer, No. Q17118X, may be substituted for this potentiometer, although the total treble control range will be greater than necessary.

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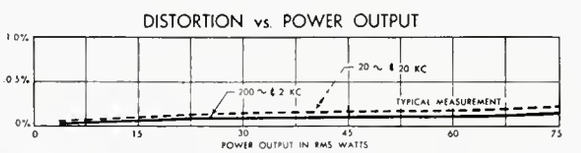


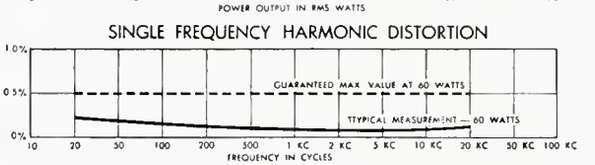
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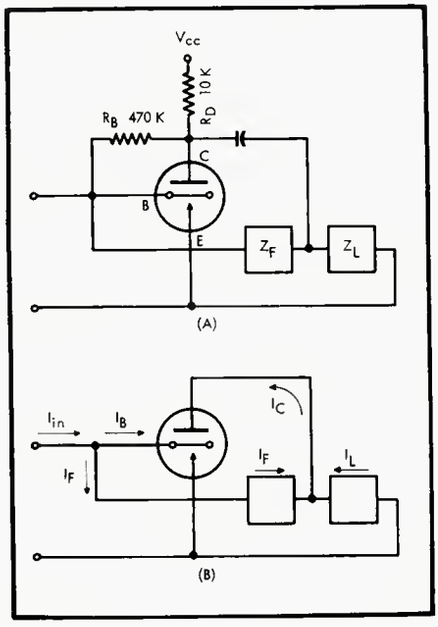


Fig. 5. Transistor feedback circuit for obtaining stabilized current gain approximately equal to Z_F/Z_L.

of the following stage, is quite low, and it is therefore more convenient to control the current flowing into the base than it is to control the voltage from base to emitter. The impedance Z_L will be the series combination of a control impedance and the very low input impedance of the following transistor stage.

The particular resistor and capacitor configuration developed for the tone control of *Fig.* 2 produces the desired variable turnover characteristics. This configuration may be adapted for loss-type controls for either transistors or vacuum tubes as well as for the feedback control described here. We note parenthetically that if the tone-control network itself is removed from *Fig.* 2 and connected so that point B3 is driven by a vacuum-tube cathode follower, point B2 grounded, and the grid of a *following* stage connected to point C2, a satisfactory variable-turnover type of tone control for vacuum-tube circuits is formed.

If Z_F and Z_L of *Fig.* 5 are replaced by a pair of capacitors C_F and C_L (whose impedance varies inversely with frequency) the current gain will remain flat with frequency as long as the conditions of Eq. (*1*) hold, since the frequency dependence of Z_F cancels that of Z_L. By proportioning the capacitors suitably, and designing the remaining circuit properly, Eq. (*1*) may be made to hold over the entire audio band. In particular, Z_L must not get too small relative to the input resistance of the amplifier stage following the tone control, since the high-frequency response will be about 3 db down at the frequency at which the capacitive reactance of Z_L is equal to the third-stage transistor input impedance. Furthermore, at low frequencies, the capacitive reactance of C_F will rise as the frequency is lowered until the low-frequency response is 3 db down at the frequency at which the capacitive reactance of C_F is equal to the total resistance in shunt with it. This total resistance is made up of the parallel combination of three components: First, the bias resistance shown at (A) in *Fig.* 5; second, the collector-to-base resistance of the transistor itself, which is of the order of two megohms; third (and most esoteric), the d.c. load resistor multiplied by the current gain of the transistor, which is of the order of one-half megohm if the transistor current gain is 50 times.

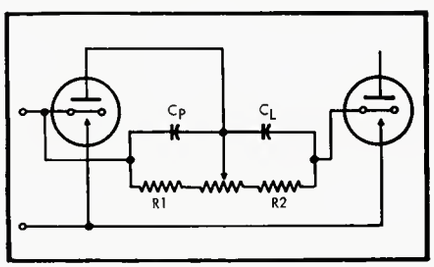


Fig. 6. Basic circuit for the bass control.

Thus we now have a capacitive network which is essentially a *capacitive* collector-current divider, sending part of the collector current back to the input as feedback (where, if the feedback is large, it is essentially equal to the input current to the stage) and part into the load as useful load current. It should be emphasized that while the impedance of the network falls as the frequency increases, the current gain is flat with frequency. We now wish to use a pair of potentiometers in order to vary the ratio of load to feedback currents at bass and treble frequencies.

For bass control, the ends of a potentiometer are connected as shown in *Fig.* 6, with the slider connected to the collector. As the slider is moved to the right, Z_F remains capacitive and rising as the frequency is lowered, while Z_L becomes resistive and therefore constant with frequency. Thus, according to Eq. (*1*), the bass signals are increased relative to midband signals. Conversely, as the slider is moved to the left, the denominator of Eq. (*1*) increases while the numerator remains constant as the frequency is lowered, thereby producing bass attenuation. In each case, as the resistance is varied, the turnover frequency, or frequency at which the response departs from its midband value, varies, thereby producing the desired variable turnover characteristics. The resistors R_1 and R_2 limit the maximum bass turnover frequency to a suitable design value, such as 800 cps.

For control of the treble signals, resistance may be inserted in series with

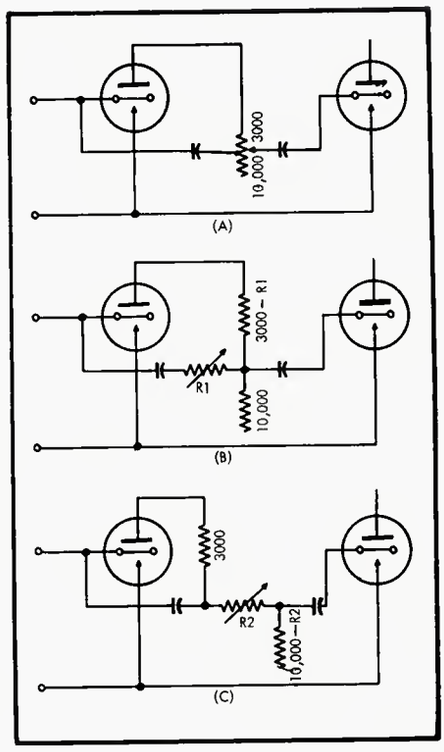


Fig. 7. (A) Treble control circuit. (B) Equivalent for (A) under treble-boost conditions. (C) Equivalent under treble attenuate conditions.

Z_F for treble boost, or with Z_L for treble attenuate, as may be seen easily by inspection of Eq. (*1*). For the case of treble boost, Z_F will comprise the series combination of the fixed feedback capacitor and the series resistance. The turnover frequency will be given by equating this resistance to the reactance of the feedback capacitor. Treble attenuation is obtained by removing the resistance in series with the feedback capacitor and inserting resistance in series with the load capacitor. The turnover for treble attenuation is the frequency at which the inserted resistance equals the reactance of the load capacitor. The series resistance must appear only in one divider arm at a time in order to secure variable turnover characteristics. The arrangement shown at (A) in *Fig.* 7 using a tapped potentiometer performs this function. As the slider is moved upward, series resistance appears in the feedback lead, but not in the load circuit as shown at (B) in *Fig.* 7, thereby giving treble boost; conversely, as the slider is moved below the fixed tap, series resistance appears in the load circuit but not in the feedback circuit as indicated at (C) of *Fig.* 7. The resistance of the potentiometer between the collector and the current division point is negligible compared with the output impedance of the transistor collector, and may be ignored. The combination of the circuits of *Figs.* 6 and 7 gives the configuration shown in the second stage of *Fig.* 2.

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Design of the Tone-Control Circuit

The design of a linear amplifier normally starts with the establishment of the d.c. operating point, which in the case of transistors is usually determined by the signal level to be accommodated in the collector circuit (as opposed to tube circuits where the operating point must be set at an inefficiently high voltage- and current-operating point in order to secure reasonable gain and low distortion). The first stage was designed for a transistor having any value of α_{cb} (common-emitter current amplification factor) between 65 and 130. The design range of α_{cb} for the second and third stages is between 33 and 66. The circuits are designed to operate without degradation of performance up to a temperature of 120° F. Collector-to-base degenerative d.c. feedback is used to achieve this stable operation[4]. A design method for R-C coupled amplifiers of this type is given in the literature[5] and is of little more complexity than that involved in the use of "Resistance Coupled Amplifier Charts" for vacuum tubes.

For the tone control stage itself, the values of the feedback and load capacitors as well as the resistance of the potentiometers must be determined. The problem of finding an optimum set of capacitor values is somewhat complex. Suffice to say that the output capacitor should be just large enough to permit full output from the output stage at low frequencies when the signal swing at the collector of the tone control stage is at its maximum value (as determined by the power supply voltage and variations in transistors due to tolerances and temperature effects). This procedure maximizes the high-frequency response while assuring adequate low-frequency signal handling capability. The feedback capacitor should have the smallest value consistent with good low-frequency response in relation to the resistance it faces, as described above, in order to secure maximum gain or, actually, minimum loss, from the stage. The circuit of *Fig.* 2 balances these factors in a direction of low distortion and wide range of control at the expense of gain. By substituting the values of *Fig.* 2 in Eq. (*1*), it is seen that the tone-control stage actually has a loss of about 10 db. The gain of the other two stages makes up for this loss and provides the additional required gain.

Having determined the capacitor values, we may now find the resistances of the tone-control network. The total treble-control resistances on each side of the fixed tap are chosen to give the minimum desired treble turnover frequency, as would be obtained with the treble control in the extreme positions of boost or attenuate. This frequency is taken as 800 cps. The resistance on the boost side of the treble control is made equal to the reactance of the feedback capacitor at this frequency. The resistance on the attenuate side is equated to the reactance of the output capacitor.

The bass-control circuit includes a pair of resistors connected to the ends of the bass-control potentiometer. These serve to limit the amount of shunting of the feedback and output capacitors, and thereby limit the bass-turnover frequency to a value not exceeding the desired maximum. This maximum was taken again as 800 cps, so that the values of the limit resistors are about equal to the values of the resistances on either side of the fixed tap of the treble control.

The choice of a bass-control potentiometer would be as simple as that of the treble control if we had a potentiometer which shunted only one capacitor at a time. If, for example, bass boost is desired, a resistance should be placed in shunt with the load capacitor C_L, and the resistance shunting the feedback capacitor should be negligibly high. If a potentiometer is connected as shown in *Fig.* 6, the resistance is not removed from its position shunting the feedback capacitor, so that at some very low frequency, the presence of this resistance will cause the response to return from its rising characteristic (as frequency is decreased) to a flat characteristic. Hence, a certain amount of bucking of the boost and attenuate portions of the bass control exists. This may be viewed in another way which may be enlightening. The current divider at the collector of the transistor is essentially a capacitive divider at midfrequencies. At extremely low frequencies, the reactance of both capacitors becomes very high so that we have essentially a resistive divider made up of the resistances of the potentiometer on either side of the slider. The response will therefore be controlled by the capacitive divider at midfrequencies and by the resistive divider at very low frequencies; in between, an asymptotic slope of 6 db per octave joins these two levels, as illustrated in *Fig.* 8. By use of a very high resistance potentiometer, the amount of bucking can be made negligibly small. If the resistance is made too high, however, the tone control action is crowded toward the extremes of rotation of the potentiometer. A compromise is indicated, in which a certain degree of bucking is tolerated in return for smooth tone control action. In the case of the circuit of *Fig.* 2, reasonably smooth control is achieved with a slight departure from true variable-turnover characteristics. As may be seen in *Fig.* 3, this departure is small, and in a direction to give less slope as the amount of boost or attenuate is lessened.

[4] F. D. Waldhauer, U. S. Patent No. 2,750,456.

[5] Reference 1, p. 171, Eq. (5–29a); p. 175, Eq. (5–43).

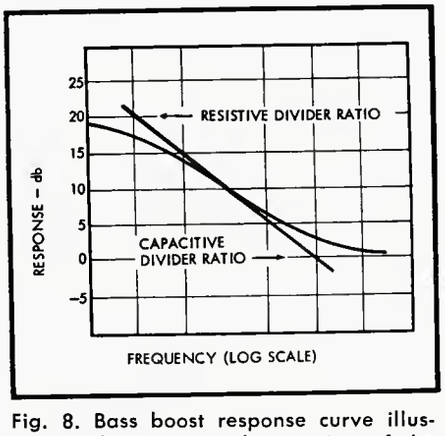


Fig. 8. Bass boost response curve illustrating the manner of operation of the bass control.

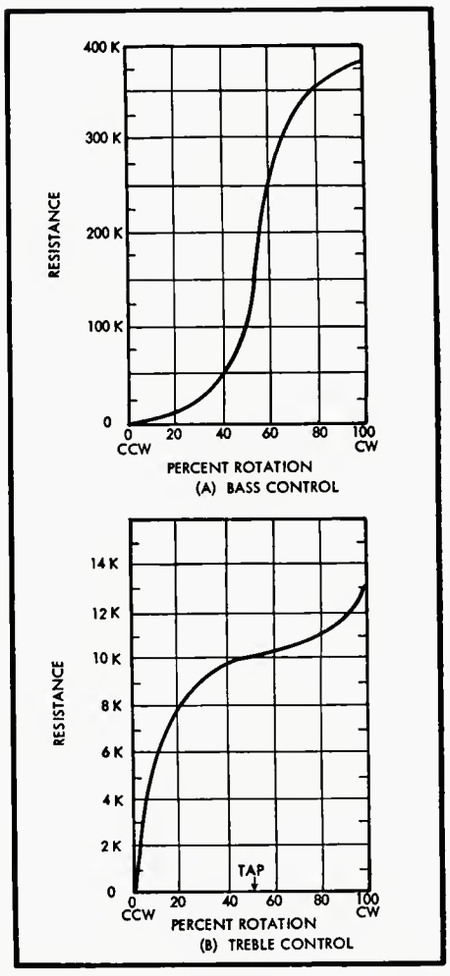


Fig. 9. Curves of resistance vs. rotation for smoothest distribution of the tone control action over the range of the controls.

Potentiometer Requirements

The requirements for a tone-control circuit closely approaching the objectives stated above have met except possibly in one respect; namely, that of smoothness of tone control action. The ideal control in this respect is probably

(*Continued on page 88*)

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Peak and Dip Circuits

The basic circuit for these purposes uses the same configuration as those step circuits shown in *Fig.* 1, the difference being that the box, instead of containing a single reactance, now consists of two reactances, connected either in series or in parallel. The natural design center of such a network is the resonant frequency of the two reactances, which will be either the peak or dip, according to configuration.

Figure 7 shows the basic configurations. It is possible to devise complete formulas giving a response for each of these configurations, but there is a somewhat simpler approach, based on the similarity to a step circuit. It could be regarded as a modified step circuit where the reactances do not vary with the frequency in the same manner as for the simple circuit.

In a peaking circuit, the height of the peak corresponds with the height level ultimately achieved in a simple step circuit, theoretically at zero or infinite frequency. In a dip circuit, the bottom of the dip corresponds with the lowest level achieved in a step circuit. Where the combined reactance of the tuned circuit becomes equal to the values used for turnover points on the step circuit design, a corresponding attenuation or boost will be shown in the peak or dip circuit on either side of the resonance. Similarly the attenuation midpoints can be marked out which will also be the maximum phase shift positions on the response curve.

In this way, all the data used for step-circuit prediction can be applied to peak and dip circuits, except the slope, because the use of reactances in combination enables the transition from one point to another on the curve to be achieved over a smaller range of frequency than is possible with the simple step circuit.

Figure 8 shows the basic response configuration achieved by peak and dip circuits together with the position of the frequencies determined by this method. The relevant formulas are given in the appendix and *Fig.* 9 gives a chart for determining the relative frequency values in terms of circuit constants.

If the problem is to produce a peak of definite response configuration this can be sketched on a piece of the semi-log graph paper usually used for response plotting, and the relevant design points noticed. The frequency relation between the design points thus obtained is used on the chart of *Fig.* 9 to find a suitable value for S. This value of S can be further used with the chart of *Fig.* 9 to ascertain that all seven frequencies give a good approximation to the desired response shaping. If this does not happen, some adjustments can be made until the best approximation for all seven points can be achieved. This is all done before any values other than S and K are put into the calculation.

The next step, is to use the appropriate formula given in the appendix from (*13a*) to (*13d*) to find the reactance of L and C at the resonant frequency. From here, suitable values of L and C can be calculated from a standard reactance chart to complete the circuit. Methods of applying this information to practical circuits are similar to those for applying step circuits and will be considered later in this article.

High- or Low-Frequency Peaking

This is a variety of peaking circuits different from that shown in *Fig.* 7 and an example of the circuit configuration is shown in *Fig.* 10. At low and medium frequencies in the response band, the transfer behaves as if L were short-circuit and C were open-circuit and the network gives just an attenuation due to the source working through r into R. Equation (*16*) gives the attenuation factor of this arrangement using the substitution of Eq. (*17*). The attenuation possibilities of the arrangement are somewhat similar to those given for the step circuit.

Further substitutions are given in the formulas in the appendix which enable the response to be simplified to a form

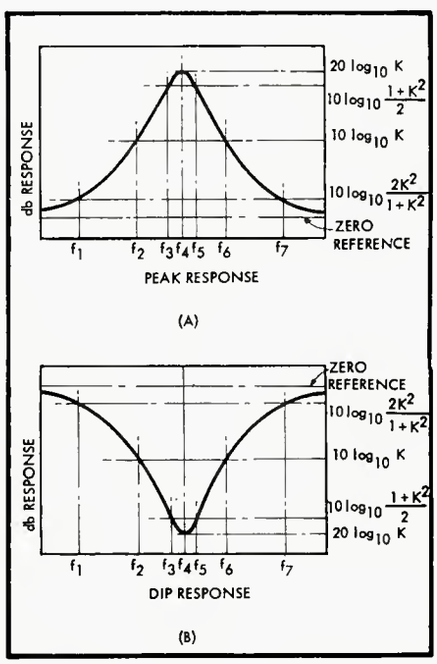


Fig. 8. Essential dimensions of peak and dip response characteristics.

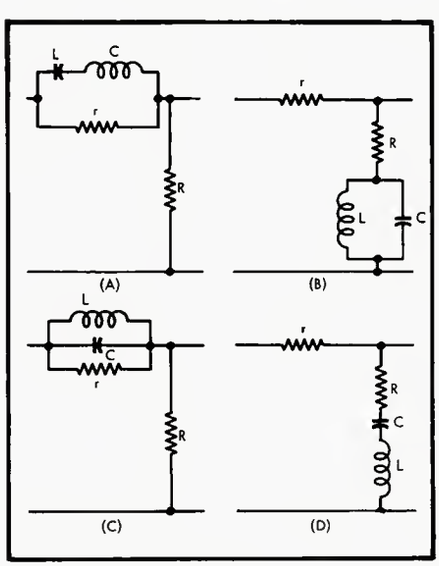


Fig. 7. Basic networks for peak and dip responses.

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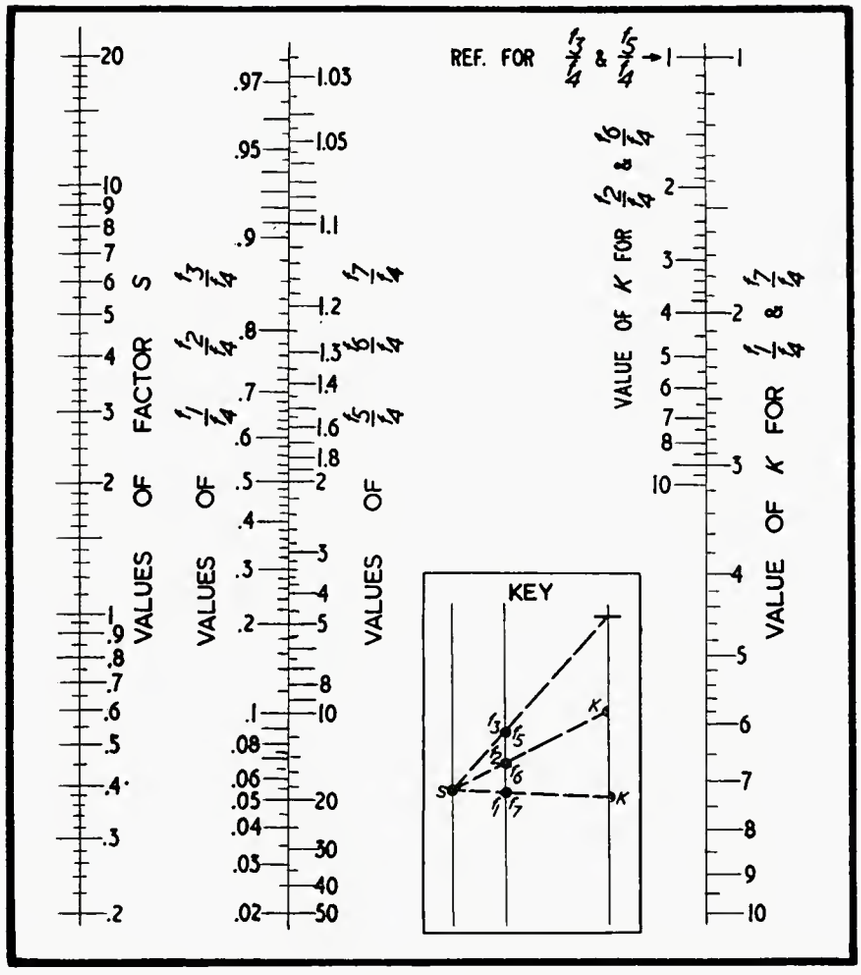


Fig. 9. Nomogram for quick computation of design point on peak and dip responses indicated in Fig. 8. The key clarifies the method of use.

shown at Eq. (*22*). This is normalized to the reference frequency where the transfer phase shift is 90 deg. and where the downward slope at the reference frequency is unity or 60 db per octave. This reference frequency forms the basis of design for the curves presented in *Figs.* 11 to 13.

An alternative reference frequency for plotting the amplitude response of a peaking circuit of this nature is the peak frequency itself. This is given by Eq. (*25*) and the response can be plotted to this reference by Eq. (*27*). This reference frequency formed the basis for the method of design given with the chart in another article.[2] This type of presentation can also be reduced to a nomograph construction but as the peak frequency is not usually of considerable importance in equalizer design this is not repeated here.

The important thing, as with the use of the other circuits described, is to achieve a direct approach, with the object of fitting the shape of the response to the shape of the correction required. To aid in this we need to know the relation between the various design points that can be used by different methods. These are plotted in the graph of *Fig.* 14, which gives: the relation between the design points using the 6-db slope with a 90-deg. phase reference point and the peak frequency; the relation between these points and the point of upward maximum slope which is where the characteristic ceases to be useful as a means of extending frequency response or correcting for a rolloff; the maximum upward slope and the boost at this point; also the same information relative to maximum downward slope, which is unlikely to be of direct use in equalizer design, but it completes the presentation.

Practical Application

All of the charts and design methods so far described produce figures in terms of ideal circuits. These still have to be applied to practical circuit configuration so as to produce the results predicted. This means that the practical circuit configurations must reduce to the theoretical ideal which has been designed.

Take first of all the circuit configuration of (A) in *Fig.* 1 which can also be applied to the peaking circuit of (A) in *Fig.* 7 or the dip circuit of (C) merely by substituting in the right values of reactance. The commonest application of these circuits is between two stages of amplification as illustrated at *Fig.* 15. This might be reduced to the form of the ideal arrangement of (A) in *Fig.* 1 or (A) and (C) of *Fig.* 7 by the transposition shown in *Fig.* 15.

First the source resistance produced by the parallel combination of the plate resistance of the preceding tube with its plate coupling resistance is calculated and represented as a series source or input resistance to the network. As the frequency discriminating portion is connected across just the resistance element R_1 the voltage distribution across the rest of the resistances in the circuit—that is, the source resistance and the output resistance R_2, will be uniform and the result will be precisely similar to that attained if the position of the source resistance and the series frequency modifying component consisting of R_1 and the reactance element is transposed as in (C) of *Fig.* 15. This can then be rearranged to show the behavior of the circuit more explicitly as at (D).

If certain of the values in this circuit are predetermined by circuit parameters, then the remaining values can be calculated from the date obtained from the chart and a circuit produced that will give the performance predicted.

There are two principal methods in which the theoretical circuit of (B) in *Fig.* 1 or (B) or (D) in *Fig.* 7 may be applied to practical configurations. These are shown at *Figs.* 16 and 17 respectively.

The arrangement of *Fig.* 16 represents the application of this circuit to an interstage coupling and shows a step-by-step reduction of it to the basic form. This will aid in making the transformation in practice and, as for the preceding circuit, if certain values are set by circuit parameters the remainder can be calculated from the data obtained from the charts accompanying this article.

Figure 17 represents an application

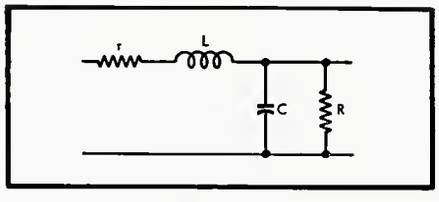


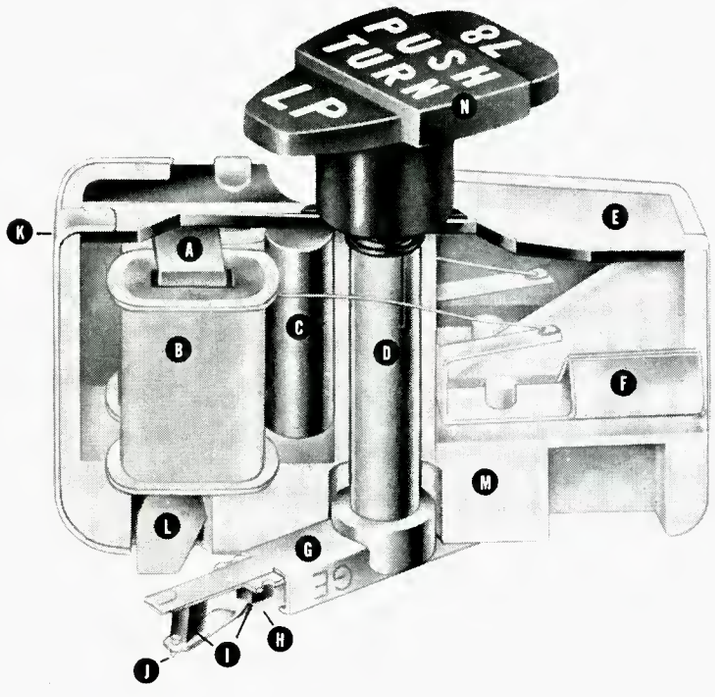
Fig. 10. Basic network for interstage high-frequency peaking roll-off.

[2] *Electronic Engineering*, Dec., 1951, p. 483.

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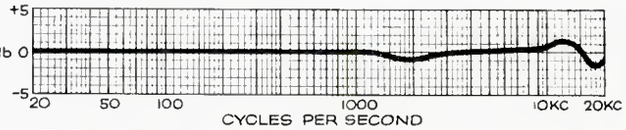
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TYPICAL FREQUENCY RESPONSE OF VR$_{II}$ CARTRIDGE MEASURED ON A CONSTANT VELOCITY BASIS

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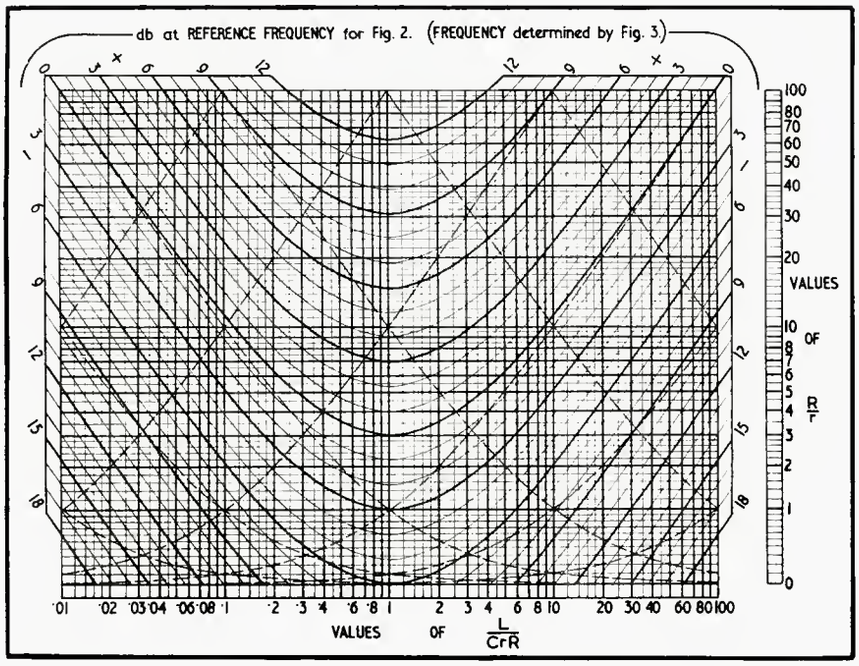


Fig. 11. Chart for determining the response shaping for known values of L, C, r, and R in the network of Fig. 10, and for estimating the effect of varying values. The dotted lines show typical paths represented by changing just r or R with the other values held constant.

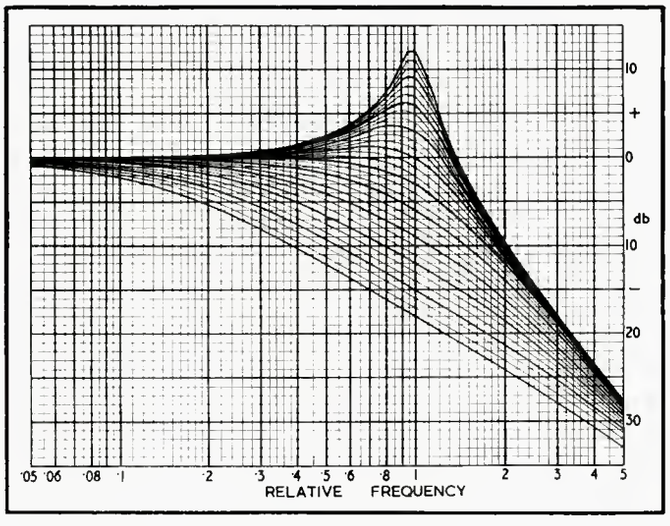


Fig. 12. The possible response curves for the network of Fig. 10. The chart of Fig. 11 identifies the required curve by the boost or attenuation at reference frequency (shown here as 1), which is f_ϕ of equation (19).

of this kind of circuit in a manner similar to decoupling in the plate circuit. The simplest form of this consists of using a small value of capacitor as a stabilizing addition to a feedback amplifier. However the same method can be adopted in applying a peak or dip circuit in the same position, if necessary.

Figure 17 also follows a step-by-step reduction to basic forms, but note the conversion between (B) and (C) of the arrangement R_c, R_d, and X to form a new configuration using different values, R_c', R_d', and X', which makes for a simpler conversion to the arrangement shown at (C) and (D) progressively.

Figure 18 shows the reduction of a practical circuit to the form of the basic high-frequency peaking circuit of *Fig.* 10. It is shown for a simple, straightforward inductance and capacitance in the circuit.

A useful application of this basic circuit can employ the leakage inductance of an interstage coupling or input transformer with a capacitance across its secondary, which may be just the self capacitance of the transformer with the input capacitance of the next stage, or it may be augmented to get the tune point in the right place, if necessary. Precisely the same method of reduction is followed for this, except that the transformer ratio has to be taken into account. Either the impedance on the primary can all be referred to the secondary by multiplying by turns ratio squared, or else the impedances on the secondary can be transferred to the primary by dividing by the turns ratio squared. The simplest way is to transfer to the secondary because this is where the physical capacitance exists and the leakage inductance can usually be referred as readily to the secondary.

This means that the source resistance has to be referred to the secondary by multiplying the physical source resistance, consisting of the plate resistance of the tube in parallel with the plate coupling resistance, by the square of the transformer turns ratio. If an input transformer is being used for this function, then the source resistance is that of the input to which the transformer is connected and it must be multiplied by the square of the step up turns ratio.

The data of the *Figs.* 11 to 14, while primarily intended for high-frequency peaking circuits, may also be applied to a low-frequency peaking circuit of the type shown in *Fig.* 19 merely by inverting the frequency characteristic in all respects. This can easily be done by means of the reciprocal scale on a slide rule, setting 1 on the C scale alongside the reference frequency used on the D scale, and reading off actual frequencies

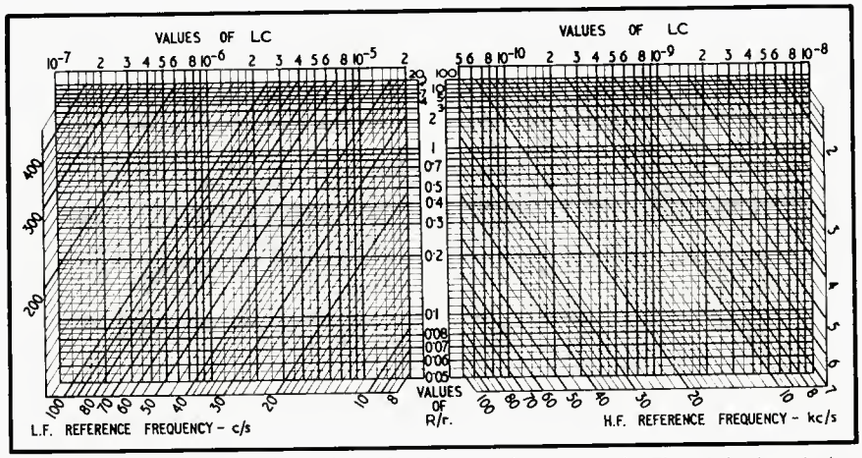
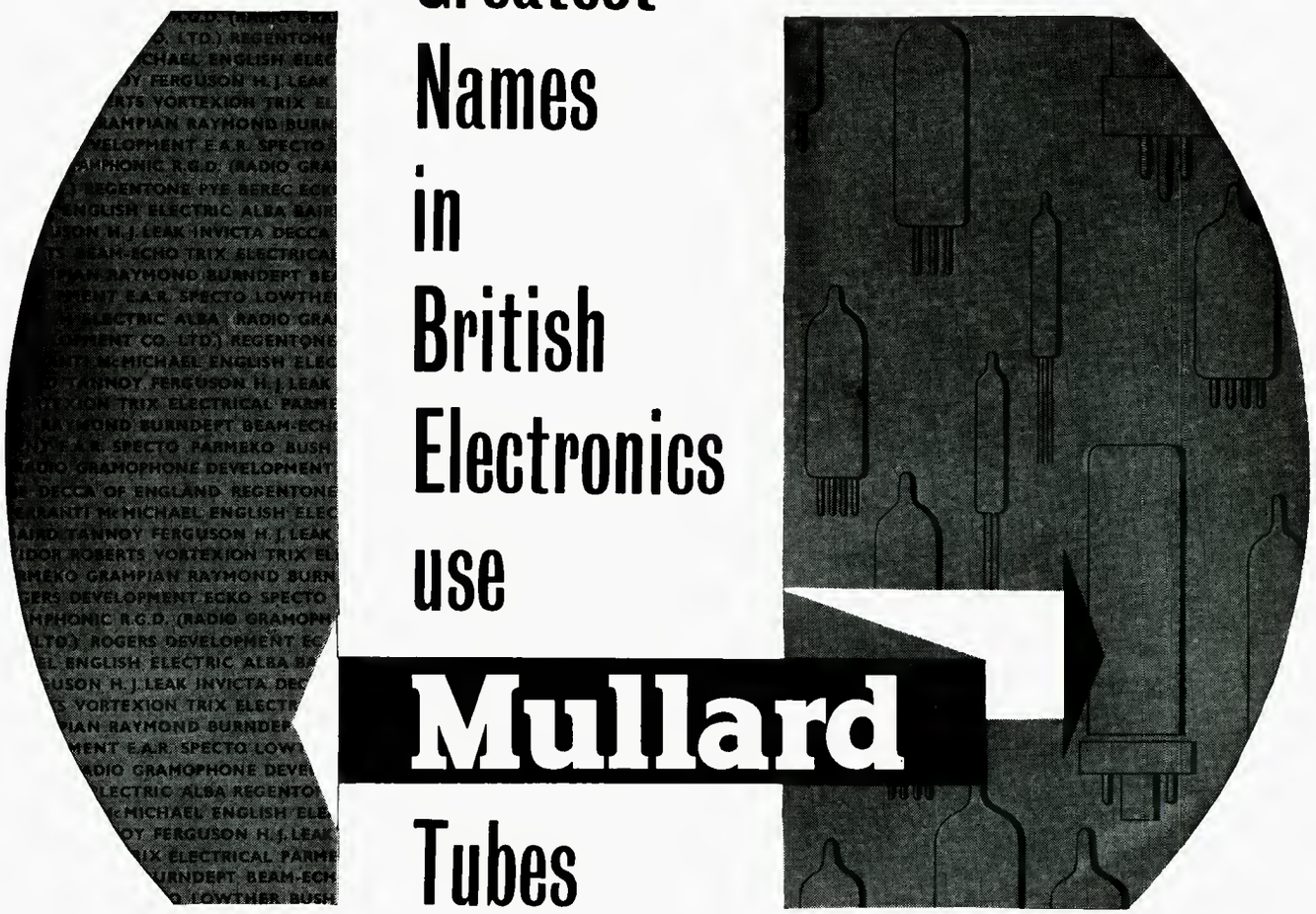


Fig. 13. Charts for giving the value of reference frequency f_ϕ. The right hand chart applies to high-frequency peaking networks as at Fig. 10. The left part applies to low-frequency peaking networks as at Fig. 19, and the charts of Figs. 11 and 12 can also be applied for this, by taking reciprocal value of relative frequency (Fig. 12).

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on the D scale against normalized frequencies on the CI scale.

Figure 20 shows how a practical low-frequency peaking circuit can be reduced to basic equivalents suitable for calculations with the aid of *Figs.* 11 to 14. If the inductance is that of a transformer winding, suitable impedance references may be necessary.

Appendix I

For peak and dip circuits a simple approach to design is to use the reactance of each element at the tune point, or center frequency; from this values of L and C can be calculated from standard reactance formulas or chart:

Appendix II

For circuit (A) in *Fig.* 7,

$$X = \frac{SrR}{r+R} \qquad (13a)$$

For circuit of (B) in *Fig.* 7,

$$X = \frac{r+R}{S} \qquad (13b)$$

For circuit of (C) in *Fig.* 7,

$$X = \frac{r}{S} \qquad (13c)$$

For circuit of (D) in *Fig.* 7,

$$X = SR \qquad (13d)$$

The data already given for step circuits can be applied to the derivation of peak and dip criteria by writing:

$$x = \frac{1}{S\left(z - \frac{1}{z}\right)} \qquad (14)$$

where z is frequency normalized to the tune or center frequency f_t. Solving for z, after substituting values of x to give relevant points on curve from (*2*) or (*2a*), the following frequency relations are obtained:

$$\frac{f_1}{f_t} = \sqrt{\frac{K^2}{4S^2} + 1} - \frac{K}{2S} \qquad (15a)$$

$$\frac{f_2}{f_t} = \sqrt{\frac{K}{4S^2} + 1} - \frac{K^{1/2}}{2S} \qquad (15b)$$

$$\frac{f_3}{f_t} = \sqrt{\frac{1}{4S^2} + 1} - \frac{1}{2S} \qquad (15c)$$

$$\frac{f_4}{f_t} = \sqrt{\frac{1}{4S^2} + 1} + \frac{1}{2S} \qquad (15d)$$

$$\frac{f_5}{f_t} = \sqrt{\frac{K}{4S^2} + 1} + \frac{K^{1/2}}{2S} \qquad (15e)$$

$$\frac{f_6}{f_t} = \sqrt{\frac{K^2}{4S^2} + 1} + \frac{K}{2S} \qquad (15f)$$

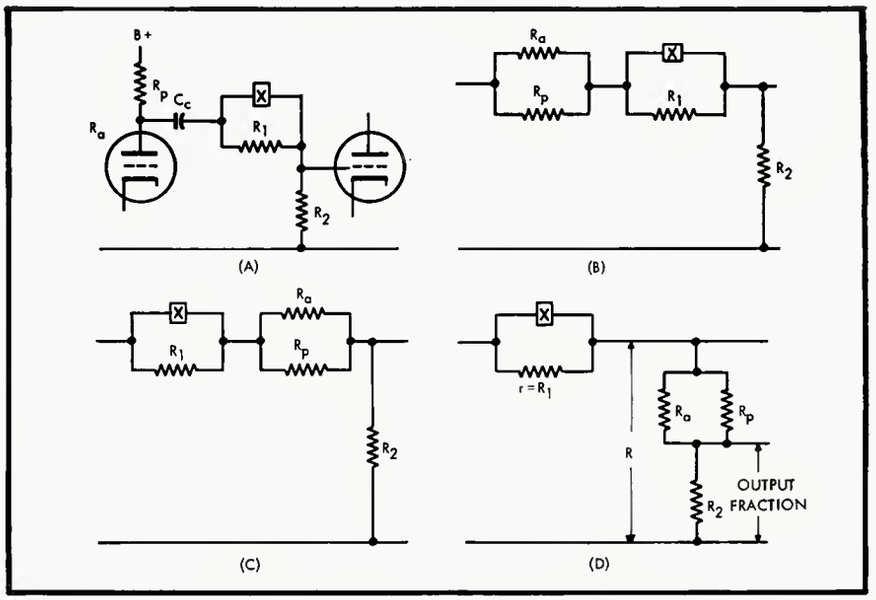


Fig. 15. Step by step reduction of practical circuit to basic network, for arrangements of (A) in Fig. 1, or (A) or (C) in Fig. 7.

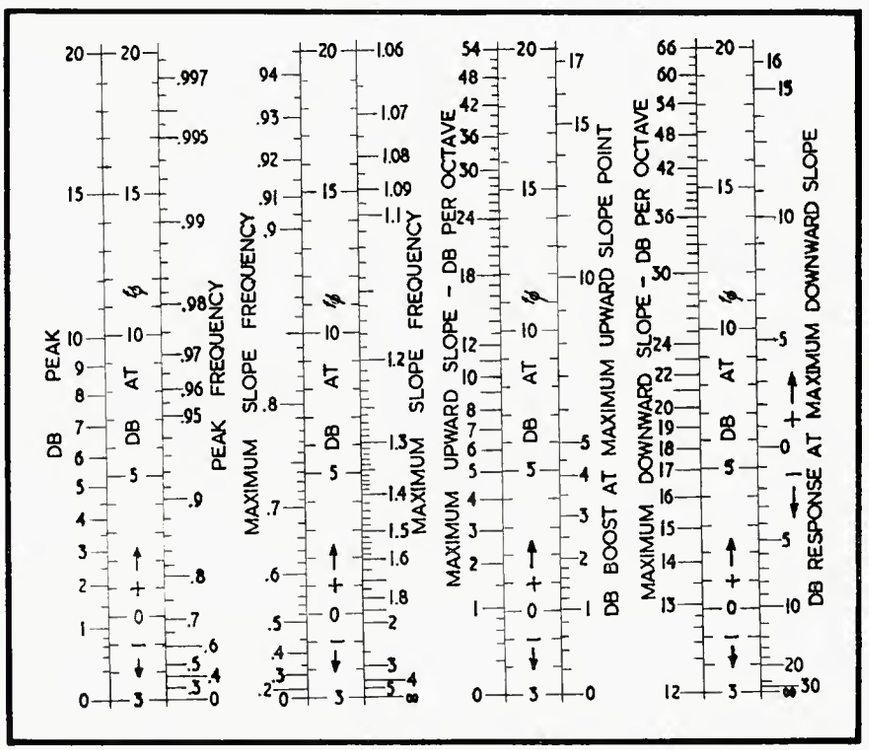


Fig. 14. These scales help in selecting the best response for a specific purpose. The same "db at f_t" point should be used in each of the other eight references.

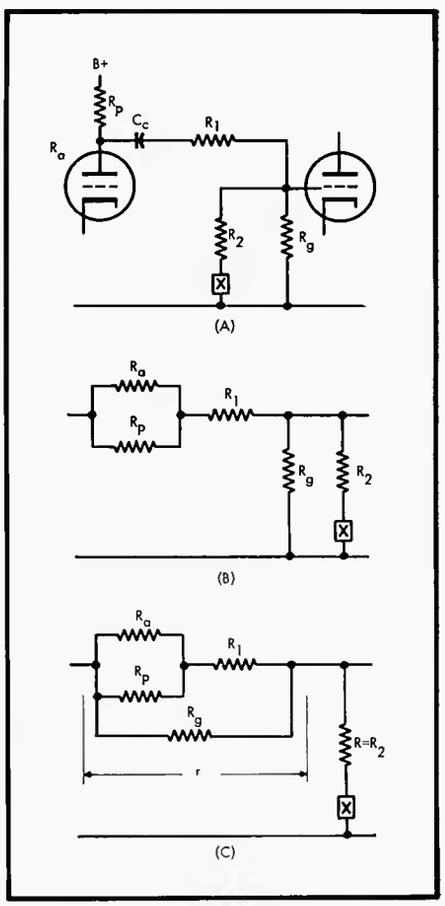


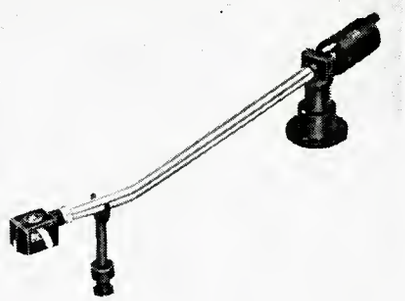
Fig. 16. Reduction of practical circuit to basic network for arrangements of (B) in Fig. 1 or (B) or (D) in Fig. 7.

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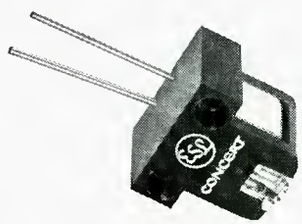
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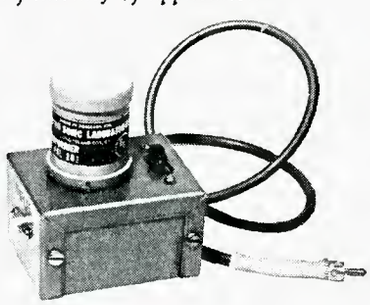


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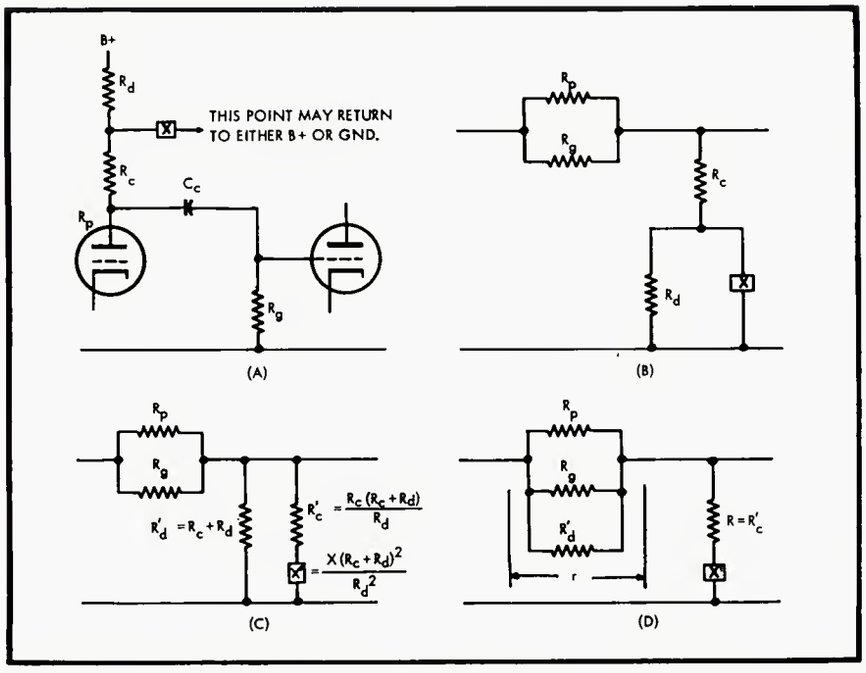


Fig. 17. An alternative practical circuit that also reduces to the same basic networks, (B) in Fig. 1 or (B) or (D) in Fig. 7. Notice in this case the conversion between (b) and (c) from R_c, R_d and X to R_c', R_d' and X'.

The response of the high-frequency peaking circuit of *Fig.* 10 may be written:

$$A = \frac{1 + \frac{r}{R} - \omega^2 LC + j\omega\left(\frac{L}{R} + rC\right)}{1 + \frac{r}{R}} \qquad (16)$$

Making the substitution,

$$\frac{r}{R} = a \qquad (17)$$

$$\frac{L}{CrR} = b \qquad (18)$$

$$A = \frac{1 + a - \omega^2 LC + j\omega L^{1/2} C^{1/2} a^{1/2}\,(b^{1/2} + b^{-1/2})}{1 + a} \qquad (16a)$$

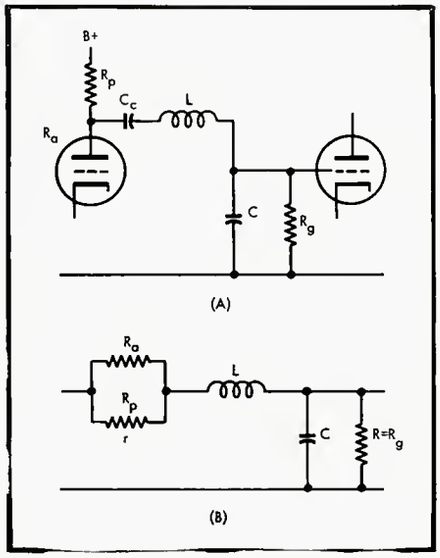


Fig. 18. Reduction of practical high-frequency peaking circuit to basic network of Fig. 10.

Writing:

$$\omega_\phi^2 = \frac{1 + a}{LC} \qquad (19)$$

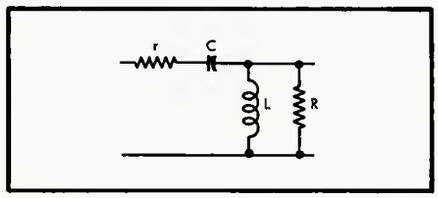


Fig. 19. Basic network for interstage low-frequency peaking rolloff. The charts of Figs. 11-13 can also be applied to this.

and

$$y = \frac{\omega}{\omega_\phi} \qquad (20)$$

$$A = 1 - y^2 + jy\,\frac{a^{1/2}}{(1 + a)^{1/2}}\,(b^{1/2} + b^{-1/2}) \qquad (16b)$$

and writing:

$$D = \frac{a^{1/2}}{(1 + a)^{1/2}}\,(b^{1/2} + b^{-1/2}) \qquad (21)$$

$$A = 1 - y^2 + jDy \qquad (16c)$$

From this form the attenuation response is derived:

$$db\ \ loss = 10\ \log_{10}[1 - (2 - D^2)y^2 + y^4] \qquad (22)$$

and the phase response:

$$\phi = \tan^{-1} D\,\frac{y}{1 - y^2} \qquad (23)$$

Giving the slope in terms of the unit-slope formula:

$$\frac{d\ \log\ A^2}{d\ \log\ y^2} = \frac{y^2[2y^2 - (2 - D^2)]}{y^4 - (2 - D^2)y^2 + 1} \qquad (24)$$

This gives unity slope when $y = 1$, zero slope when $y^2 = \frac{2 - D^2}{2}$ and a slope of 2 when $y^2 = \frac{2}{2 - D^2}$.

The attenuation response can be referred to the peak frequency, instead of the unity slope point (or 90-deg. phase reference) by writing

$$y_o^2 = \frac{2 - D^2}{2} \qquad (25)$$

and

$$x = y/y_o \qquad (26)$$

$$db\ \ loss = 10\ \log_{10}\left[1 + \frac{(2 - D^2)^2}{4}\,(x^4 - 2x^2)\right] \qquad (22a)$$

For more convenient parameter determination

$$2 - D^2 = \frac{2 - a\left(b + \frac{1}{b}\right)}{1 + a} \qquad (21a)$$

So frequency response may be written:

$$db\ \ loss = 10\ \log_{10}\left[1 + \left\{\frac{2 - a\left(b + \frac{1}{b}\right)}{1 + a}\right\}^2 (x^4 - 2x^2)\right] \qquad (22b)$$

Maximum slope can be obtained by a second differentiation:

$$\frac{d^2\ \log\ A^2}{d\ \log\ x^2 dx^2} = \frac{-(2 - D^2)y^4 + 4y^2 - (2 - D^2)}{\{y^4 - (2 - D^2)y^2 + 1\}^2} \qquad (27)$$

and equating to zero, giving:

$$y^2 = \frac{2}{2 - D^2} \pm \sqrt{\frac{4D^2 - D^4}{(2 - D^2)^2}} \qquad (28)$$

the lower root of which gives upward slope, and the upper root the maximum downward slope; substituting these roots into (24) gives the maximum slopes as

$$\left[\frac{d\ \log\ A^2}{d\ \log\ x^2}\right]_{max} = 1 \pm \frac{2}{(4D^2 - D^4)^{1/2}} \qquad (29)$$

and the attenuation at this frequency (which is a lift at the lower root)

$$db\ \ loss = 10\ \log_{10}\frac{4D^2 - D^4}{2 \mp (4D^2 - D^4)^{1/2}}. \qquad (30)$$

Æ

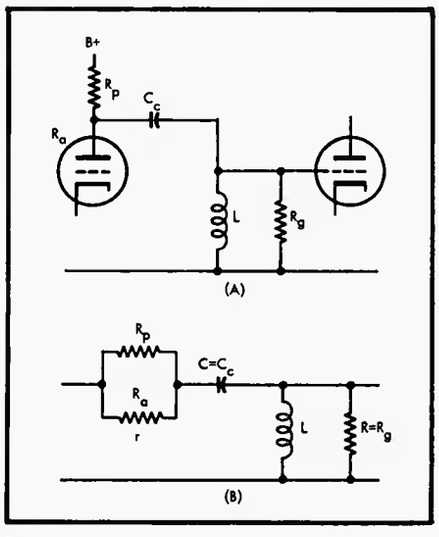


Fig. 20. Reduction of practical low-frequency peaking circuit to basic network of Fig. 19.

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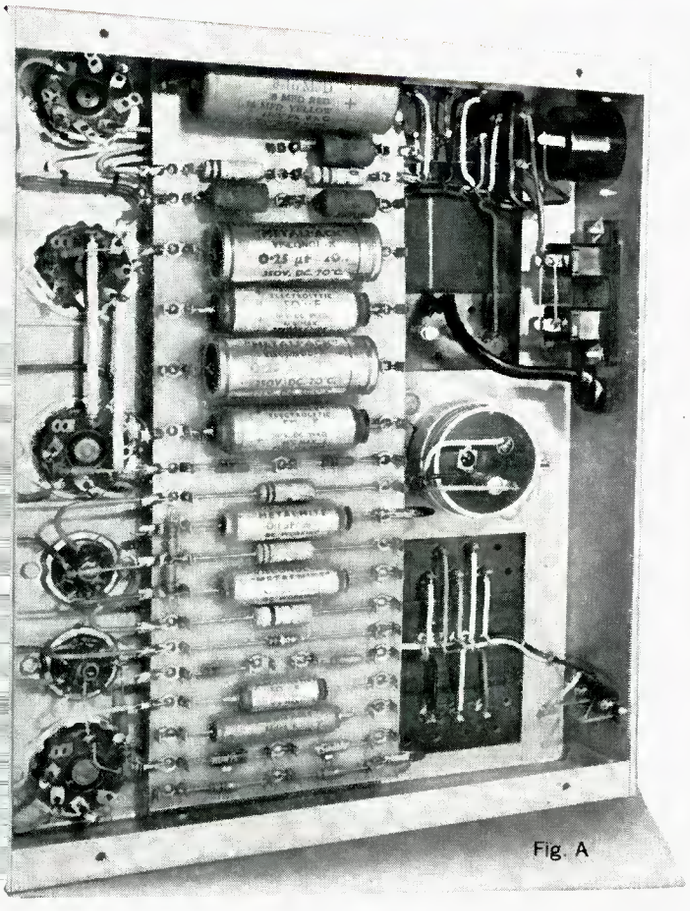


Fig. A

THE 3 NEW LEAK AMPLIFIERS

High power . . . 50, 25, 12 watts . . . all at 1/10 of 1% (0.1%) distortion

The aim in producing these new units was to give the consumer the benefit of broadcast and professional components and workmanship in an amplifier for home use.

Simply stated: these amplifiers incorporate every desirable feature the Trade and consumers have wanted . . . and without compromising the high Leak standard of craftsmanship.

CIRCUITRY

These new amplifiers continue to use a triple loop, negative feedback circuit. The unusually high amount of negative feedback in the Leak circuitry permits us to keep distortion to 1/10 of 1% (0.1%) at full rated output, and to reduce hum, noise and the effects of tube aging or replacement to a minimum. In order to utilize this amount of negative feedback, and to achieve these advantages, a highly stable circuit is necessary. This requires the finest components and great skill in testing and assembly. For example, costly sealed condensers are used exclusively.

POWER RATING

There has been a consistent demand for higher power in amplifiers for home music systems, and recent developments and improvements in output tubes have now made it possible to satisfy these demands without altering the proven Leak circuitry or compromising the Leak "Point One" performance standards. The Leak "TL50 Plus" amplifier employs the newly-developed, high output KT88 type tube; the "TL25 Plus" incorporates the recognized KT66 type, and the "TL12 Plus" the N709 type.

It is important to know what we mean by a 50 watt "plus" Leak amplifier. We rate this amplifier at 50 watts because that is the point at which the harmonic distortion reaches 1/10 of 1% (0.1%) at 1000 cycles. In actual fact, this amplifier can deliver as much as 64 watts, still with negligible distortion. This explains the word "plus" in the model number. In the same way, the "TL25 Plus" delivers 32 watts, the "TL12 Plus" delivers 14 watts . . . therefore, these model designations also contain the word "plus."

CRAFTSMANSHIP

One way to demonstrate the care taken in manufacturing a Leak amplifier is to turn it upside down and compare it with *any* other amplifier. You can show your customer the components used (and, incidentally, explain that these components . . . fine as they are . . . are all utilized well below their maximum ratings, which insures great stability and long life). (See figure A). These are the kind of considerations which produce the recognizable difference between Leak sound and that of any other amplifier.

CUSTOMER BENEFITS

You now have, for your customer, three great new Leak amplifiers. You are in a position to assist him in selecting what *he* requires in power and in price . . . with full confidence that you are giving him the finest.

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. . . sound dealers and sales personnel . . .
this advertisement is addressed to you!

It is a complete description of the entirely new LEAK line. Your customers will be asking for information.

3 ENTIRELY NEW LEAK POWER AMPLIFIERS

2 ENTIRELY NEW LEAK PREAMPLIFIERS



THE 2 NEW LEAK PREAMPLIFIERS

Compact, handsome and flexible . . . built specifically and only for the Leak power amplifiers!

The first impression you will get is the handsome, compact look of these preamplifiers. They have been completely restyled in rich gold, brown and white by world-famous designer Richard Lonsdale-Hands.

EXCEPTIONAL VERSATILITY

Careful thought has been given to the varied installations and arrangements to which these preamplifiers must be adaptable. For example, one exclusive feature is the tape recording and playback jacks on the front *and* the rear panels—to facilitate portable as well as permanent tape recording installations.

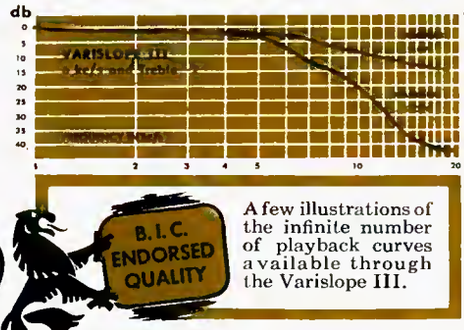
THE NEW "POINT ONE" PREAMPLIFIER

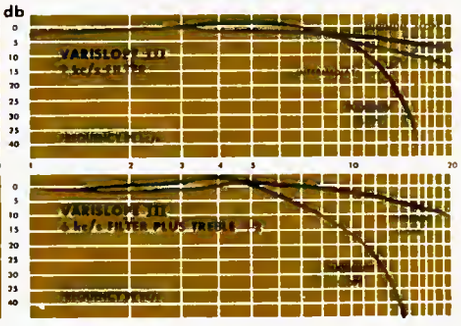
The "Point One" Preamplifier includes more expensive components, and a more complete circuitry than you will find in most preamplifiers. The reason for its low price of $55.00 is that this preamplifier was designed without a power supply, since it takes its power from the amplifier. The "Point One" is a low-noise, low-distortion 2-stage feedback tone control preamplifier. The first stage provides record compensation through frequency selective negative feedback. The second stage embodies feedback tone control circuits, which give continuously variable control of both bass and treble frequencies . . . ± 16 db at 30 c/s and ± 18 db at 20,000 c/s. A 4 kc, 6 kc and 9 kc filter permits comprehensive control of treble frequencies in old or worn records. The four playback characteristics cover all records ever made! The inputs for tuner, tape and phono cartridge each have their own balancing controls! You simply could not give your customer more preamplifier for the money!

THE NEW VARISLOPE III PREAMPLIFIER

This preamp has all the features of the new "Point One" and, in addition, has two magnetic input positions, a rumble filter, and the exclusive Leak Slope Control. This important control makes available an infinite number of equalization positions.

Here's how the Varislope works: When the Filter Control is turned to 9, a filter is switched into circuit, the turnover frequency being 9 kc/s. Other turnover frequencies of 6 kc/s and 4 kc/s are also obtainable. The Slope Control varies the rate of attenuation above the turnover frequency, between 5 db per octave and 35 db per octave. The Treble control is operative at the same time, and you can see that these three give a most versatile control of the high frequency range. In actual practice, records which may sound distorted . . . harsh or shrill . . . can be controlled to remove the distortion, yet keeping all the musical content. This will give your customer the greatest listening pleasure possible for every record in his collection.





B.I.C. ENDORSED QUALITY

A few illustrations of the infinite number of playback curves available through the Varislope III.

HERE ARE THE SIX LEAK GROUPINGS AND THEIR CONSUMER NET PRICES, FOR CONVENIENT REFERENCE:

AMPLIFIER + PREAMPLIFIER = PRICE		
"TL/50 PLUS"	VARISLOPE	$228.00
	POINT ONE	$204.00
"TL/25 PLUS"	VARISLOPE	$188.50
	POINT ONE	$164.50
"TL/12 PLUS"	VARISLOPE	$168.00
	POINT ONE	$144.00

Shipments of these new units have already started. Be sure that you have them on order and on demonstration. Send for literature for yourself and your customers.

BRITISH INDUSTRIES CORPORATION, Dept. LM17, PORT WASHINGTON, N. Y.

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Two-Channel Transistor Remote Amplifier

DONALD K. HAAHR*

The author gives the details of a broadcast-type amplifier transistorized in the manner of the Collins 212 Z-1 Remote Amplifier but with only two inputs. This unit might easily be adapted to serve as the input amplifier for a tape recorder in addition to its normal uses as an extremely compact remote unit.

THE ORIGINAL PURPOSE of our transistor remote amplifier at WOI was to replace the spare, one-channel, two-piece, emergency amplifier. While we were at it, we decided to incorporate the features we considered important for our individual needs. First, we needed two channels—one for the sportscaster, and the other for the announcer who did color between quarters or halves. Going one step further we decided to add a second input to the second channel in order to make background sound effects available during the sportscast, reasoning that they would seldom be needed at the same time. A master gain control was considered necessary to maintain balance between crowd noise and announcer in an open booth and yet ride adequate gain.

We chose potentiometers with quarter-inch shafts for normal knob sizes to assure smooth mechanical operation without the necessity for miniaturizing the operator's hands. 22.5-volt batteries were selected to permit a self-contained power supply and a spare, with provisions for external power supply of either battery or rectified a.c. A test tone was considered necessary, as was monitoring with headphones. Our needs on campus often require lower than zero level because of such short runs, so a ten db pad was incorporated. The VU meter is one made by International Instruments, and the amplifier operates into a 600-ohm load at a level of +4 VU.

Most of these features and many more are incorporated in the Collins four-channel broadcast remote pick-up amplifier, Model 212 Z-1, which was described by Paul G. Wulfsberg in the January, 1956, issue of *Electronics*. With the Collins schematic in mind, we strove to miniaturize not for the sake of miniaturization, but with the thought of reducing waste space and weight as our specific needs were met, because this was to be only an emergency spare mixer amplifier.



Fig. 1. The transistorized remote unit developed at WOI shown alongside a conventional tube-type Collins 12Z remote amplifier.

Construction

For the durability necessary in remote equipment, the unit was built into a zinc-plated steel chassis, 3-in. high, 6-in. wide and 14-in. long, and cut down to a final length determined by the volume needed for internal components, which was 7 in. The front panel was cut from the waste of one side, the bottom from the remaining top, and the unused end was cut just deep enough to serve as a cover for the front controls. *Figures* 2 and 3 show the general construction. The front panel was countersunk about 1/16 in., and lips were added to the lid to fit down in the front recess. A handle was added to the lid, and provisions made to allow the lid to be fastened to the bottom of the mixer amplifier

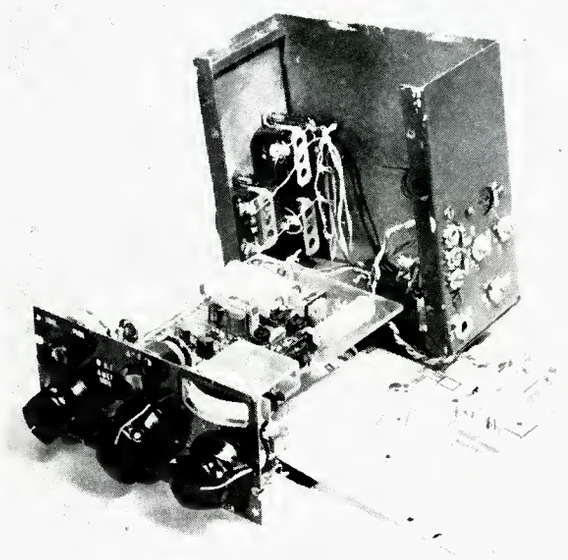


Fig. 2. Internal view showing one side of amplifier chassis.

* *Iowa State College, Ames, Iowa*

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You will find the Bozak name on only one grade of loudspeaker —

The very finest we know how to build —

because we build them for only one man —

The experienced listener who will settle for nothing less than the best.

All Bozak Speaker Systems are identical in the quality of their components, consonant in their tonality . . . differ in power and realism only because of the number of speakers and size of infinite-baffle enclosure employed.

The quiet elegance of Bozak cabinetry, like the unequalled listening ease of Bozak Sound, will never outlive its welcome.

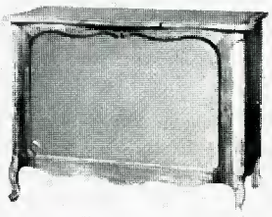
Your nearest Franchised Bozak Dealer will be happy to show off his Bozak Speakers. Write for his name. Careful comparison, using the finest associated equipment and program material, will show you why the Bozaks are known the world over for

The Very Best in Sound

All Bozak Products are Designed and Built by the R. T. Bozak Manufacturing Company

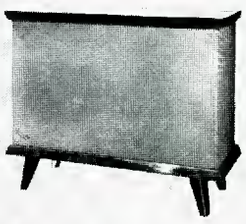
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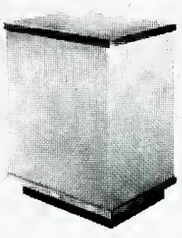
The Charming B-305 Provincial

Two-woofer, three-way system to grace the traditional living room. 35 to 16,000 cycles, 16 Ohms, 30 Watts.



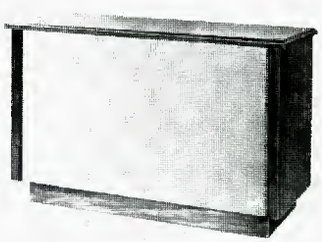
The Elegant B-305 Contemporary

In acoustical specifications and performance a twin to the Provincial. Unrivalled for the average living room with modern decor.



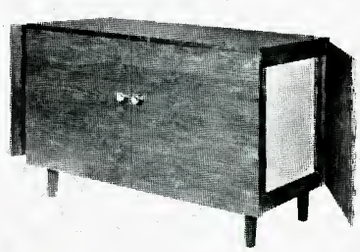
The B-302A Gem

One-woofer, three-way speaker system in the smallest practical enclosure. 40 to 16,000 cycles, 8 Ohms, 15 Watts. **B-300** two-way system in the same enclosure with the same specifications.



The Distinguished B-400

Four-woofer, three-way speaker system, offering in a low-boy enclosure the only rival of the B-310. 28 to 16,000 cycles, 8 Ohms, 50-60 Watts.



The B-304 Stereo-Fantasy

Single-cabinet two-channel stereophonic speaker system. Each Channel 40 to 16,000 cycles, 8 Ohms, 30 Watts. Also available in graceful provincial styling.

THE R. T. BOZAK SALES COMPANY • BOX 1166 • DARIEN • CONN.

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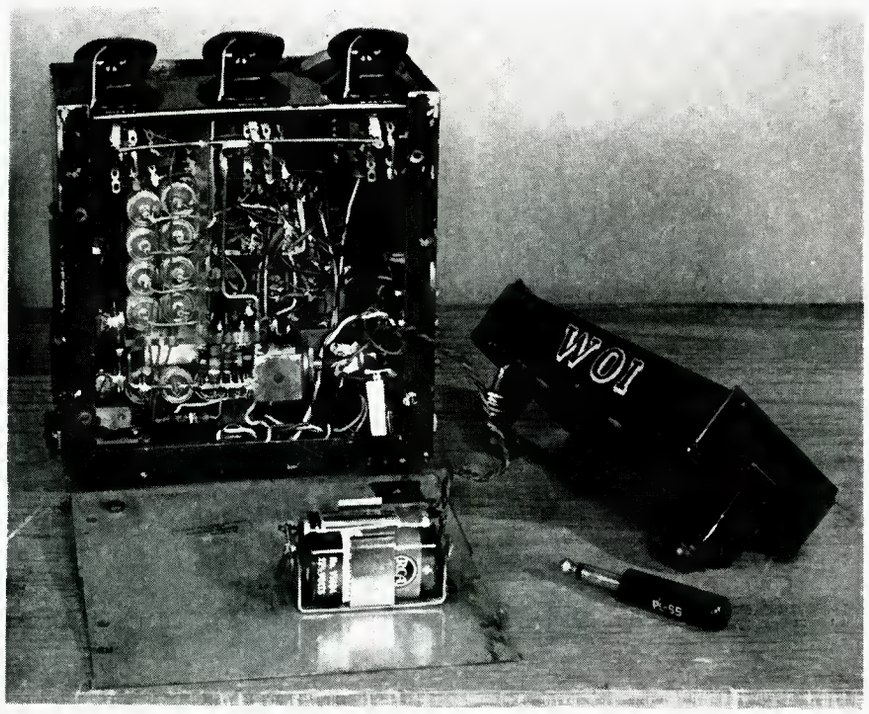


Fig. 3. Bottom view of chassis with cover. Note mounting for internal batteries.

thereby raising the control knobs to a reasonable and comfortable operating height. Notches in the bottom plate serve to keep the lid in place there. Rubber feet were placed on the top of the handle, at the back of the bottom, and on the back end for vertical storage. We painted the case with gray Krylon, but failed to use a primer and the paint job is unsatisfactory. Lettering was done with Artype transfers, and covered with clear Krylon spray.

One feature which worked out to our advantage was a plexiglass sub-chassis, fastened to the front panel. A "T" of plexiglass was added to the bottom to allow the chassis to be self supporting during construction and for resistors and capacitors to be mounted to and through the chassis for both mechanical support and insulation. We etched the schematic of transformers on the bottom of the chassis, and we numbered and marked the polarization of transistor sockets, which could be read from either side of the chassis. Transistor sockets mounted nicely when a pilot hole was drilled, the plastic softened with a soldering gun or small iron, and the socket inserted while the plastic was still soft. Waxed lacing cord was used to tie capacitors together to the "T" support to eliminate chances of shorting or of breaking leads through vibration. Holes were drilled and tapped for the plexiglass joints and reinforced with cement.

To reduce size and cost, tandem potentiometers were substituted for the

(*Continued on page 84*)

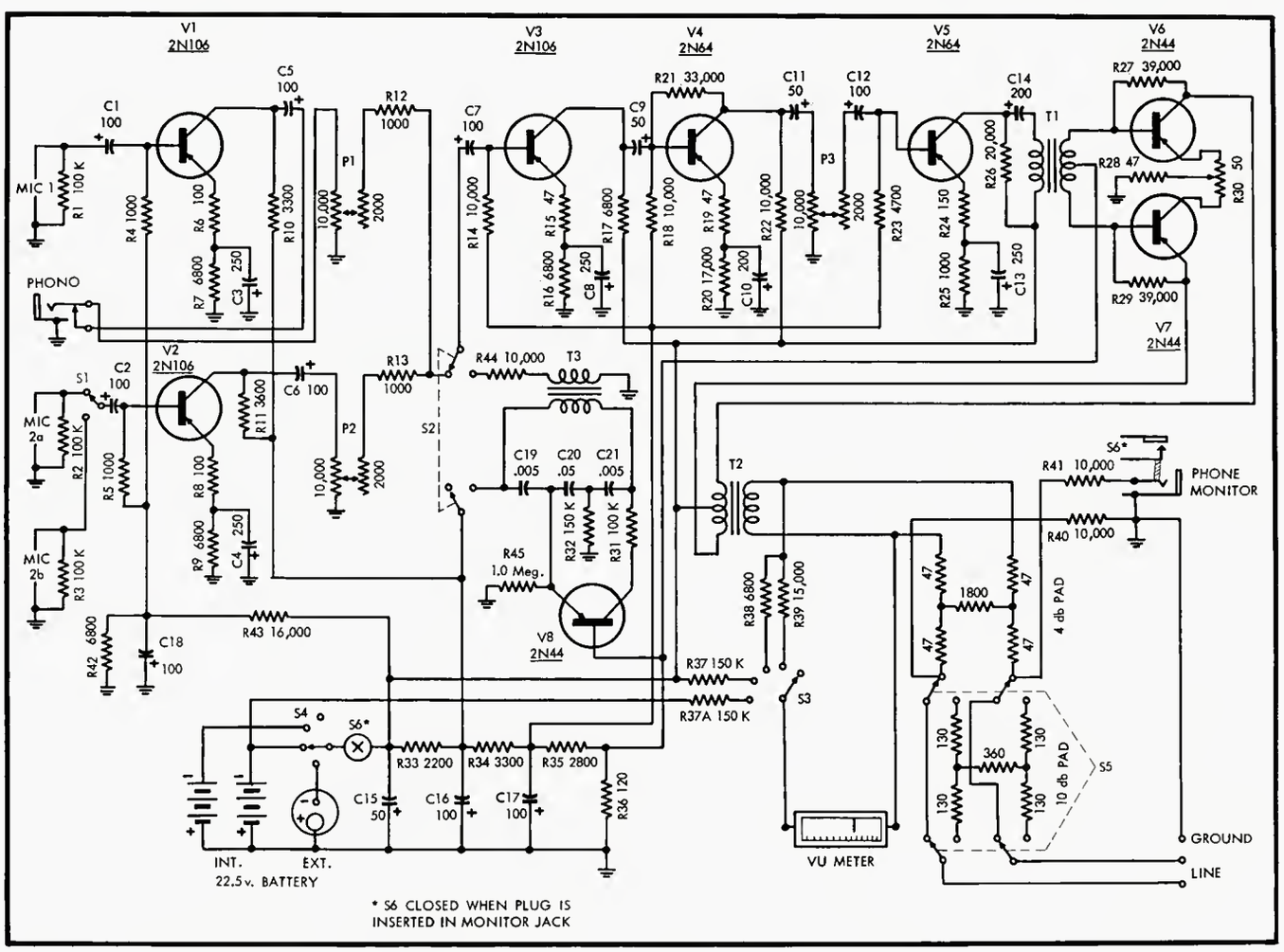


Fig. 4. Schematic of the transistorized remote amplifier.

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NOW

STUDIO

PHONO REPRODUCER

PRICE $79.50

You can obtain superb fidelity—with a new 0.7 mil radius Diamond stylus—at one gram tracking force!

You can completely avoid accidental scratching of your records—and practically eliminate record and stylus wear!

You don't have to worry about groove jumping or leveling turntables!

You obtain the silk-smooth action of a fully jeweled bearing movement!

You obtain the low distortion of a dynamic pickup with the ruggedness and convenience of a magnetic pickup!

The exceptional performance and remarkable features of this revolutionary new Shure Studio Dynetic cartridge and arm assembly are reflected in the data shown below.

1 GRAM TRACKING—0.7 MIL RADIUS NEEDLE

The new Studio Dynetic tracks at only 1 gram! This is 1/6 of the usual tracking force—It makes it possible to use the new 0.7 mil radius diamond tip needle, compared to the usual 1 mil radius—which affords a remarkable improvement in fidelity over conventional high fidelity reproducers. The 1 gram force also means that the record will not scratch if you accidentally slide the arm across it. Your mint LP's stay that way . . . no matter how often you play them.

BALANCED DESIGN

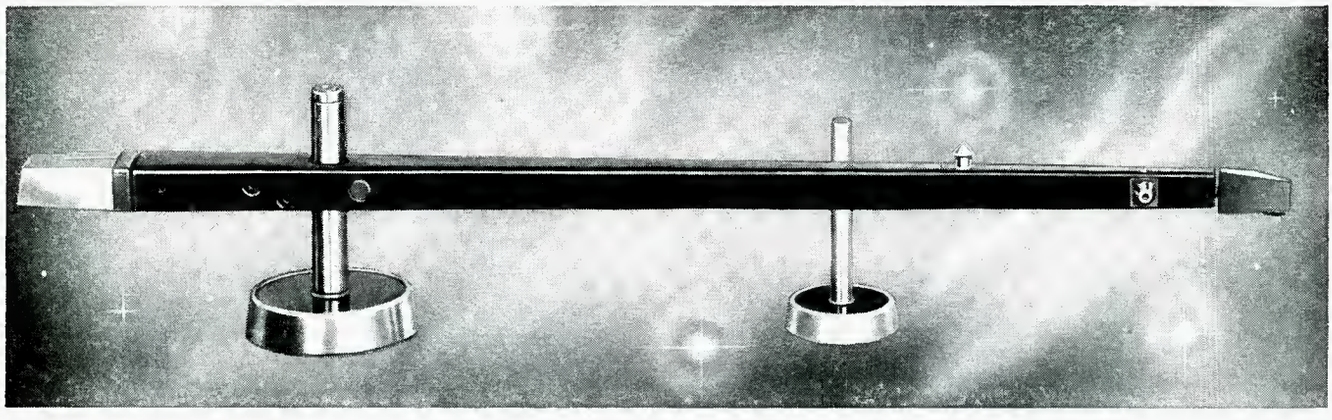
The Studio Dynetic Phono Reproducer is fully balanced about a ruby pivot on its vertical axis. This means that there is equal mass on both sides of the pivot. The cartridge is mounted on a low-mass beam provided with two sleeve-and-cap ruby bearings of amazing strength and negligible friction—with counter balance adjustment of 1-2 grams. When something causes vibration—be it motor board rumble or heavy-footed people walking by—the balanced design causes the vibration in the front part of the arm to be compensated for in the back, thus *cancelling it out!* Balanced design, combined with low mass cartridge mount, means that the Studio Dynetic at 1 gram is far more stable than most high fidelity reproducers at 4-6 grams.

BALANCED DESIGN AND THE LAW OF GRAVITY

When you use the Studio Dynetic, you don't have to worry about leveling your turntable. Balanced design compensates for the law of gravity, and keeps the stylus perfectly in position, even if you tilt the motor board while the record is playing. Yes, and you also get fine reproduction from your warped records.

PERFECT FIDELITY WITH PERFECT CONVENIENCE

The Studio Dynetic phono reproducer was designed with your convenience in mind. Exclusive push-button groove selector helps you find the desired groove on the record—avoids the possibility of damage! The stylus can easily be replaced by the user. Adequate output eliminates the need for transformers—will provide full volume from your present high fidelity equipment.



WHY HAVEN'T WE SAID ANYTHING ABOUT FREQUENCY RANGE?

Because we felt these other features—being unique to the Studio Dynetic—had more interest. If we didn't have these unique features to talk about, we could still talk about the exceptional performance of the Studio Dynetic. The Studio Dynetic has a Laboratory Verifiable frequency range from 20 to 20,000 cycles per second, plus or minus 2 db, with measurable response to 30,000 cycles! Its straight line shape reduces arm resonance to an absolute minimum; and its Dynamic Damping eliminates "boom," low frequency rumble, and motor noise. Its "groove oriented" stylus gives an optimum tracking condition. Its high vertical compliance and low needle-tip mass practically eliminate "needle talk". For truly high fidelity performance the Studio Dynetic is your best buy.

For reprints of informative published articles, write to attention of the Sales Department.
See your hi-fi dealer for a demonstration of this amazing unit.

SHURE *The Mark of Quality*

"IN ELECTRONICS SINCE 1925" SHURE BROTHERS, INC., 222 HARTREY AVENUE, EVANSTON, ILLINOIS

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ROCKBAR *introduces*

The new Collaro World's First



First models of the 1958 line of Collaro changers, featuring the new transcription-type tone arm are brought to America by Major Christopher Collaro (see photo), Managing Director of Collaro, Ltd. The company is the largest manufacturer of record playing equipment in the world.

The transcription-type arm, exclusive with Collaro, literally transforms the conventional record changer into a new instrument—a TRANSCRIPTION CHANGER, with features of the finest professional equipment.

The arm is a one-piece, spring-damped, counterbalanced unit which will take any standard high fidelity cartridge. It is free of any audio spectrum resonances. It permits the last record to be played with the same low stylus pressure as the first record. Between the top and bottom of a stack of records there is a difference of less than a gram in tracking pressure as compared with 4 to 8 grams on conventional changers. Vertical and horizontal friction are reduced to the lowest possible level. These qualities — only found in the Collaro Transcription changer — insure better performance and longer life for your precious records and expensive styli.

Because the record player is so critical in a fine music system, you cannot afford to compromise with quality. Your loudspeaker may reproduce 20 to 20,000 cps; your amplifier may put out 50 watts of undistorted power — but the music begins at the record player.

That's why today's high fidelity systems require the all new Collaro changer. In its performance the new Collaro meets the rigid requirements for high fidelity equipment. *Here, for the first time in a changer — you get professional quality at a price you can afford.*

There's a Collaro to fit your budget. Prices begin at $37.50.

Major Christopher Collaro Brings Changers From England

ROCKBAR *Corporation*

FREE: Colorful new Collaro catalog — describes complete Collaro record changer and accessory line. Includes helpful guide on how to build a fine record library. Send postcard for your copy today to the ROCKBAR CORPORATION, Dept. A009, Mamaroneck, N. Y.



Rockbar is the American sales agent for Collaro, Ltd., and other fine manufacturers.

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High Fidelity Transcription Changer

Featuring The New Transcription-Type Tone Arm



The Collaro Continental, Model TC-540: Featuring the revolutionary new transcription type tone arm (see description on opposite page.) Here, for the first time, is professional quality at a moderate price.

The Continental features include:

4 speeds; manual switch to permit playing of a single record or portion of a record; wow and flutter specifications – ¼% RMS at 33⅓ RPM – superior to any changer in the world; automatic shut-off after last record; automatic intermix, plays 7", 10" or 12" records in any order; heavy duty 4-pole, shaded pole induction motor; heavy, rim-weighted balanced turntable; muting switch and pop-click filter for elimination of extraneous noises; removable heavy rubber turntable mat; jam-proof machinery; pre-wiring for easy installation; attractive two-tone color scheme to fit any decor; tropicalization to operate under adverse weather and humidity conditions; easy mounting on pre-cut board or base. All Collaro changers are custom tested at the factory for wow, flutter, stylus pressure and correct set down position.

*The Continental – $46.50**



The Collaro Coronation, Model RC-440: Combines the custom qualities of The Continental, with the flexibility of a standard plug-in arm and universal head shell. Will accept all standard high fidelity cartridges.

Special features include:

wow and flutter less than ¼% RMS at 33⅓ RPM; extra heavy duty 4-pole, shaded pole induction motor; heavy, rim-weighted, balanced turntable for fly-wheel action; 4 speeds plus manual switch for turntable operation; automatic intermix; automatic shut-off after final record; elimination of extraneous noises through muting switch and pop-click filter; removable heavy rubber turntable mat; attractive two-tone colors to fit any decor; pre-wiring for easy installation, mounting on pre-cut mounting board or base; tropicalization to operate under adverse weather and humidity conditions.

*The Coronation – $41.50**



The Collaro Conquest, Model TC-340: A radically new, simplified precision changer with a tone arm that automatically changes and finds the record to be played. Incorporates many precision features, including the new Collaro dynamically balanced transcription type tone arm, for superb high fidelity performance.

Other features include:

heavy duty 4-pole, shaded pole induction motor; heavy removable rubber turntable mat; 4 speeds and manual switch for turntable operation; heavy, rim-weighted turntable; automatic shut-off after last record; jam-proof machinery; muting switch and pop-click filter to eliminate extraneous noises; wow and flutter less than 0.25% RMS at 33⅓ RPM; fast eight-second change cycle, independent of record speed; handling of 7", 10" and 12" records stacked in order of decreasing size; two-tone color fits any decor; easy mounting on pre-cut mounting board or base; tropicalization to operate under adverse weather conditions.

*The Conquest – $37.50**

**Prices slightly higher west of the Mississippi.*

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Equipment Review

Miracord Record Changer, Miraphon Record Player, Miratwin Phonograph Cartridges—Acoustic Research AR-2 Loudspeaker—Grado Phonograph Cartrige—Kingdom Products' Audette Sr. Loudspeaker

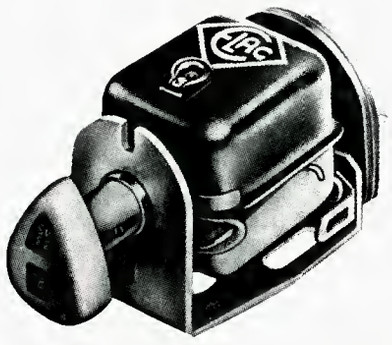


Fig. 3. Miratwin MST-2—a turnover cartridge of high output and low hum pickup—as well as the expected smooth and extended frequency response.

BECAUSE OF CHANGES made to incorporate various minor inprovements in practically all high fidelity components, it falls our lot to review certain lines at times to keep readers up to date on the latest models of the more important products in the field.

When we originally described the Miracord XA-100 changer in August, 1954, we began with "It is probable that the designer of a record changer considers that amplifiers are 'Rube Goldbergs' compared to his simple products, but most of us who claim to understand amplifiers are amazed by almost any record changer. The Miracord has a number of features which are new to the changer field, but which result in an interesting and efficient unit."

Deleting the references to a "new" item, the same comments would apply today. Some of the features are still novel, and performance is even better than it was three years ago. Furthermore, the line has been expanded to include the Miratwin phonograph cartridges, which have already achieved wide acceptance in the pickup field. The third member of the family is the Miraphon XM-110A, a four-speed manual player.

The Miracord XA-100, *Fig.* 1 has two basic modes of operation—as a completely automatic push-button operated record changer, and as a completely automatic manual record player—and it is capable of performing all operations at all four speeds. Because of its unique construction, the tone arm is free at all times, and may be lifted from its rest and placed at any desired point on the record, or it may be lifted from the record at any point and returned to the rest.

Operation is controlled by five push buttons. The START button initiates the operation, causing the mechanism to cycle and lower the arm at the proper place on the record. In addition, the START button functions as a reject control. The STOP button causes the arm to lift from the record and lower onto the rest, stopping the motor. The REPEAT button, pressed alone, causes the mechanism to finish playing the record then on the turntable and then repeat it; if pressed *with* the START button, the record then begins over immediately. When the PAUSE button is depressed, it causes an indicator disc to move progressively from 0 to 4; at 0 the silent period between records is the cycling time of the machine—5 seconds for 78's, 12 seconds for LP's. At numbers from 1 to 4, the delay times for LP's are 82, 164, 246, and 328 seconds, respectively, and proportional at the other three speeds. Thus the user may hear one record side and then have a pause of controllable length before the next selection begins. The FILTER button introduces a rolloff action which reduces surface noise with older records.

To use as a manual player, the Magic Wand changer spindle is removed and replaced with a short spindle. The unit is then started with the START button, and after playing the record through the arm lifts and returns to the rest automatically and the motor stops. If the single-play spindle is inverted, the unit will repeat a 10-inch record continuously until the machine is shut off.

The heavy-duty four-pole motor is isolated from the main plate by rubber isomodes so as to prevent transmission of vibration to the turntable. 10- and 12-inch records may be intermixed in any sequence, while for automatic playing of the 45's an entirely different center spindle replaces the Magic Wand.

The Miraphon XM-110A, *Fig.* 2, uses the same chassis and motor as the Miracord, and is essentially the same unit except for the automatic features. The turntable is mounted in a special ball bearing assembly which ensures smooth and silent operation. Wow and flutter, combined, measure at less than 0.2 per cent, and rumble is sufficiently low as to be completely unobservable on the average system.

Both models have plug-in heads that accommodate all standard cartridges, and both are shipped completely assembled with leads and plugs.

The Miratwin Cartridges

There are two models of the Miratwin cartridges—MST-2, which incorporates two completely separate elements mounted back to back and arranged in a turnover mount (*Fig.* 3), and MST-1, which is a single unit in a clip-in holder (*Fig.* 4). The dual model has one microgroove unit and one standard unit, and may be had with two sapphires or with a sapphire standard-groove stylus and a diamond LP stylus. The single unit may be had for standard or LP use, and with either diamond or sapphire.

Combining high output, exceptionally low hum pickup, and high compliance, the Miratwin cartridges are especially suited for use in record changers. Output for the LP unit is 55 mv for a 10 cm/sec groove velocity; for the standard unit the output is 45 mv for the same velocity. There is virtually no magnetic pull, and with the armature assembly in place the units will not even attract iron filings.

Frequency response of the LP unit is flat within 2 db from 20 to 20,000 cps at

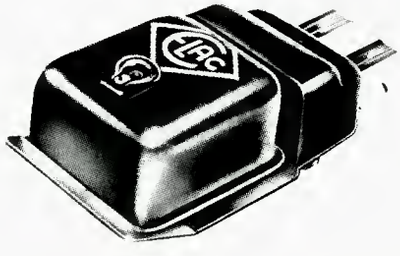


Fig. 4. Miratwin MST-1—a single unit available either for microgroove or standard records.



Fig. 1 (left). The Miracord XA-100 record changer—push-button operated and completely automatic at all four speeds. Fig. 2 (below). The Miraphon XM-110A manual player, of the same size and mounting dimensions.



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Left to right: RCA 301W1 Solid Mahogany (Blonde finish) $74.50; RCA 300W1 Solid Mahogany (Ruby finish) $69.95*; RCA 302W1 Solid Cherry (Fruitwood finish) $74.50*.*

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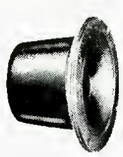
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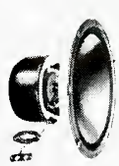
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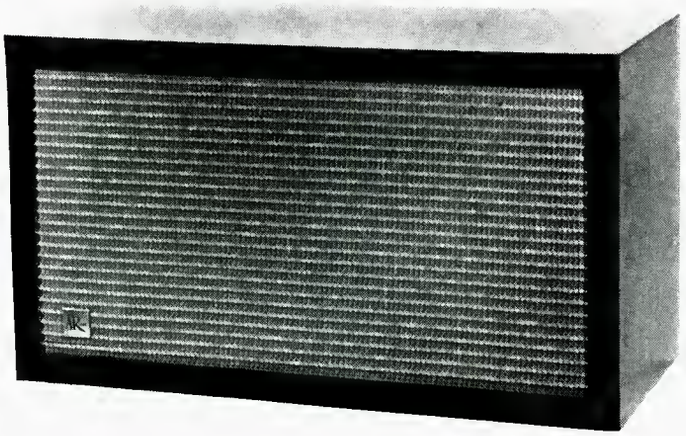


Fig. 5. The AR-1 loudspeaker, practically identical in appearance to the AR-2 described.

33⅓ rpm, and for the standard unit it is within 4 db to 22,500 cps. Hum pickup is extremely low, comparing favorably with that from moving-coil cartridges, which are known for low hum susceptibility. In instances of a high a.c. field from the turntable motor, the trouble may usually be eliminated completely by the use of the Miratwin cartridges.

These units are tropicalized, and output is unaffected by changes in temperature and humidity. Recommended tracking force in record changers is 6 to 8 grams, but in transcription-type arms they track satisfactorily at as little as 3 grams.

J-17

THE AR-2 LOUDSPEAKER

When the average audio fan begins to assemble equipment for a conversion to stereo, he is likely to encounter some objections from the XYL (to borrow a term from amateur radio), usually couched substantially in these words, "No, you can *not* put another big loudspeaker cabinet in our living room." Faced with the potentiality of eliciting such an ultimatum, we found it possible to inch an AR-2 into the second-channel position without too much objection. The most important thing is, however, that the second channel is not just a makeshift (actually we didn't expect it to be), as so many often are, but it is quite capable of being the principal speaker of an single-channel system as easily as many other and larger speakers.

Noticeably lower in price than its predecessor, the AR-1, the 2 is slightly smaller in size, measuring 24 in. long, 13½ in. high, and 11⅜ in. deep, and is essentially the same in appearance. It incorporates a 10-inch woofer in the acoustic-suspension enclosure made famous by the AR-1, together with a tweeter assembly to cover the entire audible range quite satisfactorily. Its increased efficiency over the AR-1 makes it possible to obtain excellent performance with any good 10-watt amplifier.

One thing that this observer has always noted when comparing the AR speakers with any others is that the latter *apparently* have less bass. This is only noticed when one switches from the other speaker to the AR. After listening to the AR for a period of time—half an hour or so—and then switching back to the other unit, one is immediately conscious of the peak in the upper bass register of the other speaker—say, around 80 to 100 cps, where most average-quality loudspeakers have a peak. But while listening to the AR, one is perfectly satisfied with the bass response, and it does not appear to have any peaks in the low end whatever, but rather to have an extended low-frequency response that is quite smooth. Actually, of course, this is the way it measures.

While the AR-1 was designed to provide low-frequency response down to about 30 cps, (±5 db), its successor is rated at the same response down to 42 cps. Extension of the low-frequency range is expensive in terms of efficiency, and the AR-1 is recognized as not being very efficient. By designing for a low-frequency extension to only 42 cps, the efficiency is some 10 db higher, which is the reason it can be used satisfactorily with a 10-watt amplifier and still provide adequate sound level for the average room.

But even though the AR-2 is small as loudspeaker enclosures go, one should not judge it by its size alone. This observer has long felt that the only fair way to compare the AR speakers is to place them behind a screen so that the visual effect of their small size is not allowed to influence the listener's aural judgment. It is our firm opinion that the AR-1, for example, can hold its own against many a larger enclosure, and in judging the AR-2 one must bear in mind the fact that it is considerably less expensive than the original model. We well remember Ed Villchur's comment when the AR-1 was first shown and received the comments that it was so small and yet it cost so much. He asked them, "What are you buying, a loudspeaker or a piece of furniture?" The same comment might well apply to the AR-2.

We found no trouble in driving the AR-2 with a 10-watt amplifier without any feeling of limitation from amplifier overload, and, as a matter of fact, if the AR-1 can be driven satisfactorily with a 30-watt amplifier, the AR-2—being 10 db more efficient—should work perfectly well with a 3-watt output. To prove this, we connected one to the output of a battery portable to see how it would sound, and we were pleasantly surprised.

At the other end of the frequency spectrum, we find that the AR-2 to have adequate output to 14,000 cps, and usable response to 16,000, corresponding to the rated outputs of ±5 db and ±10 db, respectively. While no absolute measurements on speaker performance are ever made by this observer, it is felt that comparative listening with known equipment is sound procedure, and the AR-2 can best be described as a smooth, wide-range loudspeaker.

J-18

GRADO PHONO CARTRIDGE

One sometimes wonders when improvements in phonograph cartridges will ever end—for with each new model that is introduced one must assume—rightly or wrongly—that the manufacturer believes his is better than any other or he would not enter into the commercial market until he had perfected it. The Grado—as of this moment is the newest to be introduced—has a number of features which place it among the top few in the pickup category.

As shown in *Fig.* 6, the new pickup is simple and attractive in appearance. It has a black plastic body with a brushed chrome cover over the operating mechanism. Departing from the usual practice for top-quality pickup, this model was designed to be used in a changer, although naturally it will function in professional arms just as well or even better. The lower surface of the housing is fitted with a small piece of radium active sulphate impregnated in gold and silver, and this material deionizes the record surface, serving as a static eliminator and reducing dust collection. The radioactive material is recessed so as to avoid contamination of its surface by oil from the skin from touching it, and to prevent possible injury to the user from its radioactivity. The cartridge fits all standard pickup heads, and is equipped

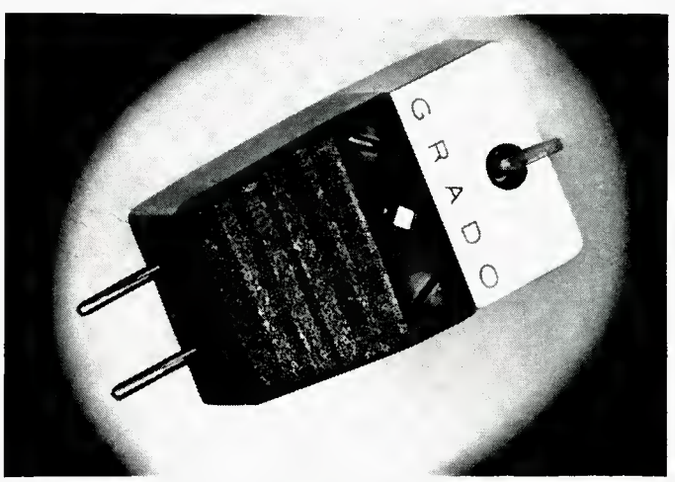
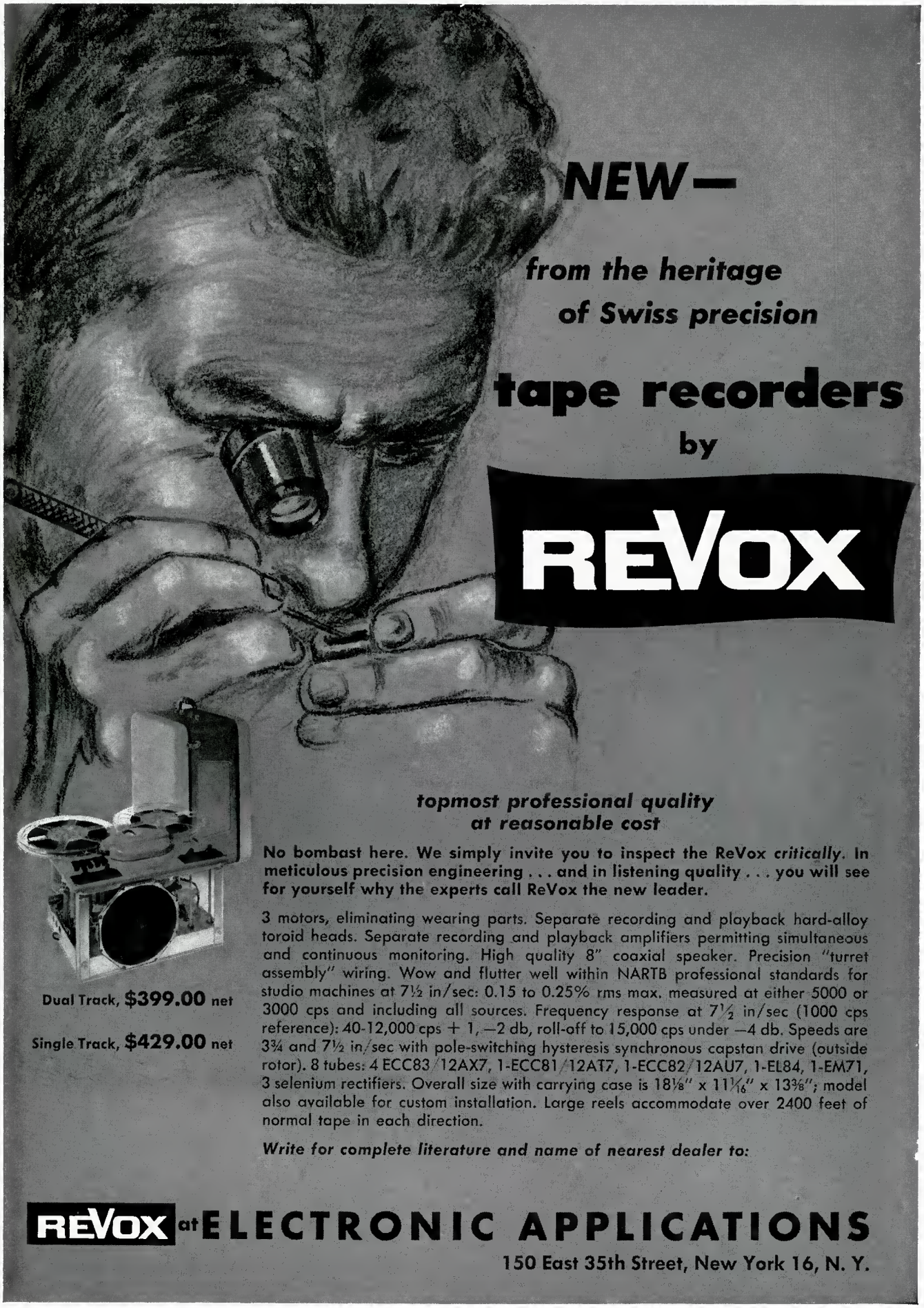


Fig. 6. The new Grado moving-coil phono cartridge.

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3 motors, eliminating wearing parts. Separate recording and playback hard-alloy toroid heads. Separate recording and playback amplifiers permitting simultaneous and continuous monitoring. High quality 8" coaxial speaker. Precision "turret assembly" wiring. Wow and flutter well within NARTB professional standards for studio machines at 7½ in/sec: 0.15 to 0.25% rms max. measured at either 5000 or 3000 cps and including all sources. Frequency response at 7½ in/sec (1000 cps reference): 40-12,000 cps + 1, −2 db, roll-off to 15,000 cps under −4 db. Speeds are 3¾ and 7½ in/sec with pole-switching hysteresis synchronous capstan drive (outside rotor). 8 tubes: 4 ECC83/12AX7, 1-ECC81/12AT7, 1-ECC82/12AU7, 1-EL84, 1-EM71, 3 selenium rectifiers. Overall size with carrying case is 18⅛" x 11 1/16" x 13⅜"; model also available for custom installation. Large reels accommodate over 2400 feet of normal tape in each direction.

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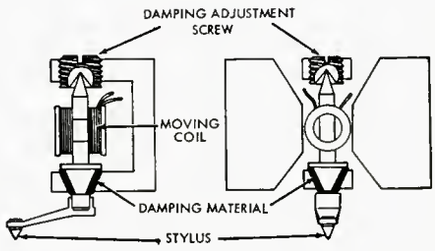


Fig. 7. Diagram of internal elements of the Grado cartridge.

with two friction slip-on contacts for the electrical connections.

The Grado is a moving-coil unit, and internally it differs considerably from other models. The coil is wound on a subminiature bobbin which is rotated in the magnetic field by movement of the tempered sheet shaft which serves as its axis. This shaft has a conical pivot at the top seating in a stainless steel cone bearing which is threaded and adjustable, as may be seen in *Fig.* 7, which shows sectional views from front and side. The lower end of the shaft is a tapered "pivot" which seats in a semi-solid damping material. By adjusting the upper cone bearing—a simple procedure because of the threading—it is possible to vary the compliance of the stylus over a wide range. Tightened up completely, the compliance is zero; loosened, it may be increased almost to infinity. This adjustment is not left to the user but is made at the factory to an accurate degree. The stylus arm is a plastic material, and the design is such that all of the vertical compliance is confined to this arm. The coil itself cannot possibly be moved vertically, and thus none of the vertical movement of the stylus is converted into electrical energy as it rides the grooves. Thus there is no distortion arising from this source, and it is claimed that elimination of any moving iron in the magnetic field serves still further to reduce distortion.

In any case, the sound quality of this new Grado pickup is pleasant, to say the least. Measured frequency response covers all of the test records at our disposal with ±db variation from 20 to 20,000 eps, even though the manufacturer quotes a higher figure for the top end. Actually, there is little doubt about this, for there is not any beginning of rolloff even at 20,000 eps, and the sine wave reproduced from the Cook Series 10 (78) test record was exceptionally pure at that frequency. Claimed response is to 28,000 eps, and with no peak or rise in output as far as 20,000, we would be inclined to believe this figure.

Listening tests were made using the Grado in a high-quality professional arm with a similarly high-quality turntable, and in a conventional record changer. There is no doubt that the pickup is smooth and free from distortion, and while we first thought it was slightly dull, we are convinced that this apparent dullness is due to the complete absence of any peak in response up to the limit of our hearing, at least. While it is, to say the least, a subjective description, the quality of reproduction might be termed "silky." Most listeners will agree that there is some coloration to any pickup—due to minor resonances, undoubtedly—which make it possible to identify the pickup solely from its sound. The Grado would have to be identified by the complete absence of any coloration, resulting in a very high listening quality.

To the other side of the picture, it must be noted that the output is relatively low—approximately 6 millivolts for a stylus velocity of 10 cm/sec. This requires that the gain of the amplifier be increased, and in some instances the increase in hum output because of the amplifier controls being turned up higher might be disadvantageous. However, many amplifiers perform satisfactorily with inputs as low as this, and the pickup should not be judged by the equipment with which it is used. Used under proper conditions, the Grado should be considered highly satisfactory by any listener.

J-19

AUDETTE, SR. LOUDSPEAKER

Another loudspeaker in the smaller-than-normal class comes up for discussion this month. This unit—the Audette, Sr.—measures 22 in. wide by 10½ in deep and 27 in. high, and is mounted on 4-in. legs. It is available in walnut, mahogany, and blonde, and is quite attractive in appearance, A true two-way system, it employs a 12-inch woofer cone and 2-inch tweeter, concentrically mounted, together with the Helmholtz principle of reinforcing low-frequency radiation. Its claimed frequency range is from 45 to 17,000 eps, which is borne out by listening tests. Both of the speaker components are Lorenz units, already well accepted for their performance.

It is always difficult to describe loudspeaker performance in terms which are sufficiently objective to satisfy the critical reader without the possibility of making absolute measurements of performance. This must be done, of course, in an anechoic chamber if true performance is to be evaluated, or in an open field well away from reflecting surfaces and free from extraneous noises—both difficult problems in the vicinity of New York. On the other hand, very few listeners are likely to place their favorite loudspeaker in an anechoic chamber for actual use—most of us are content to place them in our living rooms and hope that typical living-room acoustics will not mar the performance appreciably.

With this in mind, we retired to our living room with the Audette, Sr. for a long period of listening. Armed with the specifications of a 45-eps low-frequency rating, we were somewhat skeptical at first as to how the unit would sound—the upper end did not concern us because we have listened to the 2-inch Lorenz tweeter for a long time and we already knew of its quality.

The first thing we noted was the absence of a peaking in the low-frequency end. While we could not say that the bass response would compare with the Standard comparison speaker—which extends downward for almost another octave below the specified 45 eps—we must admit that there is so little in most music below 40 eps anyhow that its absence is not easy to note. Furthermore, the average buyer of small loudspeakers is more apt to do his listening in smaller rooms, and it is just not possible to develop a high level of 20-eps sound, for example, in a room which measures 8 by 10 feet.

The Audette, Sr. would best be described as providing good listening quality with low distortion, and with low power requirements. The unit is efficient, and will provide more than adequate sound level from a ten-watt amplifier.

Technically, the impedance of the Audette, Sr. is 8 ohms, and power handling capacity is in excess of 20 watts continuous. For an unobtrusive, small, and fairly inexpensive loudspeaker, this model will provide good listening quality for any installation.

J-20



Fig. 8. Audette, Sr., a true two-way loudspeaker unit employing Lorenz components.

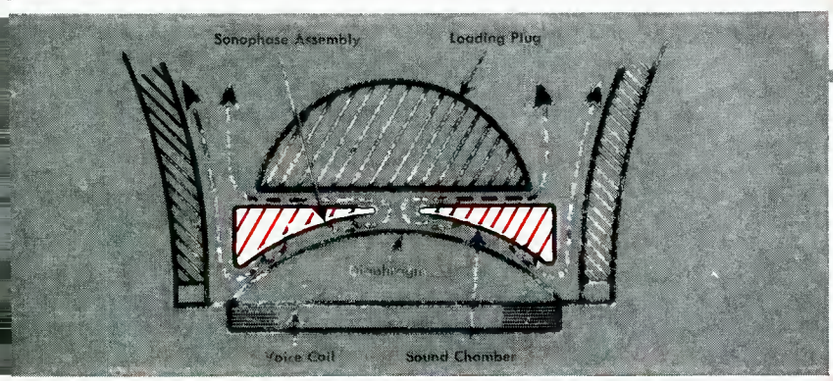
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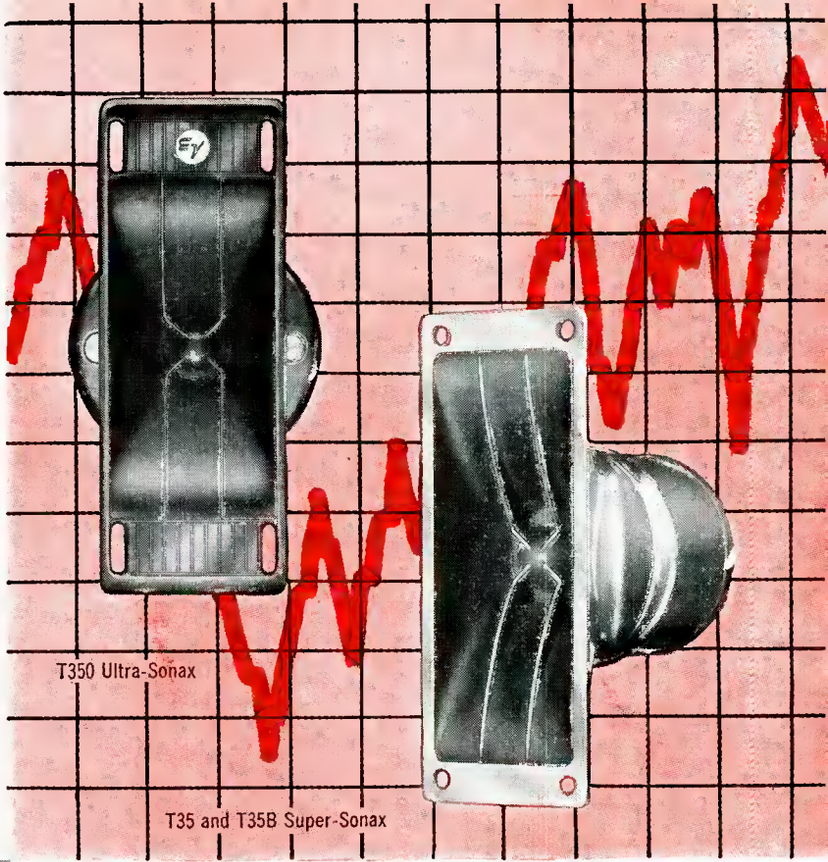
Electro-Voice

NEW Ultra-Sonax and Super Sonax Very High Frequency Drivers, Diffraction Horns and Revolutionary E-V Sonophase Throat Design

No other manufacturer gives you very high frequency drivers combining all the customer benefits of these unique new Electro-Voice models. Today's folded horn and phase loaded speaker systems with their low first-octave response *require* flat, extended high range response beyond the very limit of audibility if essential musical balance is to be achieved. These very high frequency drivers, employing the time-tested diffraction principle and the new Avedon Sonophase throat design, overcome range and sensitivity limitations, function without distortion at the highest ranges.

All three models—T35, T35B and T350—have 180° dispersion patterns, program capacities of 50 watts, peak 100 watts, voice coils one inch in diameter and 16 ohms impedance. Chart shows other characteristics of each model.





Specifications	T35	T35B	T350
Frequency Response:	±2 db 2 kc—19 kc	±2 db 2 kc—18 kc	±2 db 2 kc—21kc
RETMA Sensitivity Rating:	57 db	54 db	60 db
Magnet Weight:	7 oz.	4 oz.	1 lb.
Gauss	13,500	9,000	20,000
Size:			
Horn:	5¼ in. long x 2 in. wide		7½ in. long x 2⅞ in. wide
Pot Diameter:	2¼ in. maximum		3½ in. maximum
Depth:	3¼ in. overall	3 in. overall	4½ in. overall
Shipping Weight:	3 lbs.	3½ lbs.	9½ lbs.
Net Price:	$35.00	$22.00	$60.00

And These are the Reasons Why

The Avedon Sonophase Throat Design

The unique throat design illustrated here overcomes a problem common in conventional high frequency drivers. This is diaphragm deformation at high frequencies, occurring at frequencies above 5 kilocycles. Piston action is destroyed, the phase is shifted and the result is destructive interference.

These Electro-Voice UHF drivers solve the diaphragm deformation problem with a longer sound path from the center of the diaphragm. This restores proper phase relationship. This is important above 12 kilocycles, where sound must be taken from the center of the diaphragm *and* from the outer edge simultaneously. The diagram shows E-V's Sonophase construction.

The Hoodwin Diffraction Horn

This is the Electro-Voice development which is used in all E-V horns to disperse sound *equally in all lateral directions* from a single point source. This is especially important in stereophonic reproduction to preserve the undistorted depth and width of the original sound. Diffraction horns insure balanced levels of both right and left stereo speakers. These drawings tell the diffraction horn story:

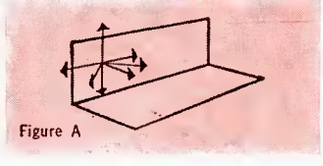
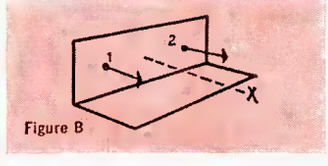
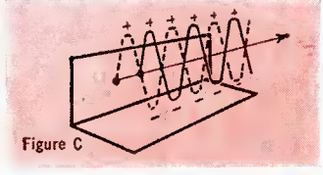


Figure A—This shows how sound disperses equally in all directions from a single point source.



In Figure B two sound sources are shown. On the axis, at point "X," double the sound power results as the resultant pressures are in phase.



But in Figure C, if the distance between the two sources is ½ wavelength or greater, the sound from the two sources will be considerably out of phase for points off the axis, resulting in decreased sound pressure.

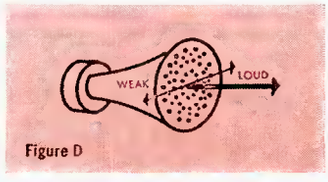


Figure D will show the deficiencies in horns of wide lateral dimensions compared to the wavelength being emitted. Any horn mouth can be considered as a group of small point sources of sound. They must beam the sound down the axis by their very nature.

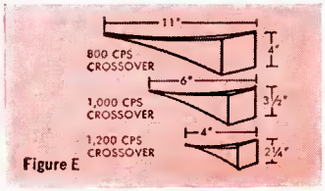


Figure E shows representative horns, illustrating that horns must have a certain length, as well as cross sectional area along this length and at the mouth to load the driver diaphragm down to the lowest frequencies to be reproduced. The lower we go, the longer must be the horn and the greater the mouth area.

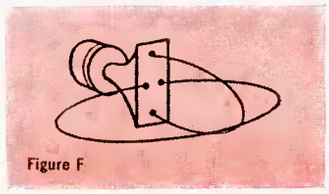


Figure F shows that narrowing the horizontal area and extending the vertical dimension of the horn mouth preserves the loading area necessary for good low end response, disperses the sound perfectly in the horizontal direction where it is so necessary, and keeps interfering reflections off the floor and ceiling.

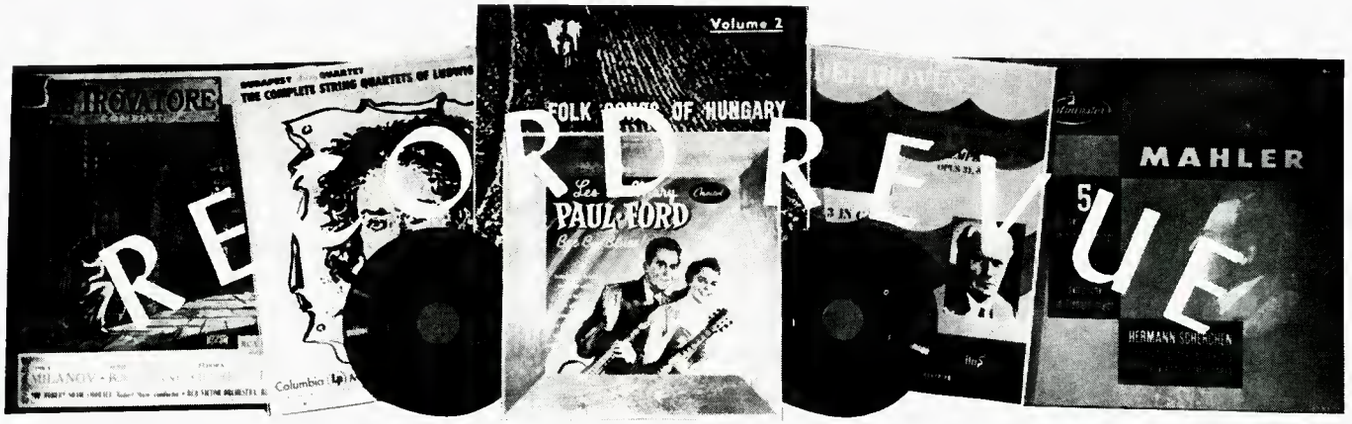
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EDWARD TATNALL CANBY*

1. ALTA FIDELIDAD!

Mexico, Alta Fidelidad! Various folk groups.

Vanguard VRS 9009

Authentic stuff by the sound of it, made up of vast numbers of native guitars, in many sizes, harps, high-voiced singers. Not much basso profundo here, but plenty of alta. Hi-fi, definitely.

Bill Bell and His Tuba.

Golden Crest CR 3015

. . . And here you'll find lotsa low stuff, of a sort. Bill is the tuba player to end 'em all, having played under Toscanini and the like as well as done Tubby again and again and from there on out. First side here features a small combo, tuba in each item plus a baritone voice—the tuba player's own. The "new Golden Crest studios" were used, the deadest, utterly driest sound I have yet to hear. Swathed in black velvet! Side 2 is tuba (close) and piano (distant, jangly and a wee bit out of tune) in classical items such as variations by Beethoven on a tune by Handel. Give me side 1 any day.

P.S. By simple figuring I figure that Bill Bell's lowest fundamental here, in a Mozart excerpt from *The Magic Flute*, is around 44 cps. Ought to be able to get that out of any halfway decent speaker enclosure.

Tchaikowsky: Nutcracker Suite. Chabrier, Espana, etcetc. Royal Philharmonic, Beecham.

Columbia ML 5171.

Symphonic Dances. Hollywood Bowl Symph., Slatkin.

Capitol P 8369. (Also stereo tape.)

Here are two full-orchestra hi-fi miscellanies—no space to list all of the items included—and both are super-hi-fi in somewhat different ways, both enjoyable.

What is a chestnut? One of those pieces of music about which the conductor and/or musicians say *ugh, not that again* . . . and the listeners, following their cue, say the same. Sir Thomas B. is one of the last of the great chestnut-converters, who can make real music out of these same pieces.

Sir T.'s collection of not-chestnuts ranges from the Nutcracker Suite through Chabrier's Espana, the eternal Dance of the Hours and an overture by Suppé, all of this the old-fashioned sort of stuff that once was "pops" before the days of Khatchaturian's *Sabre Dance*. Most conductors play such music with a tired feeling today. Sir Thomas is positively brilliant in it, with results that actually make for hi-er fi since the precise tailoring of every phrase, the neat shaping of tone for each instrumental combination, brings out the very things that hi-fi ears enjoy. Man, listen to that triangle! It sounds like a triangle, not a telephone.

Capitol's Symphonic Dances make an interesting comparison. This collection is updated pops, of a later generation, that includes Khatchaturian, Glière (*Red Poppy*, of course), as well as earlier stuff. The Hollywood playing is even more streamlined and precise than Sir Thomas's, but the effect is very different and much more modern, with an almost perceptible jazz beat, a somewhat chilly efficiency of production, a no-nonsense, businesslike polish. Fine hi-fi, too, but not as interesting musically as the Beecham masterpieces.

Professional Engineering Series—Excerpts from Verdi, Handel, Boito. Assorted orchs., cho., solos.

Urania UR-X103.

Urania has a new management but hasn't got out of its old habits, despite fancy red vinylite, fancy engineering titles, and new covers. These, I gather, are excerpts from the same old German tapes, mostly war-time radio stuff, and the distortion is the same as ever. In at least one my ancient and well-practiced ear detects the presence of an almost-forgotten instrument, the Noise Suppressor. Swish, swish. Screeching in the loud parts, smoothness in the soft.

If "professional engineering" requires this sort of treatment it's not hi-fi in my book. Even if I'm wrong on the suppressor, it's low-fi stuff, for any ear.

2. Round-up.

(Note: Short reviews don't indicate shortness of content! Sometimes this department simply has to make a big effort to catch up. E.T.C.)

Beethoven: Symphony #6 ("Pastorale"). Berlin Philharmonic, Eugen Jochum.

Decca DL 9892

Scout #2 calls this "dumpy." Jochum has turned out some fine Brahms and other German music—I'd suggest that "dumpy" refers to the central European style of playing, never quite as scintillating as we over here expect from our showpiece orchestras.

Beethoven: Symphony #6. Vienna Symphony, Klemperer.

Vox PL 16,070.

Klemperer in his recent Angel series of Beethoven symphonies has emerged serenely as one of the top elder statesmen of German conducting. This Sixth (absent in the Angel series) is more like the older Klemperers, somewhat stiff and dogmatic, unrelaxed. The sound is fine and there's nothing dumpy about the playing—it just doesn't let go in the right places. Let's hope he records it again, whether for Vox or Angel.

Beethoven: Symphony #5. Schubert: Symphony #8 ("Unfinished"). Hamburg Philharmonia, Winograd.

M-G-M E3509

Scout #1 thinks this coupling of the familiar two symphonies stands up to more famous ones, RCA's with the Boston Symphony and Epic's with the Cleveland Orchestra and Szell; so don't sneeze at the Hamburg outfit and Mr. Winograd. The Hamburg is a workhorse orchestra these days but it can play well when the occasion is right.

Beethoven: Sonatas for Violin and Piano, Op. 12, #1, #3. Leonid Kogan, vl., Gregory Ginsburg, pf.

Vanguard VRS 6029.

This is a very fine teaming-up of two Russian players and as good Beethoven as you'll get. That peculiarly old-fashioned Russian sound, rich and Romantic but smooth as well, shows up particularly nicely in this music, which tends towards over-tense, over-dry performances in the West among our younger players. The Russian tape fi is now excellent.

Schubert: Moments Musicaux; Sonata in C Major (Unfinished). Rudolf Serkin, piano.

Columbia ML 5153.

For some unfathomable reason, Serkin's Beethoven is invariably terrific, but his Schubert is curiously ineffective—I speak, of course, on a high relative plane. Serkin being one of our great pianists.

The short *Moments Musicaux* are impeccable and lovely to hear, in spite of Columbia's dry, inside-the-piano recorded sound and in spite of some strange noises that evidently emanate from Serkin's vocal chords. But the big unfinished Schubert *Sonata* suffers from the same thing that struck me in a concert performance by him of another Schubert *Sonata* (the B Flat), a seeming lack of feeling for the remarkable harmonic experiments that are characteristic of these late-Schubert pieces. Dunno why—but he plays them as though they weren't there. A frustrating experience, if you feel them as I seem to. They cry out for dramatization, and do not get it.

Gonzalo Soriano, Pianist—Mendelssohn: Variations Serieuses; Schumann: Three Romances; Schubert: Sonata in A Minor, Op. 164.

Boston B 303.

Now this is strange—here is a relatively little-known pianist and a "Latin" (Spanish) one at that, who does an unexpectedly fine job on a program of immense German Romanticism. I found all three sections unusually intelligently played, very musical and rightly styled—and this includes the big Schubert *Sonata* (one whole side), which has the very drama in it that Serkin's beautifully sculptured Schubert lacks. Good piano sound.

Schubert: The Death of Lazarus. Soloists, NDR Chorus, Hamburg Philharmonia, Winograd.

M-G-M E3526

For all Schubert lovers—and that means vast numbers of people who go beyond the *Ave Maria* and the *Unfinished Symphony*—this is an extraordinary find, if not at first an easy one to absorb. It is an unfinished opera, only the first act (one of dozens of incomplete pieces the slightly disorganized

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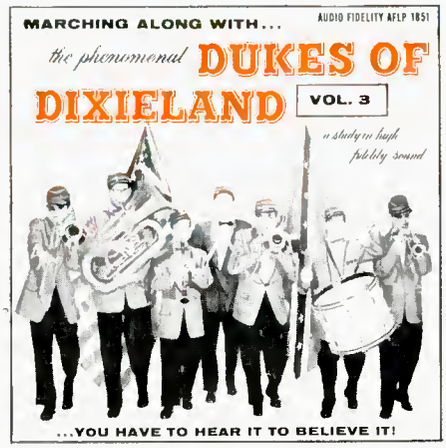
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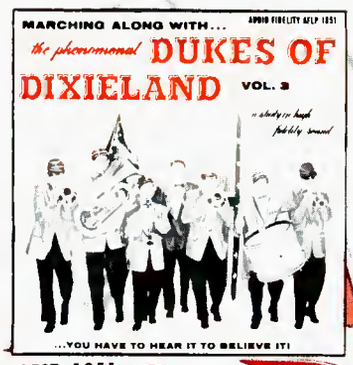
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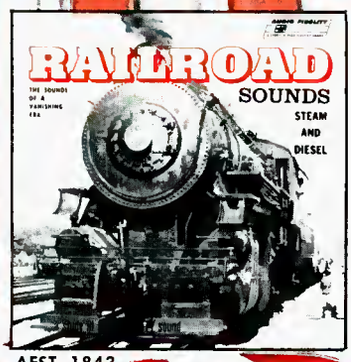
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Schubert left behind him), which has never been heard before, was hailed in print by the late Alfred Einstein—who had a marvelous ear for good things hidden away in scholarly corners.

As an opera—no. This is a gentle, serene, transfigured piece for a handful of quiet soloists, Lazarus (on his deathbed) and a group of his immediate family and friends. At first it seems nothing but a long series of semi-recitatives—there's only one vocal ensemble worth mentioning. But if you follow the printed text and listen several times, the heavenly Schubert quality appears—it is, indeed, a masterpiece.

A small and earnest cast, not vocally very distinguished, works so sincerely that we can only praise them for a fine job. Beautiful orchestral playing. Clearly everybody was enthused at the delicate, impractical, unearthly beauty of this unknown music.

Clementi: Trios. Trio di Bolzano.

Epic LC 3351

Excellently robust trio playing, piano, violin and cello, of music that will surprise and please, especially those who have played the little Clementi sonatas, so often used in piano teaching. This is music of the Beethoven period, like early Beethoven more than Haydn or Mozart. Clementi was quite a man; he also made a fine success in business as a music publisher and a piano manufacturer. Class him with such as Palestrina, who also did well for himself on the side.

Schumann: Waldscenen, Op. 82; Kinderscenen, Op. 15. Clara Haskil, piano.

Epic LC 3358.

Haskil's Schumann is as fine as her Mozart for my ears—and Schumann is a hard man to play convincingly today. These two "scenes" are nicely contrasted, the early and familiar Scenes from Childhood set off against a less often heard but enjoyable later set of short pieces, the Woodland Scenes; they are on a larger, more complex scale. Excellent European-style piano sound—the piano itself, I mean, is European with a tone quite unlike our big Steinways.

Dvorak: Symphony #2 in D Minor. Vienna Philharmonic, Raphael Kubelik.

London LL 1606

A splendid performance of this intense, vigorous, Brahms-like symphony; Kubelik is peculiarly at home in this musical style, out of his own home region, and would seem to be a good deal more of a conductor than at first we had thought. (He conducted awhile over here.)

This is a splendid example, too, of the mature "ffrr" recording style, still characteristically brilliant with close-to strings and gorgeous liveness. The general habit elsewhere has been to record this sort of Romantic music in a big, Romantic blur—I like it a lot better this way; Dvorak's expert instrumentation has a chance to show itself in wonderful detail.

Tchaikowsky: Serenade in C for Strings, Op 48. Mendelssohn: Octet, Op. 20. Serkin Chamber Orch., Fine Arts Quartet, augmented.

Vanguard VRS 1003

This is an illuminating record of string music, comparing, on one side, a true piece of chamber music, the *Octet*, where each player has his own solo part, with a piece for true string orchestra—not very much larger—in which each part is played by a group of instruments. The sound is remarkably different as well as the character of the music. Intelligent, sympathetic playing.

The recording, presumably by Vanguard, is excellent, but oddly enough, these same works played by the same ensembles were released a number of years ago on standard and stereo tape; if my memory is right, it was Webcor, now Concertape. If this is a reissue, it will be the first commercial tape I know of to be transferred to the LP medium—usually it's the other way round.

Brahms: Piano Sonata in F Minor, Op. 5. Badura-Skoda.

Westminster XWN 18447.

This is one of the current re-releases of earlier Westminster recordings and I got hold of it mainly to see how it sounds in its new form. (There are hundreds, literally, of these newly cut and re-equalized Westminsters and it's impossible to re-review them all.)

The answer is—excellent. No possible way to tell it isn't a brand new recording. The improvements in these reissues are mainly (1) better reproduction of the high quality in the original tape masters (2) RIAA cutting—the old ones were mostly the old NAB curve; and (3) much better surfaces—the old ones were noisy compared to today's product. In addition I suspect that assorted doctoring here and there has further improved the earlier Westminster breed, which was pretty good for its time, as we all remember.

I have no hesitation in recommending the reissued Westminsters as equivalent to new hi-fi recordings. I also suggest that replacement of the old ones in your collection would be an excellent idea, if only for the new RIAA standard curve.

The Brahms? Briefly, the florid, enthusiastic early work, that splurges all over the piano, is played very beautifully by Badura-Skoda, with more bravado and punch than his Mozart fans might have expected. A pleasure to listen to it.

Steinberg Conducts Wagner. (Parsifal—Prelude, Good Friday; Siegfried Idyll; Prelude to Die Meistersinger). Pittsburgh Symphony.

Capitol P8368.

These are the warhorses of the Wagner repertory, each one recorded and played innumerable times. The modern recorded sound is welcome here and a good part of the music is well played—especially the *Parsifal* music, which tends to suffer more than the others in most playings.

The Meistersinger prelude comes off well, with a modern, straightforward reading, not as dramatic (nor as pompous) as many an older one. But the highly personal, delicate *Siegfried Idyll* isn't very good here. Misses the atmosphere, the pregnant pauses, the scented changes of key.

Mozart: Symphonies #39 in E Flat, #40 in G Minor, Amsterdam Concertgebouw, Bohm.

Epic LC 3357

There are dozens of recordings of these—I seldom have enjoyed the two works as much as in this modest but top-rate job. The bane of the famous *G Minor* is its very fame; it tends to receive eccentric, portentous, or over-intense readings that don't give Mozart a chance to speak on his own. Here, this chestnut of the conductorial art does speak for itself freshly and naturally, and the recorded sound complements the interpretation.

There are actually two versions of the *G Minor;* this is the less commonly heard one, in which there are no clarinets. Interesting to see how the many clarinet passages in the other version are taken here by other instruments. Otherwise the music is the same.

Mozart: The Early Symphonies. Vol. 2 (#2, #3, #4, #5, #7); Vol. 3 (#8, #9, #10, #11). L'Ensemble Orch. de L'Oiseau-Lyre, Froment.

London OL 50118, 50119.

This series supplements the hard-to-get Concert Hall recordings of these surprisingly pleasing short works from Mozart's early 'teens. They aren't symphonies in the later big size but short, pleasant, semi-divertimenti, in three or four movements, astonishingly mature for such a child. (Mozart, of course, was no child musically at age twelve.) The earlier volume is, oddly, as interesting as the later one since several works in it are not by Mozart at all, but copies of music by well known mature composers of the time, whose style he was studying. *Symphony #2,* it seems, just might be by Papa, Leopold Mozart.

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Mozart: Eine Kleine Nachtmusik; Divertimento in D, K. 136. Gabrieli: Two Canzone. Telemann: Viola Concerto in G. H. Kirchner, vla., Stuttgart Chamber Orch., Münchinger.

London LL 1321

A beautiful string recording with a wealth of musical interest. The Mozarts are played with the proper small group, transparently but richly, the *Divertimento* featuring solo fiddle playing. The Telemann, more massive and with harpsichord continuo accompaniment, is Bach-like in the fast movements, more like Vivaldi or Handel in the slow ones, an effective and accomplished piece. The two earlier Gabrieli works were likely for brass choirs in the original but the sound for two string orchestras is lovely, if rather soft for the brilliance of the music. Serious, musical playing in all of these and the string sound was never so good on records.

Haydn: Symphony #100 ("Military"): Trumpet Concerto; Italian Overture. Vienna Philharmusica, Swarowsky. **Toy Symphony.** Radio-Symphonie Orch. of Paris, Leibowitz.

Urania UX 104

This Urania is superb, all around. The three Vienna recordings are really fine performances, especially the *Trumpet Concerto* which is given as good a playing as I've heard anywhere. Trumpet—and cornet—lovers should rush out for this one. The little *Toy Symphony* (now known to be originally by Leopold Mozart) gets a positively whirlwind performance, intense and brittle with the cuckoos and birdsongs fairly singing their heads off.

The Vienna recordings are made in a large, live hall, almost too resonant, though miking is excellent. The trumpet is glorious in this big space. This is a reasonably hi-fi record—no complaints at all.

3. Oddities

Panorama of Musique Concrète, Vol. 2. (Henry, Schaeffer, Philippot.)

London DTL 93121.

Zowie! The first volume of this Paris-UNESCO series had mostly the earliest experiments in "tapesichord music" as some call it over here, rather crude and mostly done with disc dubbing—a feat. This volume brings us up to near-present and is well worth any engineer's ear, if only on the basis of how-in-the-world-did-they-do-it? Weird noises, but with a lot of pattern and plan; one piece entirely put together from a single short phrase of recorded voice, multiplied and divided *ad inf.* In sophistication as well as in technique the French are maybe still ahead of us, zany or no.

Leuning-Ussachevsky: Poem in Cycles and Bells; Suite from "King Lear"; Piece for Tape Recorder. Bergsma: The Fortunate Islands.

Composers CRI 112

Here is the indefatigable American pair of tape experimenters—their stuff is getting pretty tricky these days. *Poem* is for Tape and Orchestra, the orchestral part constructed more or less out of ideas from tape and the whole assembled so that you hear the same things in both. The live players tend to keep time with the (inevitable) tape echo. Musically not very enterprising and more or less conventional American-modern (with folk song)—anything but revolutionary. But the technique is well worth studying as one of the most advanced experiments yet of live and recorded sound worked together into one piece. The other stuff is all-tape, except Bergsma who doesn't belong on this record at all. Just plain music from him.

Fassett: Symphony of the Birds.

Ficker C 1002

(Ficker Records, Old Greenwich, Conn.)

I almost typed out "for the Birds"—but actually the piece is quite entertaining. It is

(*Continued on page 90*)

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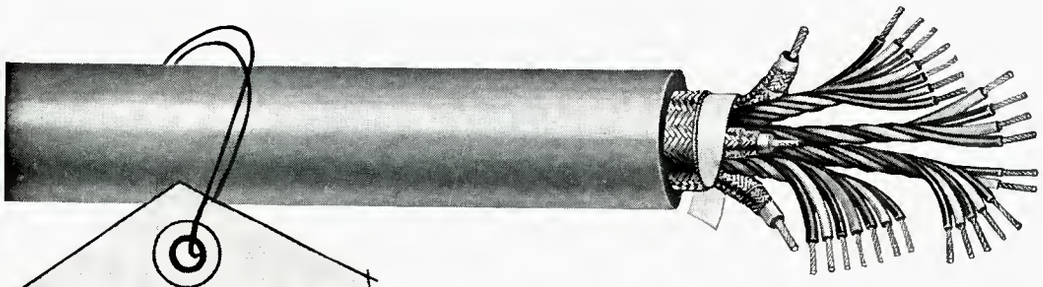
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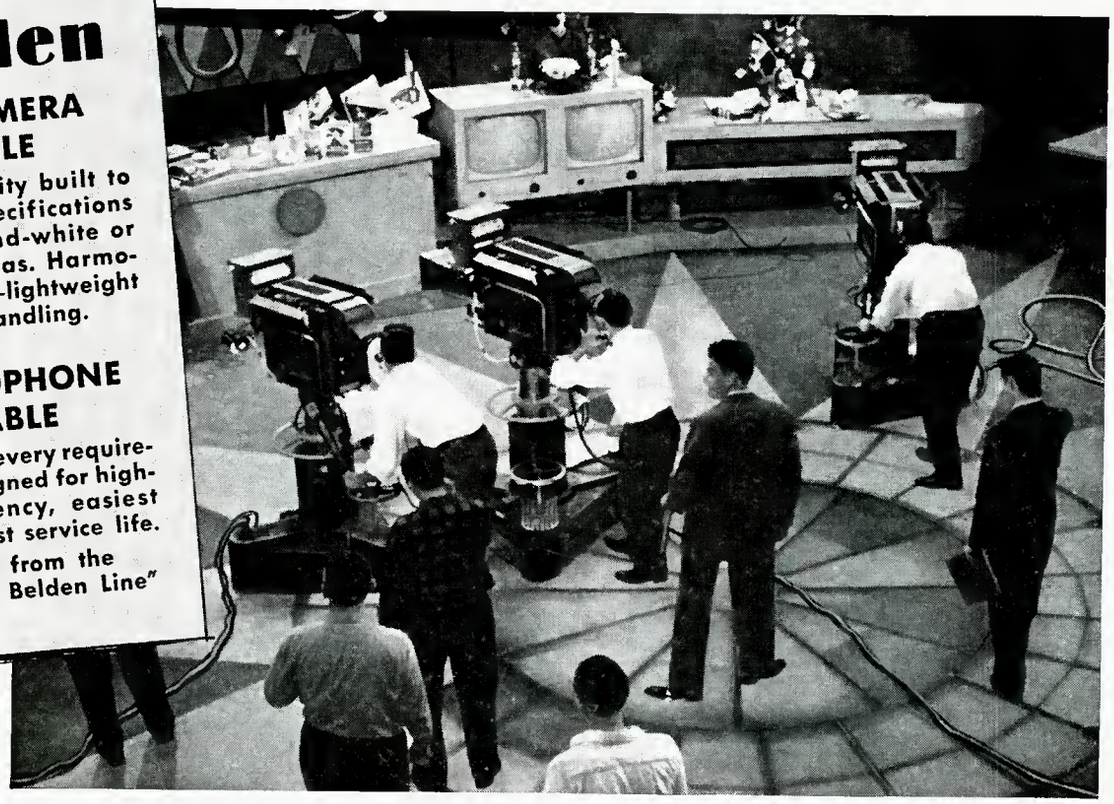
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1. And now . . .

And now, having worked ourselves into a tizzy of excitement over stereo tape these last months, are we about to have a new explosion of major interest? Well, if it weren't so long between writing and publication, I'd stick my neck 'way out and say, looks like yes; but maybe I'd better play close. Rumors, just rumors, at this early stage of the game. But who knows what will have happened by the time this gets out, in September, that happy month of audio innovations.

Rumor has said, and said again, (to get down to neck-sticking) that stereo is about to swoop upon us in a new form. Disc. Maybe it has, as of the time you read this. But in the deep, hot days of midsummer, back aways, I'm much too far from all the excitement to do any nosing around—and it wouldn't get me very far anyhow if I did; for if a "secret" were in truth let out in my direction, I'd have to shut up about it. Long as I don't know officially, I can guess all I want to.

So, out goes this long, long neck, a little ways. All I can say, first, is that if stereo disc does make a commercial break towards the public here, it will have to be a big break, and a low-priced one. No use fooling around with ultra-high-priced stereo discs. The disc has always been, and is now more than ever, a mass-adapted medium, basically easy to duplicate, easy to handle, sell, and play, and marketable at bottom prices. Nobody in his right senses, with tape on hand and so attractive, is going to throw in a new disc at tape prices. Not for long, anyhow.

And any conceivable stereo disc, launched as I suggest on a big-time scale, would have to be as compatible as possible—which is a lot. Same general size and shape, same speed, and equally vital, the same range of playing time. (The old "binaural" disc with its two bands of grooves and two pickups fell down basically right here.)

Moreover, there should be compatibility, to some extent, between the stereo and standard disc playing. The stereo pickup—one pickup, of course, not two—should be able to play standard discs, just as a stereo tape player also plays non-stereo tapes.

All of these things are already matters of fact in the recent British (Sugden) stereo pressings that use the lateral-vertical system. The Sugden discs look like ordinary LP's and are pressed like them, play as long. The stereo lateral-vertical pickup unit (two crystal elements hooked to a single stylus, if I have it right) will play ordinary LP records via its lateral element, presumably with the proper switching to send the lateral signal into both speakers. Same as the SINGLE (monaural) position on stereo tape players.

(Lateral-vertical systems aren't, of course, entirely compatible; an ordinary pickup would have a mighty rough time bouncing over the vertical bumps in the stereo record, especially those pickups with very low vertical compliance! Ouch, is all I can say, thinking of the mayhem that would be committed.)

The stereo disc, whatever system is used, is bound to be relatively low in price since pressing problems should logically be pretty much the same as with an ordinary record. The dual equipment for preparation of the master is a relatively minor item of cost in the whole operation. (Indeed, stereo recording equipment for the tape masters is already in operation in almost every record company's studios.) In fact I can't see how the stereo disc can be an economic problem at all. Everything is already there.

The major problem, of course, is the stereo system itself—which must *work*, and work well. The public you see, is not going to accept any stereo disc for long that means a compromise in actual sound quality over the regular LP record. No matter that most people have cheesy "hi-fi" phonographs: if the word once gets around that a stereo disc is less good in quality *on the record* than a standard LP, people will stay away from it in droves. And the regular LP record (maybe the 45, too) is going to be fairly hard to match. Why else has stereo disc been stalling around ever since 1929? No sooner does a stereo disc system advance a bit than the standard record advances even more, and stays ahead in sound quality. Has, at least, for these last 28 years.

So, the first public question that should be asked, as I see it, is "How does it sound? *Is it as good as LP?*" It had better be.

And a very important item in that sound is the stereo disc playing equipment. The stereo pickup, whatever system is used, will clearly have to be one-piece. One stylus. If there are two needles, then somebody's got to do some very tricky finagling and I'd like to be persuaded that it can be done—permanently and with commercial success! One stylus, please, or something that the public thinks is one and treats like one.

My expectation is that the British stereo pickup with two crystal units is not the ideal arrangement for the United States market, if only because of the widespread feeling hereabouts (right or not) that

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crystals are inferior to magnetics. In fact, if it must be crystal, it would have to be ceramic for us, not only because ceramic has a good name but because our wild and woolly climate, in toto, really needs the ceramic's stability. But surely the design of a magnetic unit, to reproduce two disc stereo signals, would not be too much of an extra problem.

I'll admit that ceramic or crystal pickups go well with low-priced, mass-produced products in the phonograph area. The Columbia 360, the first "hi-fi" mass-made phonograph, had a ceramic and most of the widely sold "hi-fi" machines still do. Maybe disc stereo equipment belongs primarily in this category—if not a poor man's stereo, then a novice's stereo. If so, ceramics should do the job. But magnetic pickups will sell better, as well as sound better, if the manufacturing economy allows for it.

Come to think of it, there's no reason why, if disc stereo catches on, a whole range of playing equipment should not develop. The one important thing is that the records themselves, and entire system, allow for uncompromised high-quality sound. Given that, given the potentiality for good sound, then, as in LP, the equipment can be varied to suit the market. Remember the original LP pickup, a crystal that played nothing above 6000 cps? But the LP record was better, and better equipment eventually appeared—still appears—to match it. So should it be with stereo disc playing equipment, whatever type may appear at first. The stereo system itself *must* be inherently capable of LP-type sound quality, if disc stereo is to make a permanent dent.

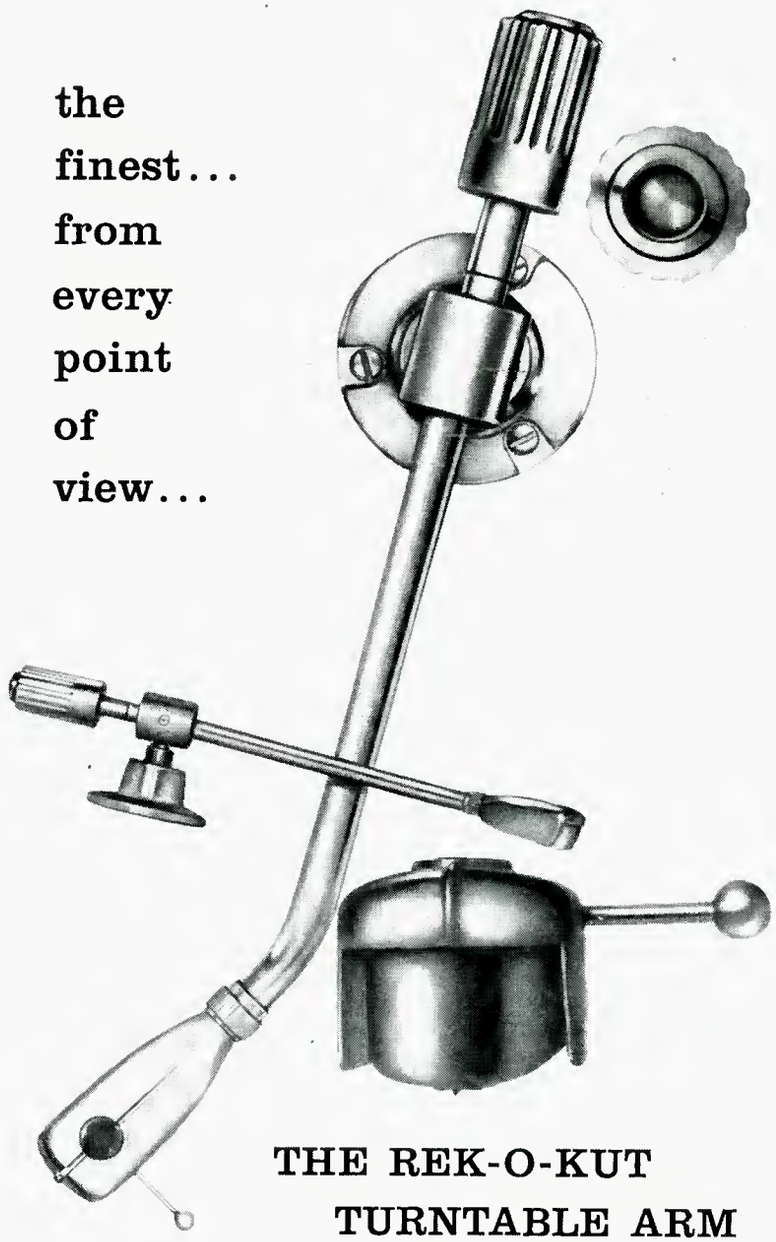
I can go on to speculate that—the big IF having been satisfied, good quality—stereo disc could well be brought down to the over-all price of present standard disc. Stereo pressings are bound to be inexpensive. The stereo pickup can be made cheaply, with ingenuity and experience, though it would seem to be inherently more complex than the standard item. But, more significant, dual channel amplifying and speaker equipment is, I would guess, susceptible to a great deal of ingenious development aimed at producing two sounds for the price of one.

Dual amplifier channels don't have to cost much, in the long run. That is, dual amplification is very susceptible to low-priced mass production, for mass-type quality. You can buy high priced, full-scale amplifiers if you want, of course, or a dual-channel amplifier of modest but good quality in a medium price range. Much of this is already on the books and more is obviously on the way. But bottom-priced dual amplification—with transistors?—is clearly a good bet. Stereo isn't really such an expensive proposition in these respects, when you come down to it. Why not two channels for the price of one?

A more problematical item is the speaker system and, oddly enough, the cost of dual cabinetry looms as the most expensive item of all in stereo playing, for the masses.

Two speaker enclosures of modest type, unfinished, are now to be had for a really very proper cost, in the lower brackets. Speaker system performance has without any doubt been going steadily up, price for price, in the last few years. It will not

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

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

The Saturday Review *(David Hebb)*

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

AUDIO *(Julian D. Hirsch)*

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

audiocraft

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

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

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

be too difficult, then, to provide fairly good budget double stereo speakers at a nonprohibitive price. And remember that stereo itself, and the stereo separation of speakers, does a great deal to "improve" apparent sound quality, over the one-speaker, one-point system.

But good furniture is a stubborn problem! Note that the RCA Stereotape Victrola (AUDIO, July) has an ultra-simple dual-channel stereo amplification system housed in one of its two cabinets, a batch of very small speakers, not expensive, and a small, compact enclosure—but the two pieces of finished furniture account for nearly half of the cost of the entire machine, as I figure it. The difference in price between the plain suitcase model and the living room furniture model (with two identical finished wood cabinets on legs) is a full hundred dollars.

It'll take a lot of ingenuity to make two home-style pieces of furniture to cost what one did before—especially when you consider that if a housewife doesn't like just one of a particular cabinet model, she's going to blow up sky-high at the thought of two of the darned things. Yep—here's the biggest headache in popular disc stereo! Furniture.

* * * *

Except, of course, for the hub-headache of all, the utterly basic little engineering matter of the disc stereo system itself, which I have carefully avoided, aside from the mention of the British lateral-vertical method already in experimental use as an all-over system.

Lateral-vertical would seem to any speculative outsider to be the obvious way to solve the two-signal problem and already well on the way towards mass practicality. It should allow for equal quality in each channel (with proper pickup and recording head design) and more or less equal wear, as well as equal noise—very important items, I assure you, since any stereo system that exhibits even a minor difference in sound between the two channels is doomed, and a system where one channel *wears* faster, or differently than the other, is doubly doomed.

These things may be problems in lateral-vertical, but they are nightmares, if I am right, in other systems already rumored here and there.

But this I don't intend to go into now, at the risk of a perfectly good neck. I'll merely state, in case things happen between now and publication, that the straws that float about with the wind these days seem to indicate that maybe it won't be lateral-vertical, but some other system for inscribing the two signals on one disc. Of course we might have, to give a zany guess, the bottoms-up disc which plays (like some jukeboxes) on the bottom as well as the top, or if you tip the thing on its edge, it plays from both sides at once. Could be done—as you'll realize if you've watched a Seeburg Selectomatic 100-play juke box.

I merely throw that one out to show that there can be other systems. I know of several, by close hearsay, including the one that would modulate a second signal upon a super-sonic frequency tone recorded along with the first signal on the record. I'll stick my neck out fifteen miles and say I just don't see how that one will work; for how does one get the two channels to sound

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alike in quality, one with such a whopping handicap in having to live its life off of, say, a 30,000-cps recorded tone? I wouldn't give it a half-life of ten plays.

There are other systems, including grooves-within-grooves and the like, but let's wait and see. All of this fine speculation may be as thin as free air. Maybe we won't *ever* hear a commercial stereo disc—or not until 1984.

IF, by any chance a stereo disc has already appeared in public by the time you read me, you may now have the juicy pleasure of comparing my speculations directly with the finished specs. Not a thing I can do except join you in the same.

If nothing has happened—yet—then you may file this neatly away (*always* keep your copies of AUDIO) and forget it. And if stereo disc blossoms out later, you can dig it out and do a fine post mortem. Now, if you don't mind, I'll go ease my aching neck.

2. More Small Boxes

I've had a pair of pre-production speaker systems on hand lately, especially shipped up to me because they are small—and I'm supposed to like small systems.

I hasten to write on the subject, therefore, in time for their official debut because they *are* small and do represent an interesting new trend, or rather a new extension of a trend, coming as they do from a big company in the speaker field, University. The new models will take this large company into a new price area for small-sized systems, the fanciest model being more expensive ($250) than the hitherto champion small system, the AR-1. The other model, AR size, straddles the AR prices at around $145. I make these price comparisons deliberately because, at this writing, these are the only systems I know of in the smallest-size class in the upper price brackets; University offers competition to AR in this fastion, not head-on but complementarily, with respect to price.

Now I'm on tough ground for me, here, because it is obviously impossible for me to listen to, study, and write up the huge number of speaker systems now being produced, and I must therefore deliberately stick to items that seem to me either to be typical of a class or to be innovations in their own right. In the larger of these two boxes University already has a good deal of outward competition that ought to be mentioned too—that is, in the $200 price range and a box-size around double that of the AR speaker. Small, not smallest. Racon, for instance, with a cabinet the same size and a speaker inside that aims at the same principles as University's. Sonotone's system, only slightly larger. . . . I describe University's new products then (a) because as a major company, University's entrance into a new field—small but higher priced enclosures—is of unusual importance and (b) because one of the two models at University is virtually the same size as the AR, though the larger cabinet is the size of Racon's and others'.

I see it all this way. We've had "small" enclosures forever and anon, notably the shoe-box arrangements so utterly convenient in generations of little table model radios and phonographs. But the idea of a hi-fi separate speaker box deliberately designed for a new and maximum improvement in space-bass ratio bloomed first with the RJ enclosure, quite a few years ago—as duly hailed in this department. The RJ's tightening-up of the space-bass ratio worked out successfully and people approved; its outward embodiment, more bass in smaller enclosures, caught on and was taken up in all sorts of speaker systems of similar size and price, conventional and unconventional as to their innards. Everybody jumped on the *outward* idea, the looks and shape and the relatively hepped-up performance. Obviously it was a good idea, this small-sized but still potent speaker system. A compromise with ideal quality, of course, but a compromise that brought a lot of improved sound to people who didn't want big furniture in the way.

Those who wanted the best in sound, without compromise in space requirements, still went to the higher price brackets and the larger enclosures. Something for everybody.

Nobody has claimed, as far as I remember, that these new small systems would equal the ideal large-size enclosure in ideal performance. The new systems were designed to better the performance-to-size ratio, and this they did splendidly. (Or not so splendidly, according to model and according to taste.) The main bulk of the small speakers, therefore, stuck to the low-priced range and this included most uses for the RJ itself, which did best, practically speaking, in the modest price ranges—though of course almost any speaker of conventional size could be used with it. The principle, if you get me, was one of use; if you wanted really expensive, top-quality sound you would automatically go for a larger cabinet, for maximum performance from costly speaker equipment. Common sense.

And so for a good five years the small speaker systems proliferated in all directions—almost exclusively in the range well below a hundred dollars for the complete system. Most were fairly simple adaptations of bass reflex; the excellent sound that was possible at the low cost could be ascribed mainly to the steadily improving small speakers themselves—for it now became of interest to speaker people to turn out wide-range, low-resonance speakers, especially in the small 8-inch size used in many cabinets.

Then—came the AR-1. This was again revolutionary, whether you think its sound the ideal one or no. Revolutionary in outward aspects, I mean, for it took the small-size enclosure idea for the first time into a high price bracket, implying really high sound quality, worth paying for. The earlier small enclosures implied, via their lower prices, that higher quality still meant a larger enclosure. AR implied—and that is the best word—implied, that in quality of reproduction it could match competition at the higher price, regardless of size.

That was definitely new. In hi-fi stores, in homes, this was an idea that shouted revolution—and I'm still speaking strictly from the outside. It was an *expensive*, small box that challenged expensive big ones. If it worked at all, it had proved something new. The extension downwards of the AR principle to a lower price in AR-2 simply

(*Continued on page 89*)

AR-1

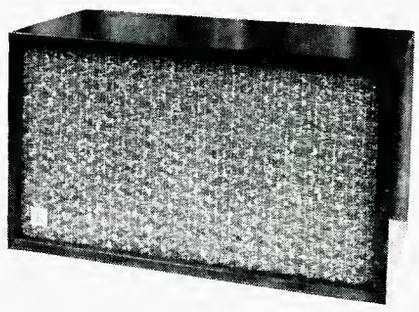
WHEN the AR-1 speaker system first made its appearance on the hi f market, our published specifications were sometimes greeted with skepticism; for a speaker to perform as claimed, particularly in such a small enclosure, was contrary to audio tradition.

Now, two years later, the AR-1 is widely accepted as a bass reference standard in both musical and scientific circles. There is general understanding of the fact that, due to the patented **acoustic suspension** design, the small size of the AR-1 is accompanied by an advance in bass performance rather than by a compromise in quality.

AR-2

The AR-2 is the first application of the acoustic suspension principle to a low-cost speaker system. Prices are $89 in unfinished fir cabinet, $96 in mahogany or birch, and $102 in walnut.

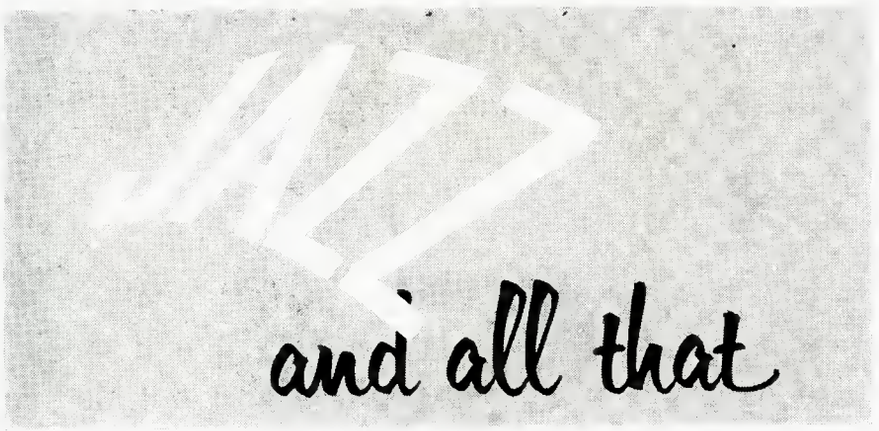
We would like to suggest, as soberly as we invite comparison between the AR-1 and **any** existing bass reproducer, that you compare the AR-2 with conventional speaker systems which are several times higher in price. No allowances at all, of course, should be made for the AR-2's small size, which is here an advantage rather than a handicap from the point of view of reproducing quality.



Literature is available on request.

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CHARLES A. ROBERTSON*

Coleman Hawkins: The Hawk Flies High
Riverside RLP12-233

Following close on the heels of the two-hour documentation of Coleman Hawkins' own story, this album casts the veteran of the tenor saxophone with some of the more stimulating jazzmen of another generation. In such company his horn shines with a new glitter in a sparkling recording by Jack Higgins. And the round of studios, which Hawkins began nearly a quarter-century ago in acoustical days, is broadened to include a visit to Reeves Sound Studios.

Founded in the 1930's by Hazard Reeves, the company moved from Broadway to the former home of the Beaux Arts School of Industrial Design, at 204 East 44th Street, shortly after World War II. The five-story building is designed to fill the requirements of putting sound on film, from television commercials to documentaries and feature films, including Cinerama and the parts of Elia Kazan's current "Face In the Crowd" made in New York. Thirty dubbing machines are distributed among the various studios to handle the final mix of a soundtrack. But the attention of the audiofan is drawn to the largest of them, Studio B, which covers most of the second floor. It is the scene of all orchestral recording and Riverside jazz and other dates.

In the course of nearly six years at Reeves, Jack Higgins has made it more or less his private domain. In displaying some of its attributes he said, "No studio is without its idiosyncrasies and the better half of the engineer's job is in learning how to cope with them. As our rates are figured by the hour, the scheme is for the greatest flexibility in the shortest space of time. The movable bandstand is backed by a shell and is located to set the size of the room to fit the needs of the group. Carpeting is available in strips and is laid in varying amounts to attain the degree of liveness or deadness desired. Partitions are also used to help in this. They are called 'Gobos,' the movie term for spotlight screens, and are covered with soft acoustical material on one side, with the other left hard and shiny.

"Some of the facilities are not needed on a jazz date. There is a vocalist's room for completely separate recordings of orchestra and singer. Also not used are two echo chambers, one in this building and a more sizable one next door. Orrin Keepnews has an aversion to them and the studio is large enough for a big band. But they did come in handy to obtain an effect on one number of the Zoot Sims' date."

The adjacent control room is equipped with a bank of three monitor speakers, each consisting of two Jim Lansing 15-inch woofers and tweeter, driven by a Fisher 50-watt amplifier. "Stereophonic sound has made a lot of changes in the control room," Higgins explained. "The two outside speakers are used for stereo and the one in the middle for monaural and three-channel work. We were going along nicely with monaural sound when stereo came around the corner and things are nowhere near settling down yet. It seemed most wise to allow for three channels in the permanent changes on the control panel and to bring the number of mixers up to nine or more. Jazz dates have been made in stereo for some time and I plan to experiment with three channels on them.

"There is no patch panel here as that is located for each studio in the master control room on the fifth floor. This is a time-saver in case anything goes wrong. It only takes a minute to call the engineer there and have him switch to another circuit and amplifier. As the customer never sees a maintenance man or knows anything is awry, it may also be good salesmanship. The rest of the fifth floor is entirely given over to maintenance and engineering. This part of the staff comes in an hour early to test each circuit. Check sheets are kept on every piece of equipment and bench tests are made at regular intervals. With our engineers it is never a question of what has been done before, but of what is needed now.

"They made much of our equipment, but all of our tape machines are Fairchild. These are no longer manufactured and I guess we will need to go into the second-hand market for more. I can run as many as five tapes on a date and always make at least two. This means the protection tape is the same quality as the original. Of course, the tape used is Sounderaft, an allied product.

"Jack Mathews is in charge of our mastering division. We either work together on a tape, or he does the job from my notes. He uses a Grampian cutterhead, a Gotham 100-watt amplifier and a Fairchild lathe. This is a part of the business still more of an art than a science."

Now thirty-five years old, Higgins went from technical high school in his native Detroit to the RAF as a volunteer in 1940. He was trained at the RAF College at Cramwell in England and went into experimental radar work. While on weekend leave in Dublin, he learned of an OSS film unit and applied for transfer. His electronic experience sped this along, and he was chief sound mixer for the group of Hollywood trained technicians at the war's end. While instructing a WAF class in radar operation, he met the future Mrs. Higgins and the reason for his remaining in England as a free-lance soundman. This included a spell at the Merton Park film studios and band dates for H.M.V. and English Decca. In 1950, the British movie industry was in the doldrums and the Higgins family was increasing to its present total of two boys and two girls. A return to the States seemed advisable.

On arrival, he applied for a job in the UN film section and was immediately accepted. For nearly two years, he made conference scenes and documentaries. "The first thing to impress me in this country was the abundance of equipment," Higgins said. "Wartime shortages were in evidence all during my stay in England. With the export trade favored, it was often a matter of makedo as deliveries could not be anticipated. I think at the time they were ahead of us in the single-microphone technique, but only in the classical field."

On going to Reeves, Higgins at first was involved with movies which comprise eighty per cent of the studio's work. Band recording for Mercury and other companies was handled by Bob Fine. When he departed, this task was shared by several engineers until Higgins found himself doing most of it. He has taken charge of all Riverside dates. "Recording jazz musicians presents problems not found in the usual orchestral work," he maintained. "The individual soloists must be brought into correct focus or there will be the same flatness found in a movie of a play as enacted on the stage. There is an introspective quality in much of contemporary jazz which requires the detail of a closeup. But the portrait should not be overblown, nor should it be reduced to the size of a television screen.

"It is not always easy to strike a happy medium. Orrin Keepnews and Ray Fowler are a great help. We usually arrive at something we can all agree on. They have a knack for making the musicians feel at home in a strange studio, even to the point of indirect lighting. Fowler was my assistant before going to Riverside. He is gifted with a fantastic ear. He has a love of jazz and is taking courses at Columbia to improve his knowledge of classical music.

"I am always experimenting with microphones. The salesmen know I have a weakness for anything I haven't tried. Right now I use a modified AKG dynamic for the bass and rhythm section. Two Telefunken U47 microphones, with one closed down for balance, are used for the rest of the band. Under certain conditions I like the RCA 44BX ribbon, especially for voice and a fat brass sound.

"Some recordings have a special significance for the engineer," he said. "The Alec Wilder with Mandell Lowe was the first where the over-all sound satisfied me and I felt the nuts and bolts were all in place. The necessity for capturing Trigger Alpert's bass on his date forced me to come closer to solving the problems inherent in that instrument. On the last Monk session, I had kettledrums sprung on me. They had been left in the studio after a film recording. I thought at first I might get into trouble if they were used. Then I was afraid all of us would never agree on the dynamics. Both fears turned out to be groundless. So far, I like the Hawkins most of all, but am sure we will do better."

Though he feels like one of the Riverside family, Higgins is not a sports-car owner. His eye is on the waters of Long Island Sound and a thirty-five foot ketch moored in Flushing Bay. He brought it up from Maryland last Spring to join the weekend flotilla of pleasure craft, and would like to fit in a voyage to Cape Cod.

In his spoken autobiography, Hawkins mentions the demands made upon him by recording executives to repeat his best-

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

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selling *Body and Soul* by making something similar to it. In an effort to attain popular success, they have paired him off with string sections and unwieldly studio bands. This is his first chance in some time to cut an album under his own name with a driving small band, composed of men of his choosing. The result indicates it should be done more often.

For he is still the dominant figure on the tenor sax, and will probably remain so until today's vinyl is worn to dust. As an influence, a number of men have joined him on the same eminent plateau. But in any discussion of style Hawkins' name is most frequently mentioned, if only as the basis by which comparisons may be made. Though he has encompassed a number of styles in the span of three decades, his voice is the one most readily recognized by the fullness of its passion, the intensity of its phrasing, and its sure rhythmic sense.

Just as the younger men looked to Hawkins for inspiration, he is quick to recognize what those of today are trying to accomplish, prizing their freshness of ideas and youthful vigor. His selected cohorts are the assured J. J. Johnson on trombone and the trenchant Idrees Sulieman on trumpet. In the rhythm section are Hank Jones, piano; Barry Galbraith, guitar; Oscar Pettiford, bass; Jo Jones, drums. They play as though they came to the studio determined to give Hawkins the best support he has enjoyed on records. The rhythm follows his every whim, from flowing relaxation to a building tension, and the hours meet his demand for spirited ensembles or challenging solos.

Hank Jones provides a bright, uptempo introduction in *Chant*, and Sulieman leads into a plunging blues in the extended *Juicy Fruit*. On Gigi Gryce's *Blue Lights*, Hawkins turns in a most exacting chorus and, as no session of his would be complete without an exhibition in slow tempo, adds the standard *Laura*, and the original ballad *Think Deep*. The joyous *Sanctcity* takes its healthy line from the old gospel song *Give Me That Old Time Religion*, for a communal shout of joy. Yes, the Hawk still flies high.

Studs Terkel: Big Bill Broonzy Interview
Folkways FG3586

It is amazing how few histories of jazz even mention William Lee Conley Broonzy, though belated atonement was made last year in Hugues Panassie's "Guide to Jazz" by his statement: "Big Bill is one of the great blues singers . . . his style is a model of purity in blues playing." And the discographers will probably continue to ignore him, as he claims to have written more than 360 songs and it is doubtful if he could tell how many records are to his credit. Many a jazz musician has created a blues chorus by speeding up Big Bill's tempo and his melodies are a goldmine for the Rock and Roll composer. In a haphazard way, I once gathered a good gross of them and wish I had been more diligent.

To the folklorist, his sixty-four-years on the bypaths and backroads of America forge a direct link to the origins of country blues. In this Chicago interview, he tells Studs Terkel parts of the story of his life as related to a particular blues. Then he recounts what he knows of it and sings his version, accompanying himself on the guitar. *Plough-Hand Blues* recalls early days in Mississippi. *C. C. Rider*, named for an itinerant musician, starts him on his career. *Bill Bailey* is used to point up the difference between blues and jazz players, as is *This Train* to contrast a spiritual with the blues. But the purpose of country blues is to tell a story as in *Willie Mae Blues, Joe Turner, Key To The Highway, Mule-Talking Blues* and *Black, Brown, and White.*

Because of Terkel's long friendship with Big Bill, the conversation is channeled to

An announcement we hope will gladden some very patient people . . .

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JansZen DYNAMIC

PRECISION-DESIGNED WOOFER

From the day designer Arthur Janszen finished the production prototypes of the JansZen 130, the electrostatic loudspeaker was here to stay. Such true, transparent, trouble-free treble had not been heard before from a loudspeaker. Music lovers succumbed at once, in delight, and demand ran away from supply.

This was gratifying, especially so because there had been strong misgivings here about marketing the tweeter without a woofer to match. (Not that we had any choice. It is almost axiomatic among small manufacturers of precisely crafted devices that you must sell one product to pay for the development of the next.) Worthy woofers existed, but they had been carefully designed—good woofers do not just happen—to complement tweeters of operating principle similar to their own: a moving coil driving a cone or diaphragm. Most of them, when teamed with electrostatic tweeters, showed irreconcilable variances of phasing, midrange roll-off, transient attack, impedance, and efficiency.

A few, fortunately, worked rather well, earning our recommendation, and it must be said here, with profound respect, that certain ingenious home sound experimenters managed with multiple woofers and special enclosures, to produce sound with which we could find no fault at all, except that it cost them more hours and/or dollars than most people can afford.

Obviously, we still had an obligation, but we had not been delinquent about it. As soon as the 130 was launched, Mr. Janszen and his staff had gone back to work designing a bass speaker to complement it. Silence was imposed until he could be reasonably sure of success; premature mention would have been unfair both to prospective buyers and to other manufacturers. Early last summer he admitted he had something satisfactory, which is for him a wildly enthusiastic statement. We present this product to you, as the JansZen DYNAMIC woofer.
It consists of one cone in a special cabinet. It is unique in some particulars. It had to be, because it was conceived, designed, and empirically crafted to work in seamless sonic unison with the 130 tweeter. It does. Expert listening juries have been (happily) unable to detect its point of crossover. Further, it is small, hearteningly inexpensive, and capable of clean, solid bass down to a measured 30 cycles per second. You will be able to buy it either by itself or in a common enclosure with the 130, come October.

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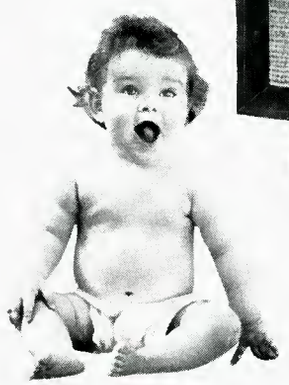
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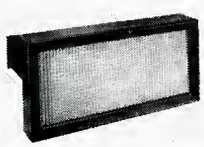
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sources of great interest and the valuable notes by Charles Edward Smith place them in perspective. The story is by no means completed in this disc. Some of it is to be found in his autobiography "Big Bill Blues," written with the help of Yannick Bruynoghe during a stay in Europe. More will be revealed in a companion LP of songs, but there is material for several others in Big Bill.

Negro Prison Camp Work Songs — Folkways P475

One place where the worksong is still sung in undiluted form is in the Negro prison farms of the South. There the oldest and most traditional are handed down by the elder men, with all their driving power intact. The ten numbers were recorded by Toshi and Peter Seeger, John Lomax, Jr., Chester Bower, and Fred Hellerman at two camps near Houston, Texas, and include *Here Rattler, Grizzly Bear, Let Your Hammer Ring,* and *Long John.* Most employ the antiphony of solo voice answered by the chorus, which unfortunately overloads on this tape of 1951 vintage. But the disc will serve a purpose if it points the way to someone with a modern tape recorder, as this music may disappear in a few years.

Carl Halen: Gin Bottle Jazz — Riverside RLP12-231

The Dayton-Cincinnati area has the distinction of two home-grown dixieland bands. Carl Halen's Gin Bottle Seven is a robust offspring of the group headed for the past ten years by the capable Gene Mayl. In the manner of Bix and Red Nichols, the leader is at ease on trumpet or cornet. He uses either instrument as indicated by the tonal values of the material and his own good taste. The band falls most naturally into the Middle Western style of playing, but couples it to the unity and building performance of the best New Orleans groups. Most valuable, in this respect, is the ability of Johnnie Pollock to employ his tuba on a harmonic line without neglecting his duties in the rhythm section. He also adds depth to the pleasant ballroom sound on this refurbishing of an Empirical disc. Of the dozen tunes *Angry, Apex Blues, Milenberg Joys,* and *Oh, Baby* are previously unissued.

Lou Donaldson: Wailing With Lou — Blue Note 1545

Alto saxophonist Lou Donaldson is joined by trumpeter Donald Byrd in the second LP to be issued under his name. It lives up to the title in a percussive Afro-Cuban modernization of the oriental Caravan, with local color from drummer Art Taylor. But there is a feeling of nostalgia in the moving *Old Folks,* and Byrd makes a serene serenade of *There Is No Greater Love.* The Donaldson originals, *That Good Old Feeling* and *More It,* have a distant relationship to *Pennies from Heaven* and *Fine and Dandy,* respectively, or the tunes they were taken from. His *L.D. Blues* is sprightly, having a structure which builds to a dramatic close.

Self taught, though blind since his birth twenty-nine years ago, pianist Herman Foster makes his record debut. In his own way he is a block-chorder, using the locked hands style to sustain organlike passages for dramatic effect. It is a powerful sound. Bassist John Morrison completes the quintet.

Lee Morgan Sextet — Blue Note 1541

With the aid of some provocative writing by Benny Golson and Owen Marshall on his second LP for Blue Note, Lee Morgan takes a firm step forward in the ranks of trumpetmen. His youthful, jaunty style meets the challenge of a moody ballad in *Where Am I,* and a melodic theme in *Whisper Not,* aspects of his playing not displayed so thoroughly before. His muted solos urge with a restless emotion and come close to breaking out into reckless gymnastics. His struggle for restraint creates much the same feeling of intimacy to be found in the more subtle work of Miles Davis and indicates a continuing development. Both are by Golson, who adds the

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buoyant uptempo *Latin Hangover* and *Slightly Hep.*

These are surroundings in which Morgan can feel completely at home. Drummer Charlie Persip is his companion in the Gillespie band. Another youngster from Philadelphia, nineteen-year-old Kenny Rodgers on alto sax, is his senior by one year and injects an evocative contrast to the easy propulsion of Hank Mobley on tenor. Pianist Horace Silver and bassist Paul Chambers complete the sterling rhythm section.

The thirty-two numbers span the years from 1924's *Somebody Loves Me* to the posthumous *For You, For Me, For Evermore,* first heard in 1947. Besides the help of her regular pianist-accompanist Ralph Sharon, Miss Connor enjoys the collaboration of arrangers Ray Ellis and Stan Free. To gain a fresh approach to the more familiar tunes, they depend upon understatement, or the novel twist of bongos in *Strike Up the Band* and *Of Thee I Sing.* But Miss Connor digs deeply into the soul of Gershwin to bring to life for the first time some lesser-known verses. *Bla Bla Bla* was written in 1931 as an expression of disgust with the popular idiom. It seems as though the composer purposely made it an unsurmountable hurdle for pop singers. Here it is skillfully clothed with warmth and tasteful styling. In preparation, performance, packaging and sound, the album is a model of what such productions should be but seldom are.

Chris Connor: The George Gershwin Almanac of Song **Atlantic 2-601**

Omnibus collections of the popular songs of Broadway composers as stylized by female jazz vocalists have turned a nice profit for the record companies during the past year. It is likely they will continue to produce them with the regularity and mechanical precision of the assembly line. The usual procedure is to commission an arranger, conductor, and band contractor to prepare the date, though all three roles may devolve on the same genius for concocting innocuous backgrounds. Should a few jazz musicians be engaged, they are suitably obscured by the scoring. When the highly-paid star arrives at the studio, everything is geared for a clockwork performance. In fact, one liner boasts of a minimum of takes in one three-hour session.

Somewhat of a departure from this uninspired norm is found in the two-disc album of George Gershwin melodies, forwarded by the pert Chris Connor. The seven instrumental ensembles which accompany her range in size from trio to octet. They are staffed by thirty musicians of unassailable standing in the jazz world. The program is spiced by cogent solos from the like of Joe Newman, trumpet, on *Liza;* Sam Most, clarinet, on *They Can't Take That Away From Me;* Jimmy Cleveland, trombone, on *My One and Only;* Peanuts Hucko, clarinet, on *Nice Work If You Can Get It.* And the vocal line is given inventive and rhapsodic support by Al Cohn, tenor sax, on *I've Got a Crush On You,* and Milt Jackson, vibes, on *Embraceable You.*

John Dennis: New Piano Expressions **Debut DEB121**

It is not easy to find something to say about a new pianist who simply plays good piano. Though fully cognizant of the activities of other young modernists, John Dennis steers clear of the limitations of any school. He is more concerned with probing the full range of the keyboard and uncovering its dynamic potentialities through tender strength and a steady flow of ideas. As an improviser, he is astonishing. There is little dependence on such crutches as meaningless arpeggios, or other devices used to conceal a pause-and-think interlude. The slick, precut canon and other classical borrowings are not needed to shore up his power of communication.

The diversity of moods planted in the six originals is expressed by the title of the solo number *Variegations.* Charming lyric passages show that a period spent pleasing a cocktail crowd need not be wasted. Dennis has a sure sense of rhythm, permitting bassist Charlie Mingus and drummer Max Roach to do more

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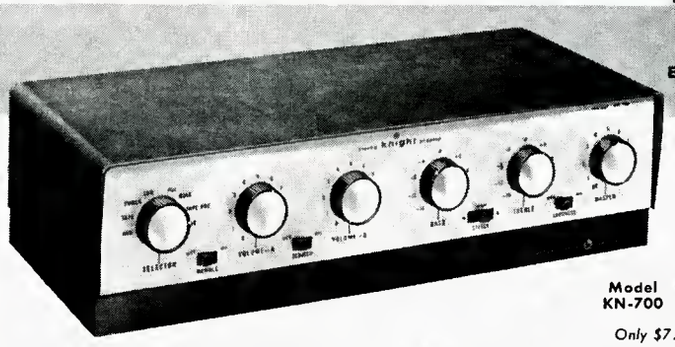


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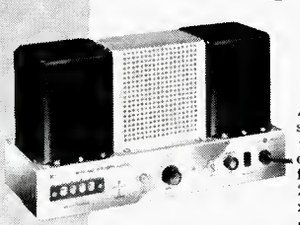
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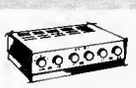
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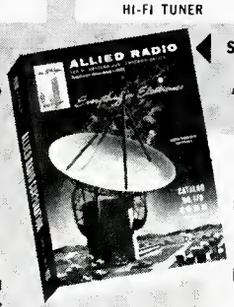
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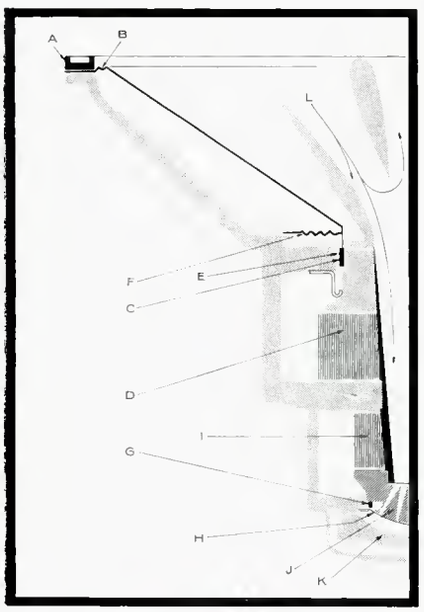
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Let's examine the 604C Duplex in detail, analyzing the design features which have made it famous.

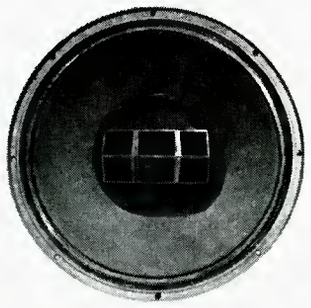


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(g) The 1.75 inch voice-coil consists of 37 turns of double insulated edge wound aluminum ribbon .0023" thick and .014" wide for maximum efficiency. (h) The domed diaphragm is made of an exclusive fatigue resistant aluminum alloy for long life and high rigidity. To provide the lowest possible mass an integral tangential compliance is formed of the same material. (i) A 1.2 pound Alnico V ring magnet physically separated from the low frequency structure. (j) A dual-annular phasing plug automatically machined to assure complete production accuracy. (k) A mechano-acoustic loading cap to provide proper back loading of the aluminum diaphragm. (l) A true exponential throat ending in six exponential horns grouped in a 2x3 multicellular configuration to provide a 40° by 90° distribution pattern. It should be noted that the exponential horn both in its sectoral and multicellular shapes is still the only type of high frequency horn which has proved acceptable in professional use.



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than just keep time in the trio. The standards are a rapid *Cherokee* and the ballad *Someone to Watch Over Me*. Anyone who sought out Brubeck, when he first appeared on the Fantasy label, will not want to miss Dennis.

Joe Puma: Wild Kitten
Dawn DLP1118

After growing up in a guitar-playing family, Joe Puma continued his training in the jam session of ten years ago. In the liner notes, he comments, "I quickly found that it wasn't how much you played, but the way you played in relation to the tune and the other players that counted." That it is an unforgotten lesson is well illustrated in his long, fluent solos on eight selections. And he is beginning to play more Puma and less of his influences.

Accordionist Mat Mathews contributes the title tune and *Rigamarole*, as well as his usual rapport with Puma. Whitey Mitchell and Oscar Pettiford share duties on bass, and drummer Shadow Wilson is added on *Rose Room* and *But Not For Me*. Puma's *Sportin' With Morton* is a lively reference to the conductor of the Jazz Unlimited program on WNRC-FM, New Rochelle, at 95.3. From noon to 3 p.m. on Saturday, Mort Fega plays new jazz releases, but limits them to the modern mode.

Cecil Payne Quartet Quintet
Signal S1203

When Cecil Payne was a youngster in Brooklyn, he wanted to emulate Lester Young on the tenor saxophone. But he started out on the alto sax at the age of thirteen, having found an admirable teacher in Pete Brown, who lived on the same block. Later, when playing with big bands, he found a baritone sax came in handy. On this awkward instrument he gradually increased his proficiency until he is now able to handle it with ease and lightness, giving expression to a fluency of phrasing more often associated with the tenor he once desired.

In his first LP as a leader, Payne plays baritone and enjoys a chance to show at length the qualities which have made him a valued sideman for so long. That he is nimble on his horn is only a part of his talent. There are those who will think him best on the slow ballad *How Deep Is The Ocean?*, or underlining the trumpet by Kenny Dorham on the four numbers by the quintet. In the rhythm section are Duke Jordan, piano; Tommy Potter, bass; and Art Taylor, drums. One of the newest of the small labels, Signal has placed its engineering in the hands of Rudy Van Gelder. The deep tones of Payne's baritone will please the sound fan.

Bill Perkins: Just Friends
Pacific Jazz M401

An addition to the Pacific Jazz line, the lower-priced M-IV series is introduced with this album. There is no discernible difference in packaging or pressing from the regular series, and the same fine sound prevails in the engineering by Val Valentin. It presents Bill Perkins on tenor, bass clarinet, and flute in a split bill with tenorman Richie Kamuca and the Hampton Hawes Trio on five tunes. Altoist Art Pepper, and a rhythm section headed by pianist Jimmy Rowles, join him on four others to complete the program.

It is an informal setting, with Perkins writing a smooth voicing for the two tenors on the standards: *Just Friends, All of Me,* and *Limehouse Blues*. His sonorous bass clarinet meanders through *Sweet and Lovely* and an original blues. Pepper contributes *Diane-a-Flow* and *Zenobia,* and is at his impassioned peak as a soloist. There is plenty of meat for the jazz fan and the sound fancier will like the flute and bass clarinet.

Chet Baker: Big Band
Pacific Jazz PJ1229

During his recent eight-month sojourn in Europe, Chet Baker developed a more positive voice on the trumpet and displayed it to advantage as a guest with Kurt Edelhagan's Or-

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chestra. He also brought back some originals by the French jazz musicians Pierre Michelot and Christian Chevalier. This combination of events prompted a session placing him in a larger context than his usual quintet. But the Baker horn is still not that of a roof-raising extrovert, so the arrangements for the two groups retain the flux and solo space of a small band with the added tonal texture of big band sound.

Chevalier's *Mythe*, *V-Line*, and *Not Too Slow* are played by a nonet which features Bob Burgess, trombone, and Bob Graf, tenor sax. Michelot contributes the descriptive *Chet* and an arrangement of *Dinah*. Phil Urso, tenor and alto; Bobby Timmons, piano; and James Bond, bass; regular members of the quintet, play with both units. The delightful *Phil's Blues* is by Urso.

Percy Heath's younger brother, Jimmy, arranged the ballads for the eleven-piece group. *A Foggy Day, Darn That Dream*, and *Tenderly* are made for the Baker trumpet style. With new firmness and feeling, he tops anything he has done previously. Trombonist Frank Rosolino and altoist Art Pepper offer limber solos.

Kenny Drew: I Love Jerome Kern
Riverside RLP12-811

In a melodic interpretation of a dozen Jerome Kern favorites, Kenny Drew meets the cocktail pianists on their own ground and leaves them gasping for a beat. His formula is simple—with a minimum of frills and a touch of Eddy Duchin style, the tune is stated in the cocktail manner and followed by sensitive variations which never depart too far from the theme. But Drew swings from start, aided by uncanny timing and a firm grasp of rhythmic nuance. It is here that he leaves much of the competition behind. The fine shadings of bassist Wilbur Ware and the full piano sound make it valuable to admirers of Kern.

Harry Breuer: Mallet Magic
Audio Fidelity AFLP1825

A veteran performer on instruments played with mallets, Harry Breuer virtually grew up beside the xylophone, marimba, and vibraphone. As he perfected his technique, they were evolving into polished, well-constructed adjuncts to the percussion section. To demonstrate their special individual and collective characteristics, he leads a quintet of agile and explosive musicians through a dozen novelty numbers. The arrangements are fashioned to explore the crisp, bright timbres struck by the bouncing mallets. On this exemplary recording they are caught in all clarity and purity, making it a sonic treat.

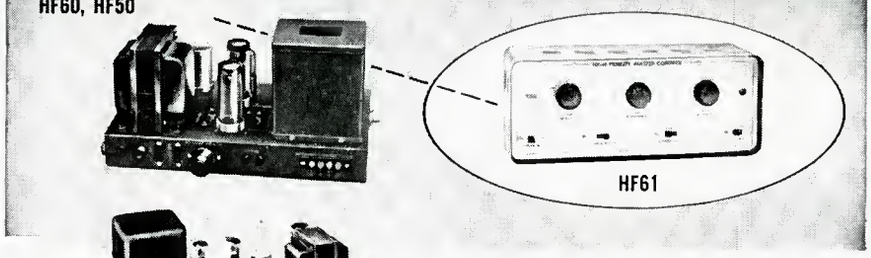
A brisk pace is set in *Mosquito's Parade March*, to be followed by the saucy *Flapperette*. A virtuoso piece, *Bumble Bee Bolero* should make Jack Benny take notice. *Chinese Doll* permits the introduction of a lustrous gong, and the marimba is displayed on *La Rosita* and *Chiapanecas*. Bongos and timbale add the spice of Latin rhythm to *Maxixe Mambo*. On *Macabre Sambra*, an extension of one of the first xylophone solos, the grotesque Saint Saëns theme is emphasized by a gruff electronic organ. *Tulip Polka* and *Buffoon* are light-hearted romps and *Maple Leaf Jump* is a rollicking new version of the ragtime favorite. The glockenspiel is heard solo on a gay *Gavotte*. Harry Breuer and his mallets have come a long way since he first picked them up in a Brooklyn high school band and later started out with the A & P Gypsies and Cliquot Club Eskimos.

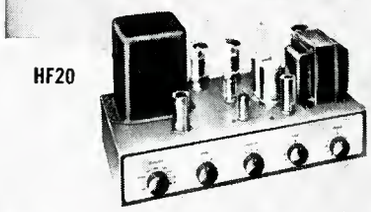
Viva Mexico!
Capitol T10083

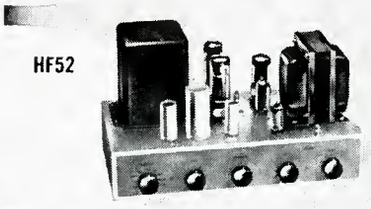
A native product on display last year at the High Fidelity Show in Mexico, this importation was recorded in the capital city by Dr. Otto Mayer-Serra. Luis Herrera de la Fuente conducted the eighty-four musicians of the National Symphony Orchestra of Mexico in four colorful and characteristic works in the classic concert hall of the Palace of Fine Arts. Two are direct rescorings of folk material and make lively Pops fare. Blas Ga-

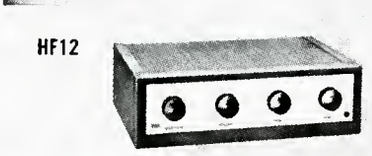
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Complete with Preamplifier, Equalizer & Control Section. Equalized direct tape head & magnetic phono inputs. **Power Output:** 12 w cont., 25 w pk. **IM Dist.:** 1.3% @ 12 w. **Freq. Resp.: 1 w:** ±0.5 db 12-75,000 cps; **12 w:** ±0.5 db 25-20,000 cps. 2-EL84, 3-ECC83/12AX7, 1-EZ81.

HFS1 TWO-WAY SPEAKER SYSTEM $39.95 complete with FACTORY-BUILT CABINET
Jensen heavy-duty 8" woofer & matching **Jensen** compression-driver exponential horn tweeter. **Smooth** clean bass & crisp, extended **natural** highs. **Overall response:** ±6 db 70-12,000 cps. **Power-handling capacity:** 25 w. **Impedance:** 8 ohms. **Bookshelf size:** 23" x 11" x 9". 25 lbs. **Wiring Time:** 15 min.

EICO is a pioneer (1945) in kit test equipment — leads the industry in distributor sales to trained and critical users.

EICO has achieved this acceptance because

- ***EICO engineering policy is to stress electrical and mechanical quality, soundness and functional completeness.***
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HP61 Master Control PREAMPLIFIER
KIT $24.95 WIRED $37.95
with Power Supply: KIT $29.95 WIRED $44.95
Does not add distortion or detract from wideband or transient response of finest power amplifiers at any control settings. High-quality **feedback** circuitry throughout & **most complete control & switching facilities.** Feedback scratch & rumble filters, equalizations, tone controls. Centralab Senior "Compentrol" loudness control, concentric level control. 4 hi-level, 2 lo-level switched inputs. **Extremely flat wideband freq resp:** ±0.3 db 12-50,000 cps. **Extremely sensitive. Negligible** hum, noise, harmonic or IM distortion. 4-7/8" x 12-5/16" x 4-7/8". 8 lbs.

HF60 60-WATT Ultra-Linear POWER AMPLIFIER with ACRO TO-330 Output Transformer
KIT $72.95 WIRED $99.95
EF86 volt ampl direct-coupled to 6SN7GTB K-coupled phase inverter driving two U/L-connected p-p EL34 output tubes. GZ34 extra-rugged rectifier. **Rated output:** 60 w (130 w pk). **IM Distortion:** less than 1% at 60 w; 0.5% at 50 w. **Harmonic Distortion:** less than 0.5% from 20-20,000 cps within 1 db of rated power. **Sine Freq. Resp: at 1 w:** ±0.1 db 15-35,000 cps at any level from 1 mw to rated power. **Square Wave Resp:** excellent 20-25,000 cps; 3 usec rise-time; **Sens:** 0.52 v for 60 w. 7" x 14" x 8". 30 lbs. **Matching Cover E-2, $4.50.**

HF50 50-WATT Ultra-Linear POWER AMPLIFIER
KIT $57.95 WIRED $87.95
Extremely high quality output transformer with extensively interleaved windings, 4, 8, and 16-ohm speaker taps, grain-oriented steel, fully potted in seamless steel case. All other specs equivalent to HF60 but on 50 w level. **Matching cover E-2, $4.50.**

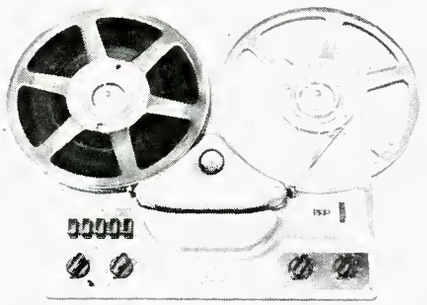
HF20 20-WATT Ultra-Linear Williamson-type INTEGRATED AMPLIFIER complete with Preamplifier, Equalizer & Control Section KIT $49.95 WIRED $79.95
Sets a new standard of performance at the price, kit or wired. **Rated Power Output:** 20 w (34 w peak). **IM Distortion:** 1.3%. **Max Harmonic Distortion:** below 1%, 20-20,000 cps. within 1 db of 20 w. **Power Resp (20 w):** ±0.5 db 20-20,000 cps; **Freq Resp (¼ w):** ±0.5 db 13-35,000 cps. 5 feedback equalizations. Low-distortion feedback tone controls. 4 hi-level & 2 lo-level inputs. Conservatively rated, fully potted output transformer: grain-oriented steel, interleaved windings. 8½" x 15" x 10". 24 lbs. **Matching Cover E-1, $4.50.**

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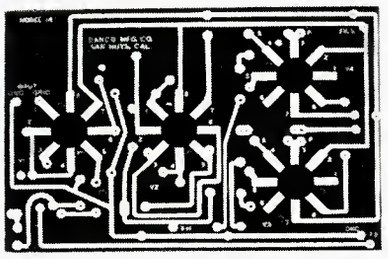
NEW PRODUCTS

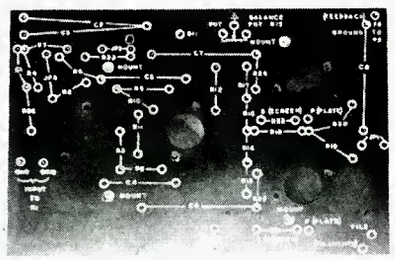
• Revox Tape Recorder. Virtually every feature expected in professional recording equipment is incorporated in the new Swiss-made Revox tape recorder. A three-motor machine, including a hysteresis motor for tape transport, the Revox incorporates separate record and playback heads as well as separate record and playback amplifiers, which permits monitoring from the tape while recording. A high-quality 8-in. monitoring speaker is built-in. Fre-



quency response at 7½ ips is 40–12,000 cps + 1, – 2 db, with roll-off to 15,000 cps less than 5 db. Operating speeds are 3¾ and 7½ ips. Wow and flutter are well within NARTB professional standards for studio machines at the higher speed. Fast forward and rewind permits complete transfer of a 2400-ft 10-inch plastic reel in 90 seconds. All functions are push-button controlled. Remarkably compact, the Revox measures only 18⅛" × 11 1/16" × 13⅜" in carrying case. Rack models are available for custom installation. Complete literature may be obtained free by writing Electronic Applications, 150 E. 35 St., New York City, N. Y. **J-5**

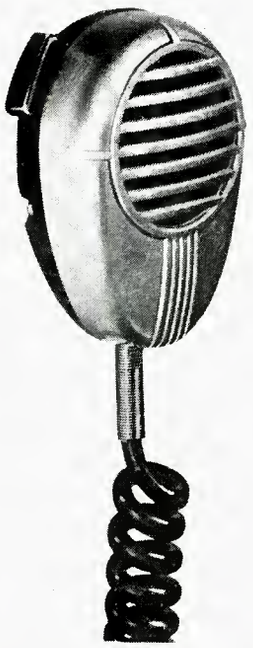
• Printed Circuit Boards. A new departure in audio craftsmanship is the line of Danco printed-circuit boards for the construction of hi-fi amplifiers and preamplifier-control units. Use of the boards reduces the construction of quality equipment to the insertion of correct components in the marked pre-drilled boards, adding the external connections, and soldering. Among types available are: Model 14, a basic amplifier which may be con-





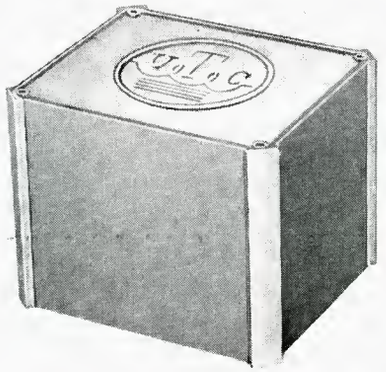
nected in either a Williamson- or ultra-linear-type circuit; Model 21, a preamplifier-equalizer stage which provides a voltage gain of 46 db; Model 31, a tone-control/input-selector stage with a Baxendall type circuit including separate bass and treble controls; Model 41, an amplifier with loudness control and a low-impedance cathode-follower output. Further information is available from Danco Mfg. Co., P. O. Box 533, Van Nuys, Calif. **J-6**

• Shure Transistorized Microphone. This new hand-held microphone for mobile communications equipment incorporates a built-in transistor amplifier. It is designed as a replacement-improvement unit for



older carbon microphones. Major advantages of the transistorized unit are greater speech intelligibility and longer life. The microphone is a magnetic cartridge with a transistor amplifier which is powered by the available supply normally used to power the original carbon microphone. No batteries, extra power supplies, or changes in circuitry are necessary. The unit is immune to temperatures up to 185° F. and to humidity up to 95 per cent. It is equipped with a 4-conductor cable, two conductors of which are connected to a push-to-talk type switch which is used for control of an external relay or switching circuit. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. **J-7**

• UTC Output Transformers. Two new high fidelity output transformers have been added to the Linear Standard series manufactured by The United Transformer Corporation, 150 Varick St., New York 13, N. Y. Type LS-35 has a 5000-ohm center-tapped primary with 43 per cent screen taps for use with EL-34 tubes in AB-feedback. Frequency response is virtually flat from 7 to 50,000 cps and output rating is 35 watts. Secondary impedances are 4, 8,



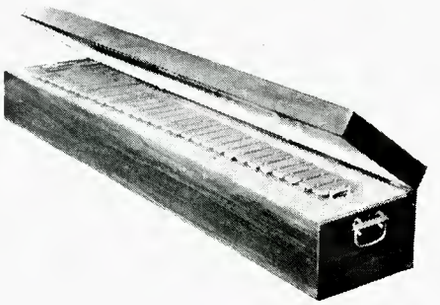
and 16 ohms. The LS-65 transformer is a similar unit with 60-watt rating, designed for use with Type 6550 tubes. Both transformers are furnished with a recommended circuit which provides maximum fidelity and stability. **J-8**

• Garrard Transcription Tone arm. Despite its modest price, this new Garrard phono accessory has been designed and built for long life and superior performance in high-quality music systems. Designated Type TPA/10, it is adjustable for length, tracking angle, stylus force and mounting height. The unit combines the features of static balance, spring loading, and viscous damping to achieve maximum vertical freedom. Spring-loaded cone-type



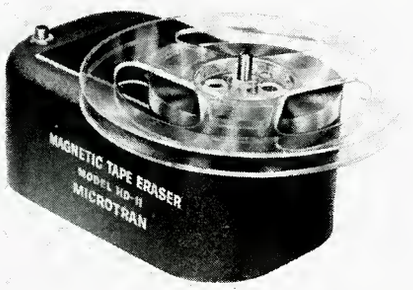
ball-bearing pivots, similar to those used in shock-proof chronometers, reduce traversing friction to an absolute minimum. The TPA/10 is strikingly handsome in design, finished in chrome and white enamel, and is made to perform with full professional quality when paired with any transcription turntable. For further information write Dept. K-28, Garrard Sales Corporation, Port Washington, N. Y. **J-9**

• Orchestra Bell Kit. Now available in a new compact form, this modern version of the famous Glockenspiel can be connected to any organ console, piano, or accordion. Tones are produced by metal solenoids striking 30 precision-ground bars. The



pitch ranges from G above middle C to the top of the standard organ keyboard. The orchestra bells can also be used for tuning organs, and are easily mounted in a hardwood box, speaker cabinet, or behind a tone opening. Kits are supplied with drawings and assembly instructions. Information is available from the manufacturer, Electronic Organ Arts, Inc., 4878 Eagle Rock Blvd., Los Angeles 41, Calif. **J-10**

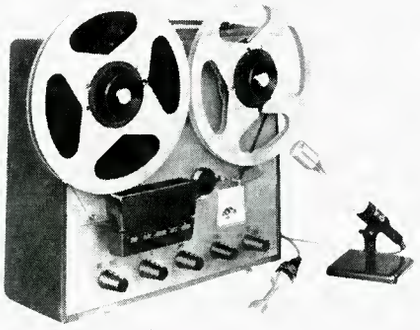
• Bulk Tape Eraser. Recorded signals are removed from magnetic tape to a degree considerably greater than that possible with most standard erase heads by the new Model HD-11 bulk tape eraser. Spin-



dle mounting of the reel to be erased permits rapid, thorough coverage. The device is useable with all standard tape reels from five to ten inches in diameter. It may also be used for demagnetizing record-playback heads, small tools and other metal objects. Supplied with baked enamel finish. Dimensions are 3" × 5" × 8" and weight is 8½ lbs. Manufactured by Microtran Company, Inc., 145 E. Mineola Ave., Valley Stream, N. Y. **J-11**

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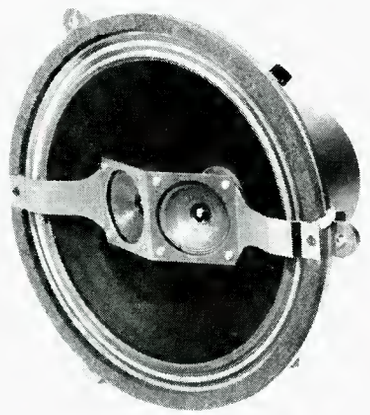
• **American Electronics Tape Recorder.** Four models, all designed on the principle of unit construction, make up the new line of basic tape recorders recently introduced by American Electronics, Inc., 655 W. Washington Blvd., Los Angeles 15, Calif. By the addition of accessories, any one model can be converted to any of the other



three in the series. Available for half track or stereophonic record and playback, the recorders are of lightweight die-cast construction and incorporate three motors, one for tape drive and two for take-up. With push-button operation and safety-erase interlock, the machines will accommodate reel sizes up to 10½ inches and are built to operate in either vertical or horizontal position. Speaker and amplifier units may be added to the basic recorder to provide a single-case record and playback machine. All models are designed for two-speed operation at 60 cps. **J-12**

• **High-Power P.A. Drivers.** Highest continuous-duty power-handling capacity in the history of University public-address speakers is announced for two new drivers which will handle 50 to 100 watts input. Model PA-HF utilizes a watertight die-cast aluminum housing for lifetime resistance to physical abuse. Frequency response is 70 to 10,000 cps. Model PA-50 employs the same internal mechanism as the PA-HF, but includes a heavy-duty multi-impedance line matching transformer built into the housing. Input terminals are marked directly in impedances of 100/165/250/500/1000/2000 ohms, and in 70-volt power taps of 50/30/20/10/5/2.5 watts for use in constant-voltage systems. Of special interest is the double rating method used by University in dealing with power capacity. Both drivers are described as having a continuous-duty "full-range" capacity of 50 watts, and a continuous-duty "adjusted-range" capacity of 100 watts. Complete details are available from University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y. **J-13**

• **Wigo Coaxial High Quality Speaker.** Frequency response of 25 to 17,000 cps and free air cone resonance of 35 cps are among the features of this new speaker manufactured in Western Germany and re-



cently introduced in the United States. The dual-tweeter system affords 120 deg. dispersion. Constructional features include a heavy cast-aluminum frame, cloth cone suspension, and Fibreglass voice-coil form. Imported and distributed by United Audio Products, 202 E. 19th St., New York 3, N. Y. **J-14**

DO YOU HEAR A DIFFERENCE IN LOUDSPEAKERS?

IF SO, AT LEAST ONE OF THEM MUST BE DISTORTING

The different characteristics of loudspeakers are due to different kinds and amounts of distortion. The most desirable loudspeaker would be one which had absolutely no distinctive character about it. The only way to achieve such a loudspeaker is to reduce all forms of distortion to a minimum.

One form of distortion is harmonic distortion. This occurs primarily at low frequencies, where the cone must make large excursions. Harmonic distortion is caused by non-linearity in the restoring force of the mechanical suspension during these large excursions.

Another form of distortion occurs when certain of the lower frequencies are exaggerated or when the whole bass spectrum is either depressed or accentuated. Distortion of this type appears when an improper choice is made of the acoustical, electrical and mechanical parameters with the result that the combined system of loudspeaker, enclosure and amplifier output stage does not have equal efficiency at all frequencies.

A third form of distortion results from frequency irregularity in the mid-range. This is usually caused by erratic vibrations of the cone or by improper matching of the frequency response characteristics of two or more loudspeakers designed to cover different ranges.

Despite the strong tendency for these forms of distortion to occur, KLH was convinced that a sufficient concentration of talent, experience and equipment, used in a properly oriented program, could devise a way to consistently produce loudspeakers in which not just one but all of these forms of distortion are reduced substantially below the level heretofore found in the best available loudspeakers. The successful completion of such a program has resulted in the production of KLH Models One, Two, and Three, speaker systems designed to cover low- and mid-range frequencies.

Low harmonic distortion is achieved by making use of the acoustic suspension principle in which the inherently non-linear mechanical restoring force is largely replaced by the inherently linear restoring force of the enclosed air in a small sealed cabinet.

Smooth extended response at low frequencies is achieved by using a direct radiator in a completely closed cabinet and properly choosing the volume of the enclosure, the mass and area of the cone, and the design of the voice coil and magnetic circuit so that the efficiency of the system remains constant down to the lowest frequencies desired without the system suffering from the common fault of being either underdamped or overdamped.

Frequency irregularity in the mid-range due to erratic vibrations of the cone has been sharply reduced by use of special paper cones of our manufacture whose design was based upon the results of an exhaustive investigation of cone structure and composition carried out in our laboratory.

Prices from $159.00 to $378.00. Literature available upon request.

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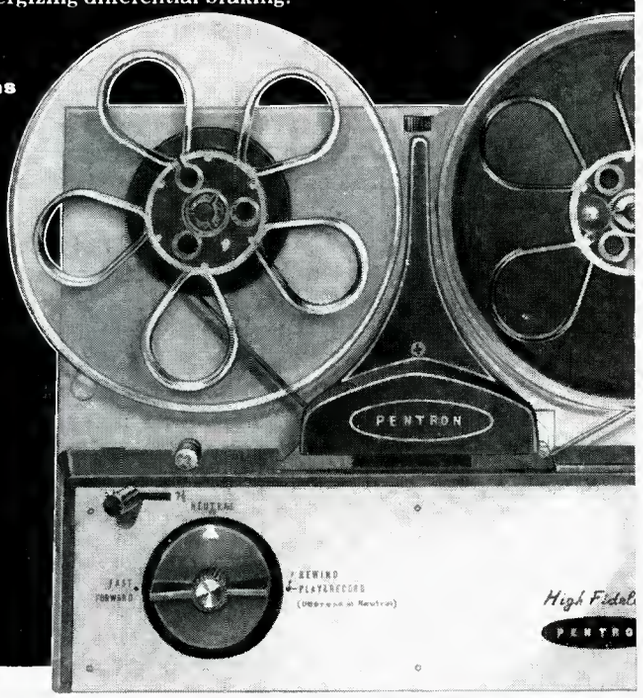
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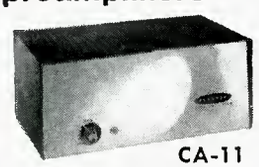
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Removable pole pieces in heads, as easy to change as a phono needle.
Automatic self-energizing differential braking.

basic specifications
TM series
mechanisms

COMBINATION HEAD: Frequency response: 40-14,000 cps with proper equalization. Signal-to-Noise: 55 db with CA units; track width: .093"; gap width: ¼ mil; impedance of record section: 6000 ohms; inductance of erase section: 60 mh • **STACKED HEAD:** track width: .080"; gap width: .15 mil; impedance: 3500 ohms • **FLUTTER:** under 0.4% at 7½ ips; under 1% at 3¾ ips. • **CAPSTAN DRIVE:** Idler driven • **MOTOR:** 4 pole induction type, individually balanced • **OUTPUTS:** 4 standard pin jack outputs to accept shielded phono plug • **CONVENIENCE OUTLETS:** two auxiliary AC outlets controlled by mechanism power switch. Supplied with removable mounting brackets with shock mounts.



preamplifiers



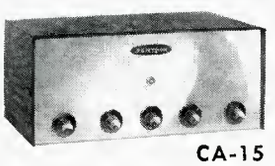
CA-11

Tape Playback only. Response: 20-20,000 cps. Signal-to-Noise: 55 db



CA-13

Tape playback preamp and record amplifier. Response: 20-20,000 cps. Signal-to-Noise: 55 db



CA-15

Stereo dual channel playback. Response: 20-20,000 cps. Signal-to-Noise: 60 db

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AMPLIFIER

(*from page 21*)

the midrange and high frequencies have been attenuated to a low value and must again be amplified by a fourth stage in order to meet the design specification of one volt output for normal tape level. This stage is also a common-emitter type with emitter-circuit feedback to allow the relatively large output signal to be obtained with satisfactorily low distortion. It differs from the previous stage in that it works into the high impedance of the first grid of a following amplifier. This allows considerably higher gain in spite of the feedback and calls for a different operating point along with a much higher value of R_{14}. Secondly, the emitter resistance R_{15} is partially bypassed by C_8. Each stage from the second on suffered from a slight high-frequency attenuation due to a low value of beta cutoff. This attenuation accumulated to about 3 db loss at 15,000 cps and the .03 μf capacitor controls the degeneration due to R_{15} sufficiently to bring the response up to flat at the high end.

Construction

The construction is clearly shown in *Fig.* 4. The unit pictured contains two identical channels. The gain control R_8 is a two-gang potentiometer common to both channels and an additional miniature potentiometer has been included in each channel so that small differences in gain or differences in output of the two heads can be compensated for. On-off switches have been provided for each channel so that battery life can be conserved when operating from a single track. The miniature U 10 battery is

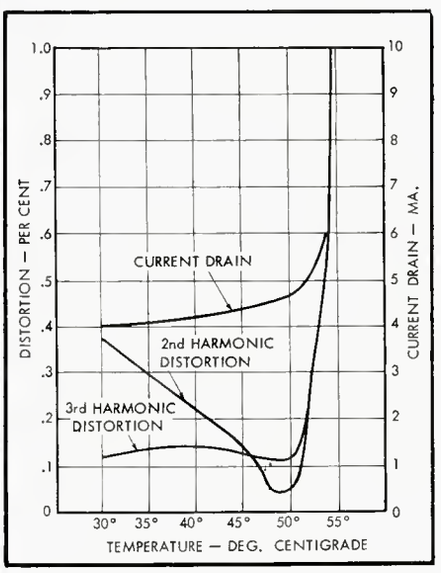


Fig. 5. Curves of distortion and current drain vs. temperature for a 0-level 400-cps signal.

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mounted in an external clip for easy replacement. Probably a more satisfactory voltage source would be a pair of $7\frac{1}{2}$ volt "C" batteries, Burgess type 5540, since each channel draws about 5 ma.

The author found it very convenient to use Alden perforated terminal boards and the appropriate lugs that can be riveted at any point, but any form of terminal board on which to mount the components should be satisfactory. As far as could be determined from experience with a breadboard prototype and the two pictured amplifiers there is nothing critical about placement of components or lead dress.

The transistors, RCA type 2N105, come with long flexible leads and it is convenient to clip them to the desired length and solder directly onto the mounting lugs. This eliminates the bothersome task of mounting the sockets and the questionable contact between the socket and the small leads. Transistors, unlike vacuum tubes, have long life and barring a catastrophe should last for an indefinitely long time. Of course, because of their nature, it is necessary to observe some simple precautions in soldering them into the circuit. If the short lead is grasped between the fingers and quickly soldered with a hot iron to a well tinned lug, the operation can be completed before any warmth can be felt on the fingers. Under these conditions there is no danger of heating the junction inside the small case to a temperature that will destroy it. While on the subject of temperature it is well to observe that the manufacturer places the rating of 50° C. (122° F.) as the maximum operating temperature for the 2N105 transistors. This will require some care when placing the amplifier near heat generating electronic components in an enclosed space. In the pres-

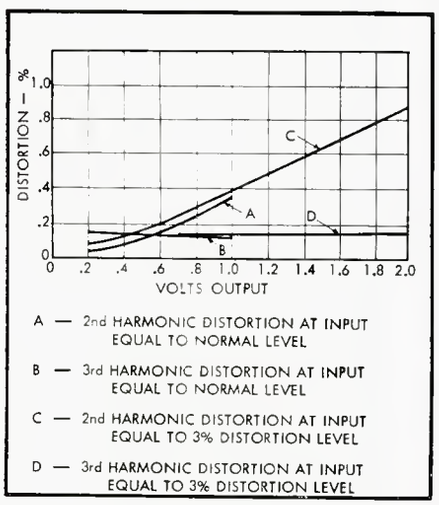


Fig. 6. Curves showing output voltage vs. distortion. (A) and (B) show 2nd and 3rd harmonic distortion respectively at input equal to normal level. (C) and (D) show the same distortions at an input of a level suitable to provide output at 3-percent distortion.

PILOT

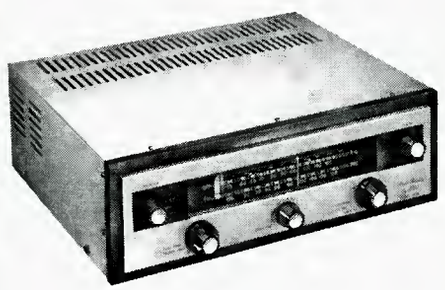
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HF-42

Includes **FM-AM Tuner** with tuned RF stage and dual cascade limiter-discriminator FM circuit for maximum sensitivity — perfect quieting even with fringe signals; precise BEACON tuning indicator; AFC with disabling switch; 10 KC filter for AM; built-in FM and AM antennas, flywheel tuning.

Preamp-Audio Control with hum-free DC on tube heaters; tape head and phono inputs with separate equalization; bass and treble controls; loudness-contour and volume controls; tape recorder output.

Power Amplifier with less than 1% distortion at 20 watts rated output (40 watts peak); frequency response: 20 to 20,000 cycles, ±1db; built in rumble filter. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 13¾"w x 12¼"d.

$209.50 Complete

HF-30

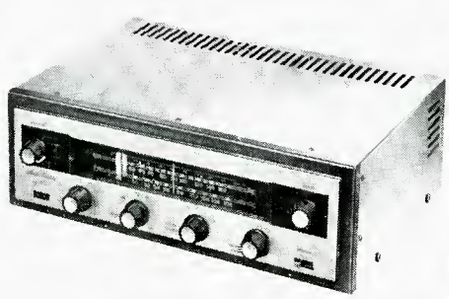
Includes **FM-AM Tuner** with tuned RF stage for high sensitivity — perfect quieting even with fringe signals; precise BEACON tuning indicator; AFC with disabling switch; 10 KC filter for AM; built-in FM and AM antennas; flywheel tuning.

Preamp-Audio Control with phono and auxiliary inputs; bass and treble controls, loudness-contour and volume controls, tape recorder output.

Power Amplifier with less than 1% distortion at 12 watts rated output (24 watts peak); and frequency response: 20 to 20,000 cycles, ±1db; selector switch for independent or simultaneous operation of two speaker systems. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¼"h x 14¼"w x 10¼"d.

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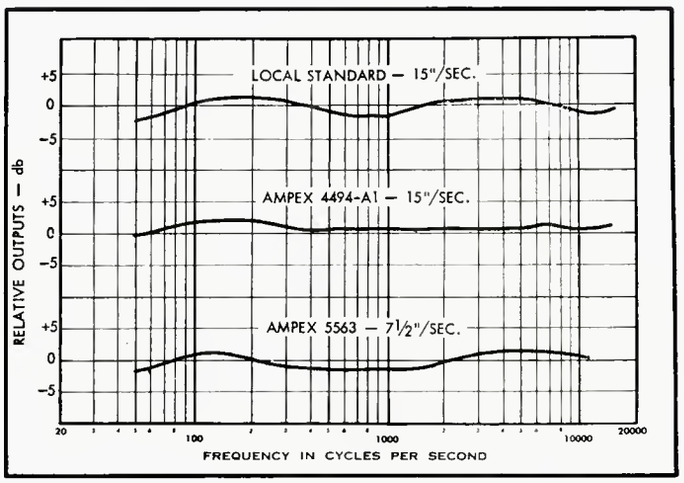


Fig. 7. Output vs. frequency response as measured from two Ampex standard tapes and one "local standard."

ent example it seemed satisfactory to mount the amplifier on the back side of the tape deck in a well ventilated place away from tubes and transformer.

Performance

At the inception of this project the author had considerable misgivings as to the wisdom of using transistors in playback amplifier service. As the work progressed the fears gradually disappeared but an unusually large amount of testing was done. Since it is feared that some of the readers will have similar doubts the performance and results will be reported in considerable detail.

Perhaps the first requirement of such an amplifier is that it must play back a pre-equalized standard tape in a flat manner. This amplifier was intended to be used with a machine operating at 7½ ips but an adequate design should perform well at 15 ips with little or no equalization adjustment. Three pre-equalized standard tapes were available and all were used. They consisted of an Ampex number 5563 at 7½ ips, an Ampex number 4494-A1 at 15 ips, and a very carefully prepared local standard at 15 ips. *Figure* 7 shows output *vs.* frequency from these three tapes as measured on a Hewlett Packard 400C voltmeter. Curve A is the result of adjusting the equalization for the best compromise with the local tape. Curve B was taken from the Ampex 15-ips tape without additional adjustment. Curve C was taken from the 7½-ips tape after slight readjustment. Without readjustment the results at 7½ ips would have been satisfactory. It can be seen that all tapes play back to ±2 db which is flat enough for the best professional recorders.

With the amplifier properly equalized, noise measurements were made. Since it was the amplifier that was under test and not the over-all system, the head was replaced with a 300-ohm resistor to represent the resistive com-

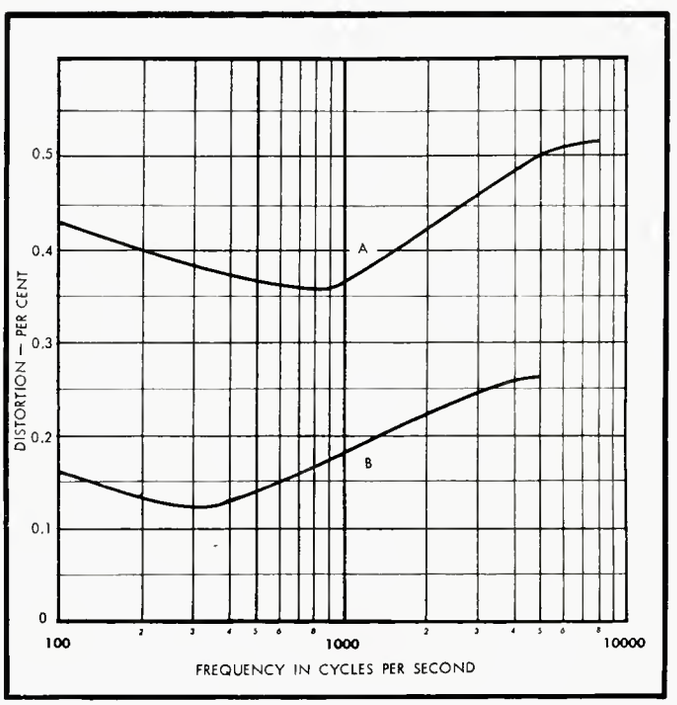


Fig. 8. Curves of distortion vs. frequency. (A) shows 2nd harmonic distortion; (B) 3rd.

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ponent of the head impedance. The noise was measured on a Hewlett-Packard voltmeter and compared to the output due to a signal equal to the 3 per cent tape distortion level. The noise was found to be 52 db below such a signal. This in itself is good but an examination of the frequency content of the noise revealed it to contain a large component of very low frequency. This is a well known characteristic of transistors and since even the best speakers could not reproduce such frequencies it was decided to define an equivalent noise ratio. The low-frequency component was eliminated by means of a sharp-cutoff high-pass filter set at 40 cps. Within the meaning of this definition the 3 per cent distortion signal-to-noise ratio was 59 db which makes it comparable to the best professional units.

Transistors without adequate bias stabilization are known to exhibit objectionable temperature characteristics. As the temperature rises the operating point shifts and distortion may increase without bound or in extreme cases the amplifier may cease to amplify at all. Careful temperature tests were made over the range from room temperature to 54 deg. C. and the results are presented in *Fig.* 5. A 0-level 400-cps signal was fed into the amplifier and the second and third harmonic distortion measured as the temperature was slowly raised. Current drain was observed to increase from four to five milliamperes while the amplification remained constant to within ±0.25 db. Within the manufacturer's operating limit of 50° C. the observed distortion remained low.

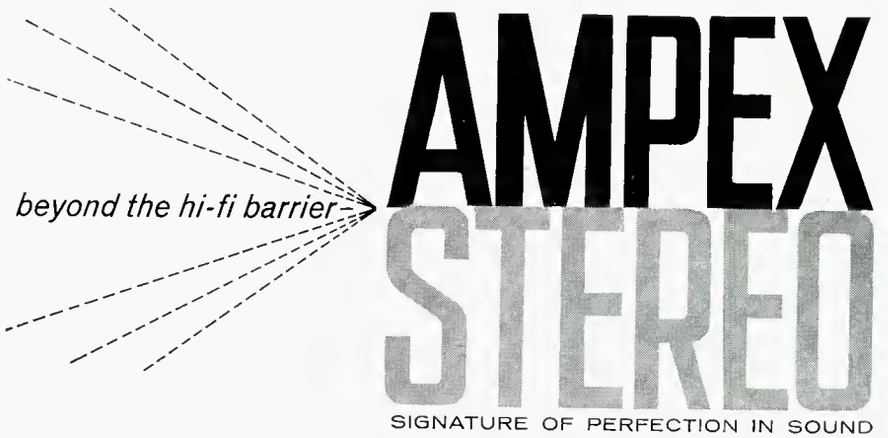
Distortion *vs.* output level is of great interest to Hi-Fi enthusiasts and the results of such measurements are given in *Fig.* 6. Curves (A) and (B) give the second and third harmonic distortions respectively for a 400-cps 0-level signal with the gain of the amplifier varied to give outputs up to one volt. Curves (C) and (D) show the same for a 3 per cent tape distortion signal. *Figure* 8 shows the second and third harmonic distortion as a function of frequency. Since modern final amplifiers will give listening level output with much less than one volt input, it is safe to say that the harmonic distortion of the subject amplifier will always be much less than 0.4 per cent at all frequencies. Thus the distortion compares favorably with the best professional amplifiers.

The final specification has to do with the output impedance and the ability to drive a length of cable without appreciable loss of high frequencies. The measured value of output impedance turned out to be 900 ohms which is within the range of average cathode followers. To discover how much cable capacitance could be tolerated a capacitance decade box was shunted across the output and the capacitance adjusted to give a 3-db attenuation at 15,000 cps. A total capacitance of 1000 μμf was required. This would represent at least ten feet of the highest-capacitance shielded cable.

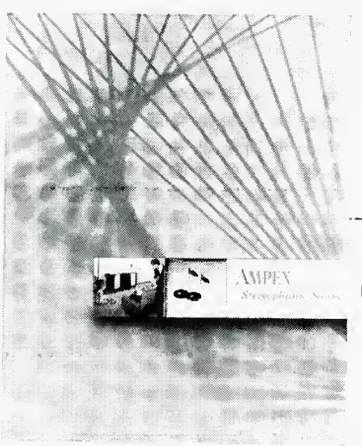
The final test can be reported only in subjective terms. About all the good quality program material available to the author has been auditioned before many people. In all cases the amplifier received enthusiastic acclaim.

Conclusion

It has been repeatedly mentioned that the goal was to equal the performance of the best vacuum tube playback amplifiers The section on performance has demonstrated that this goal has been attained. The question remains then, what are the advantages of this amplifier? No such claims are made. It simply offers freedom of design, a new way of obtaining the highest performance. In some applications the use of transistors would be indicated while in others the opposite would be true. The one case that comes readily to mind is that of a playback-only unit. The compact size and the freedom from 60-cps hum problems make a transistor playback amplifier especially attractive.



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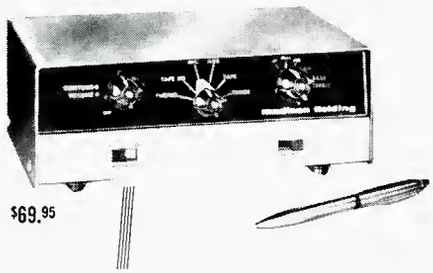
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REMOTE AMPLIFIER MIXER

(*From page 48*)

ladder networks. We could not find 2000-ohm log-taper rear or front sections so we settled for a 10,000-ohm audio log-taper front section and a 2000-ohm linear rear section. A 1000-ohm resistor was used to increase isolation between the two input channels (R_{12} and R_{13}). This means that the minimum input impedance of the driven stage could be about 1500 ohms. All controls are isolated by capacitors to remove d.c. and to ensure quiet operation.

Miniature transformers were used with some loss of low-frequency response, but this was not objectionable because we achieved a response within ±1 db from 50 to 15,000 cps. The major portion of our low-frequency loss was corrected by isolating the d.c. from the primary of the driver transformer, an Argonne 109, with R_{26} and C_{14}. Larger capacitors were used than were necessary in many parts of the circuit, but with small output and driver transformers we wanted to eliminate any low-frequency losses wherever possible.

As seen in *Fig.* 4, six switches are used to accomplish our needs: S_1 for either of two mike inputs on channel 2, which will be normally used for either the crowd mike or the announcer doing color. S_2 selects either program audio or oscillator tone, and at the same time switches operating voltage to the oscillator. S_3 is the meter switch, choosing between OFF, +8 VU, +4 VU, P_1 or normal operating battery voltage, and P or maximum operating circuit voltage (either P_1, P_2, or external source). S_4 is the power selector switch which chooses between: externally supplied voltage, P_1 (normal internal supply), P_2 (emergency internal supply) and OFF. S_5 merely throws a 10-db pad into the output line of the amplifier. Switches S_3, S_4, and S_5 are screwdriver operated, and are mounted on one side of the case. There is a battery interlock switch on the headphone jack to shut off all voltages when the phones are removed. In case operation is required without headphones, a dummy plug clipped inside the lid of the amplifier may be inserted into the jack.

Another interesting feature is the method of balancing the push-pull output stage with R_{30}. Adjustment f R_{30} while checking distortion at a low frequency (we used 100 cps), eliminated selecting 2N44's from stock (we had five on hand for this reason). One pair of transistors had a distortion of 11 per cent, which was reduced to 0.48 per cent at 1000 cps and 11 per cent to 1.6 per cent at 100 cps. This adjustment will be necessary only when output transistors are changed, which we hope will not be often.

The oscillator was built by a cut-and-try process, using parts we had on hand, but undoubtedly smaller components will work as well. Several transistors were tried and worked—CK722, 2N106, 2N64, and 2N44—but the 2N44 gives an increased output, and furthermore serves as a spare for the final push-pull stage. It oscillates at 750 cps with distortion about 7 per cent. The oscillator will be used only for checking line continuity from remote locations to the studio, and not for broadcast, so the distortion is not important.

The amplifier is powered by use of two 22½-volt batteries (Burgess U-15 or RCA VSO84), one for normal operation and the second as an emergency spare. They may be paralleled if desired, but with a load of 18 ma total, the power consumption amounts to a little more than 0.4 watts. We have operated a football remote which lasted about four and a half hours on one battery without noticeable drop in output or quality, and the battery voltage dropped

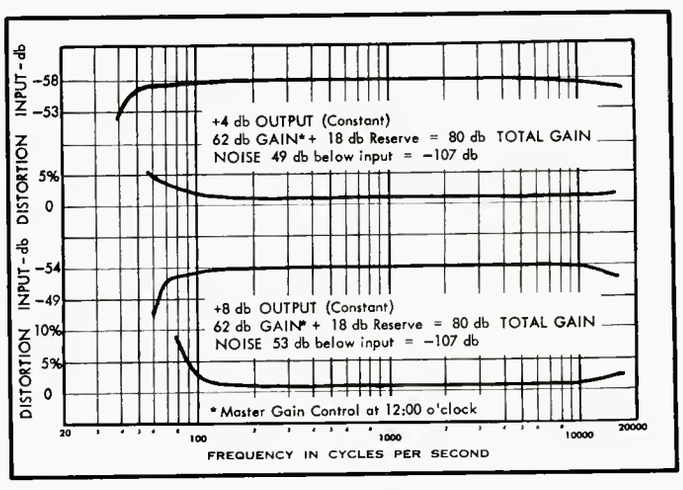


Fig. 5. Performance curves of the amplifier.

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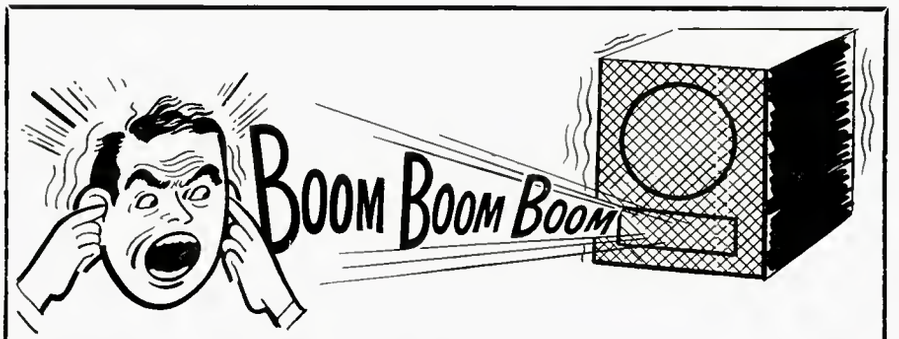
to 15 volts. During construction I paralleled the two halves of an Eveready #455 (45 volts) to get 22.5 volts. This is what we are now using for an external supply.

Final results have been very satisfying, with an over-all gain of 80 db into a 600-ohm load, the noise level measured 53 db below an input of −54 db, or 107 db below a 0 VU reference. As shown in the curves of *Fig. 5*, distortion and response is much better than a class AA telephone line, and distortion over the portion that is most important is less than 1 per cent. The weight of the entire unit is less than five pounds, including the lid. In fact we are sold on these results to the extent that we have several more projects under way.

I wish to acknowledge my indebtedness to the Collins Radio Company, Keith Ketcham, Mel' Haas and Merv Gardner for their valuable background and suggestions.

PARTS LIST

$C_1, C_2, C_5, C_6, C_7, C_{12}, C_{16}$	
C_{17}, C_{18}	100 μf, 12-v. electrolytic
C_3, C_4, C_8, C_{13}	250 μf, 6-v. electrolytic
C_9, C_{11}, C_{15}	50 μf, 25-v. electrolytic
C_{10}, C_{14}	200 μf, 12-v. electrolytic
C_{19}, C_{21}	.005 μf, 200-v. paper
C_{20}	.05 μf, 200-v. paper
P_1, P_2, P_3	dual potentiometers, front section 10,000-ohm log taper; rear section 2000-ohm linear
R_1, R_2, R_3, R_{31}	0.1 meg.
R_4, R_5, R_{12},	
R_{13}, R_{25}	1000 ohms
R_6, R_8	100 ohms
R_7, R_9, R_{16}, R_{17}, R_{38}, R_{42}	6800 ohms
R_{10}	3300 ohms
R_{11}	3600 ohms
R_{14}, R_{18}, R_{22}, R_{40}, R_{41}, R_{44}	10,000 ohms
R_{15}, R_{19}, R_{28}	47 ohms
R_{20}	17,000 ohms
R_{21}	33,000 ohms
R_{23}	4700 ohms
R_{24}	150 ohms
R_{26}	20,000 ohms
R_{27}, R_{29}	39,000 ohms
R_{30}	50-ohm potentiometer, linear
R_{32}, R_{37}, R_{37A}	0.15 meg.
R_{33}, R_{34}	2200 ohms
R_{35}	2800 ohms
R_{36}	120 ohms
R_{39}	15,000 ohms
R_{43}	16,000 ohms
R_{45}	1.0 meg.
S_1	SPDT, Input #2 microphone selector
S_2	DPDT, Program or tone selector
S_3	5-position switch, meter selector
S_4	3-position switch, power selector
S_5	4-pole, 2-position switch, 10-db pad switch
T_1	Driver transformer: 10,000/2000 c.t. Argonne AR-109
T_2	Output transformer: 20,000 c.t./50,250,600; (600-ohm winding used) T-23
T_3	Oscillator transformer; 10,000–25,000/200–500, UTC SO-3
V_1, V_2, V_3	2N106
V_4, V_5	2N64
V_6, V_7, V_8	2N44



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Most people know by this time that many, if not most, loudspeaker enclosures . . . regardless of size or price . . . boom. Boom is that dull, heavy, toneless thud often heard at low frequencies. Boom is also called "one-note bass" or "juke box bass." It is an inherent characteristic of so-called "resonant" enclosures. Boom is nothing but distortion, and any speaker system that booms is not high fidelity.

Notwithstanding this, and believe it or not, there are still people who will spend hundreds, and even thousands, of dollars for prime amplifiers, tuners, etc., and then go out and buy a boom-box. Why?

A noted psychiatrist undertook to find the answer. He found that (1) some people mistake mere loudness (so-called "augmented" bass) for true bass; (2) others are unable to tell the difference between true bass and boom; (3) some think boom *is* bass; (4) others think boom is bass because it comes from large and/or expensive enclosures; (5) others have a fixation for expiring myths, such as, "the bigger the box the better the sound"; (6) some innately resist progress and never seem able to adjust themselves to better things as they come along; (7) others are impressed by expensive advertising and high-pressure sales promotion.

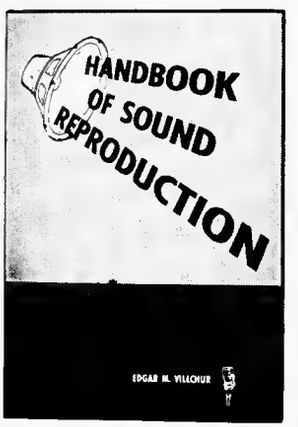
And so it goes, even though, actually, no one ever heard boom from a live orchestra. And since a live orchestra is not a boom-box, why should anyone want a boom-box in his home? Fortunately, no one has to buy a boom-box.

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THIRD DIMENSION IN SOUND

(*from page 23*)

could use any kind of program material, would not require special tape or records and could be used any time.

Recording studios have special rooms known as "echo chambers" which are used to supply the missing reverberation to music recorded in acoustically "dead" studios. The "direct" sound is played into the echo chamber through a loudspeaker system, and the reverberated sound is picked up with a microphone. Methods using magnetic tape are also used. The sound is recorded by a recording head and picked up on a playback head. The amount of delay depends on the spacing between these two heads and the speed that the tape travels. In both of these methods the direct sound and the reverberated sound are mixed together electronically by the recording engineers and then placed on the record. Neither of the methods for producing reverberation at recording studios is practical for home use. One method requires a large empty room, and for the other method expensive recording equipment is necessary.

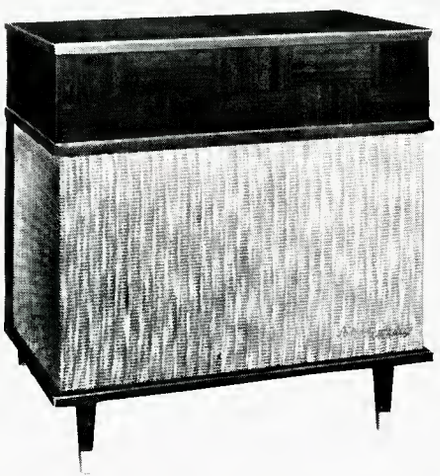


Fig. 4. 360-deg. sound radiation and the Xophonic principle combined in one cabinet.

A commercial device has been developed specifically for the production of reverberation in the home which works on a different principle. This device is the "Xophonic," which was invented by the engineering staff of the Radio Craftsmen Company of Los Angeles (see *Fig.* 2). This device uses a 50-foot hollow tube to provide the delay between the direct and reverberated sound. An acoustic driver is placed at one end of the tube and a microphone at the other (see *Fig.* 3). Since sound travels at about 1120 feet per second, it requires approximately 1/20th of a second for the sound transmitted into one end of the tube to reach the other end. After the sound is delayed, it is amplified and reproduced by an auxiliary loudspeaker, creating realistic concert-hall reverberation in a small room. This unique device is packaged in a rather small box or cabinet, and closely resembles a small loudspeaker cabinet.

For some time, the Xophonic has been available for addition to existing or proposed audio systems. While the Xophonic adds a thrilling third-dimensional quality to any home music system, it does involve the use of an additional piece of equipment. This has advantages for the music lover who wants to improve his present system. However, more and more, the trend is toward containing all the Hi-Fi equipment in one enclosure rather than to use several pieces of separate equipment. Recognizing this need, the scientific staff of the Radio Craftsman Company developed a single well-styled console model, *Fig.* 4, containing not only a 360° sound system, but also with built-in Xophonic third-dimensional sound.

The Audio art has made great strides in recent years, and with modern equipment the listener can now truly enjoy the "Third Dimension in Sound." Æ

AUDITORIUM ACOUSTICS

(*from page 24*)

Since the room coloring is due to reflections, the pick-up microphones must therefore be placed near the orchestra if the reverberation effects of the pick-up hall are to be minimized. The position of the microphones with respect to the orchestra, as arranged for the New York demonstrations of January, 1934, are shown in *Fig.* 1. The perspective effect, obtained from the use of three channels, also requires that the microphones be placed near the orchestra. This close placement of the pick-up microphones, however, is contrary to usual practice for single-channel reproduction. Here it is better to have the microphone at a greater distance from the orchestra, where more of the reverberation effects will be picked up.

When the microphones are placed close to the orchestra the effects of the acoustic characteristics of the pick-up hall are largely eliminated. The effects of the hall where the music is reproduced, however, have to be carefully studied and preserved. Studies were made in

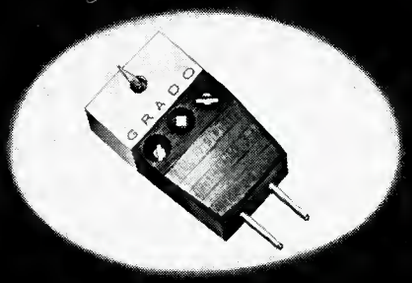
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which a heterodyne oscillator, connected to the loudspeakers through the amplifiers, produced tones of varying frequency which were picked up by a portable microphone connected to an automatic level recorder. The frequency was varied through the range from 35 to 15,000 cycles per second, and continuous curves of microphone response as a function of frequency were obtained for a number of positions in the auditorium. The loudspeakers were placed so that each covered the entire auditorium as nearly as possible, and the curves from the automatic level recorder gave a check on these coverages. They also furnished data for the design of equalizing networks which were associated with the amplifying equipment.

In general the audience will not hear the same quality of sound that is given out by the loudspeakers. This is partly due to the effects of reverberation and partly to the fact that the higher frequencies are absorbed more rapidly by the air than are the lower frequencies. The equalizers are designed, therefore, so that the best over-all characteristics of the sound will, be heard at an average listener position. Correct equalization is thus different for every hall. Since the greater part of the audience in Constitution Hall was well back from the stage, equalization was based on microphone readings taken at some distance from the loudspeakers.

Besides these various provisions to insure the best quality of music and the truest illusion of the actual presence of the orchestra, tests had indicated that it was possible to produce an aesthetic effect more pleasing than that of the orchestra itself. This was accomplished by control features manipulated by a director seated in the audience. This control position, as arranged for the New York demonstrations, is shown in the photograph at the head of this article. One of the controls was a volume adjustment which permitted the output of the orchestra to be modified as the director deemed necessary, and allowed a larger range of volume from the loudspeakers than was possible from the orchestra. When the orchestra was playing alone the volume of the three channels was controlled from a single dial. When a soloist was accompanying the orchestra, however, the center channel, connected to a different microphone, was used exclusively by the soloist and was controlled separately. This additional microphone, which cou'd be switched in place of the regular microphone for the center channel, was shielded by a directional baffle so that it responded to energy received from only a rather small solid angle. In this way the voice—even during the loudest passages of music—could be kept slightly above the level of the orchestra.

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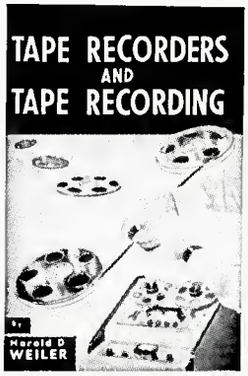
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In addition to this volume control, a set of quality control networks were provided, which could be switched into or out of the circuit by the keys in the lower right hand cabinet at the control position. These networks increased or decreased the higher- or lower-frequency components as shown by the curves of *Fig.* 2. Similar networks were provided for all three channels. When under the control of the director, the employment of these networks may add appreciably to the aesthetic effect which the music produces on the listener.

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TONE CONTROL

(*from page 32*)

one in which the flat position is obtainable over an appreciable range of the rotation to allow accurate setting of this important reference condition, and in which the turnover frequency varies exponentially with rotation. This would give equal db increments of boost or attenuation for equal increments of arc.

We may, then, set forth the requirements for the bass and treble potentiometers for ideal smoothness of operation. The desired curves of resistance *vs.* rotation for the bass and treble controls is shown in *Fig.* 9. It should be noted that rather wide deviations from this curve are permissible with very little degradation in smoothness. The linear taper used in *Fig.* 2 for the bass control, for example, deviates quite widely from the desired characteristic, resulting in a wider flat position and some crowding of the tone control action toward the extreme ends of rotation of the potentiometer. The smoothness of action of this control, however, compares favorably with dual tone controls of most commercially available equipment.

The remaining circuits required for a complete control amplifier will appear in part two of this article, along with noise and distortion measurements and an analysis of the first stage of the circuit of *Fig.* 2. —E

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AUDIO ETC

(*From page 71*)

followed up the new idea, into another new area.

Next, you see, the new principle of small speakers at *higher* prices, implying competition with a whole range of relatively de luxe larger equipment, is now about to spread into a major trend. University has taken it up. Others no doubt will too. In a way, commercial speaker-system history is going to repeat itself in this new area. For, just as the RJ itself was not (except for one instance that I know of) literally imitated or even licensed under another trade name, so, too, the AR system itself has not been exactly duplicated. Instead, it is the size principle that has been taken over, thanks to the AR success. That's what happened to the RJ size-idea, too.

With that background, you can almost anticipate the logical developments at University to meet the new need. First, a line of high-compliance speaker mechanisms of low resonance, maximum "piston" travel of the cone, with small enclosures particularly in mind. Second, a line of complete small systems based on the new woofers. (High end via multiple systems, two-way and three-way.)

The University High Compliance Woofers are models C-12HC and C-15HC, featuring in the two sizes a new magnet material and what I gather is a cloth surround, though the pictures don't look that way. (My speakers were sealed into their boxes and I didn't look at them.) Very low resonance—15 and 18 cps—and in the larger model (which has a 15-in. woofer) a double spider system to help with extreme excursions. You can use them in your own home-made small box, and they tell you its exact inside volume, plus the size of a matching duct.

The two complete systems, of course, provide this very duct, one of the Helmholtz relatives of the bass reflex port. It's in the rear and in my prototypes covered with wire net to keep out the mice and crickets. In operation, it'll neatly blow out a candle when the low notes are played. The "bigger" system, the Ultra-Linear 15, is about twice the size of the AR systems but still reasonably small—for a 15-inch speaker. Three-way, with horn tweeter, the upper stuff from existing University equipment already in use elsewhere, and with high- and mid-range level adjustments. The smaller box, very slightly bigger than the AR models, is two-way with horn tweeter. Usual assortment of woods at varying prices, ranging respectively around $250 and $145. That neatly straddles the AR prices and does so, I suspect, on purpose—to smooth out the sales "peaks," fill in the gaps, rather than heading straight into AR territory model for model.

Sound? Loudspeaker sound is still very much a matter of taste and speaker systems, hi-fi or no, are still designed to meet varying taste requirements. These new systems are also predictable in sound, as the newest in a familiar family. The low end, of course, is the significant new development, coming from a new speaker and

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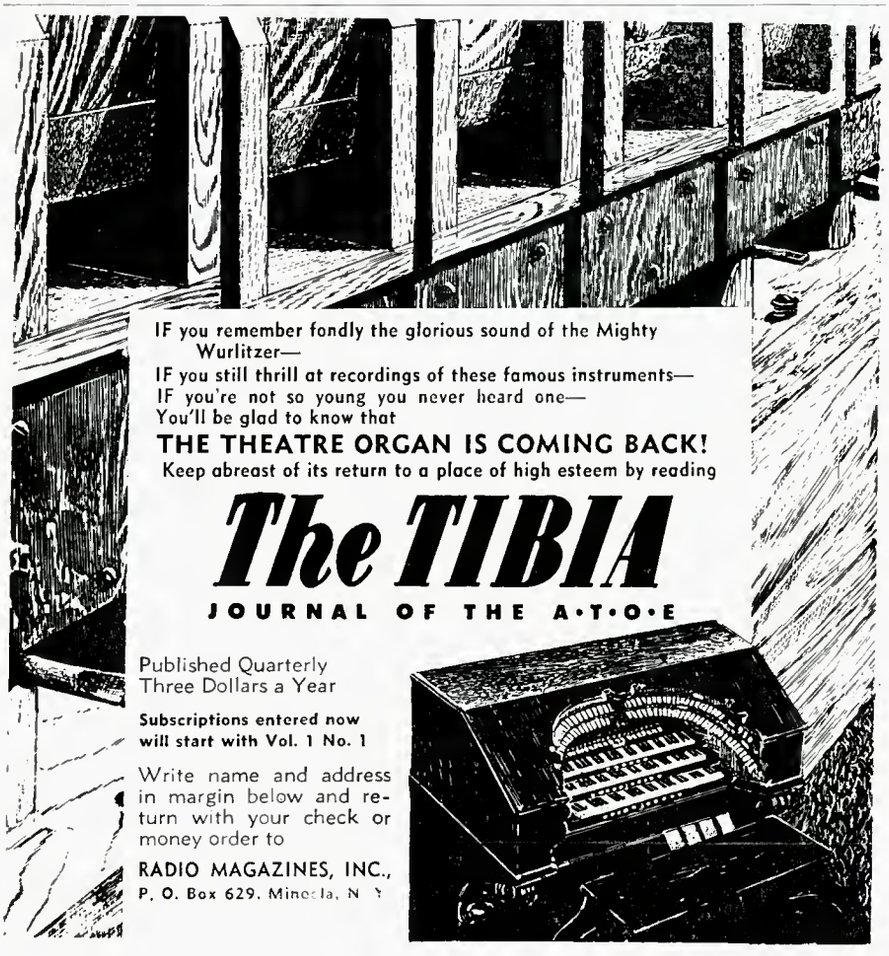
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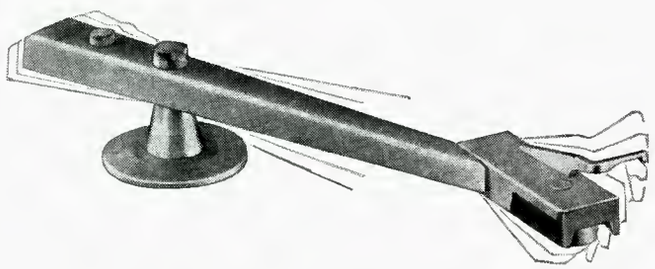
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a new enclosure; the high end is determined entirely by the use of the already familiar University horn tweeters and mid-range equipment.

As I've said before, I'm not a horn tweeter man. I prefer the less brilliant, more comfortable (to me) sound of a good cone system. Large numbers of people, however, like a brilliant hi-fi sound and that's what they'll get from these two speaker systems in the particular concatenation here used. The big system is the more brilliant, its brightness centered fairly high up. The smaller system has another balance—not, I'd say, because it is less expensive but simply to provide a different sound. It uses a different model of tweeter.

One mild innovation and a good one, that occurs in both University models, is an optional inside set-up for horizontal or upright use; you can have your choice. AR-2, for instance, is intended only for horizontal use on the floor or on a table or shelf. I'm obstinate; I use it standing on its small end because it's convenient to do so! The placing of the tweeters is important in this, since they shouldn't be down at shoe-level.

While I'm at it, I suggest, and suggest strongly, that many small-enclosure systems could be offered in alternative models finished on all sides—the back as well as the sides and the speaker front. I find that in practical use the very best way to put small boxes to work is to stand them out in the room, away from the wall. They make fine small tables, coffee-caddies, magazine rests, next to armchairs. But there is always one ugly, unfinished side showing, with connection boards, name plates, wires, etc.

Sure, it costs more. That's why I say these models should be alternative—at a higher price. Some people want them that way, others don't. Personally, I highly recommend a small-speaker set-up that has the box out in the room, aiming towards the best reflection-area, a fireplace, for example (as in my Connecticut set-up).

3. Three Speeds and Reverse.

Got into a cocktail-argument the other day about that eternal fourth speed. New table about to be launched. What—four speeds? And somebody, not me, suggested the above. Why not. (*Why?* Ed.) Æ

RECORDS

(*From page 66*)

constructed entirely from recorded bird songs, tape-tricked, and you'll be amused at the variety and complexity achieved by the indefatigable Mr. Fassett (all tape workers are indefatigable) and his CBS-engineer assistance. Commentary by himself, of his usual somewhat ponderous sort, and the back side takes a series of bird calls down an octave or two, driving home a point with unnecessary persistence. A bit goes a long way.

Cast the First Stone. Judge John M. Murtagh, Sara Harris. (See book of same title.)

Dolphin Documentary 1

This is a very moving and interesting documentary, a long interview with an experi-

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enced prostitute. Sara Harris does a superb job of warm, understanding interviewing, of a sort that adds enormously to the usefulness of the record, since the entire problem is presented in human terms, naturally, rather than as clinical evidence. Judge Murtagh offers an introduction and some side-comment.

Too bad that the fi is low, clearly from a cheap home recorder of the sort that professionals too often depend upon. (Or is it a good machine in dismal unrepair? Also possible.) But you can understand things well enough. Probably recorded at 3¾ ips—to save tape!

Golden Slumbers—Lullabies from Near and Far. Jean Ritchie, Pete Seeger, Ruth Welcome, and others.
Book-Records Soundbook.

Intended for small kids, this offers a batch of singers of utterly different backgrounds, including the top-notchers Ritchie and Seeger as well as some nursery school cute-style crooners that make *this* kid wince. Will your kiddies choose the good ones for their favorites? Try it and see. It's a sound book, with text and illustrations as well as the ten-inch record in an insert.

Piano Music by Louis Moreau Gottschalk. Jeanne Behrend.
M-G-M E3370

John Field: Piano Concerto #1; Five Nocturnes. Sondra Bianca, Hamburg Philharmonia, Jones.
M-G-M E3476

A pair of names-that-you-see-and-seldom-hear, and I was quite interested to discover that our first American piano virtuoso, Gottschalk (from New Orleans, flourished in the 1850's and 60's) was a fine musician and wrote some nice stuff, strong, too. A sort of pianistic Stephen Foster.

John Field, an Irishman often mentioned as having been well known in European salons in the early 19th century, is utterly insipid and no more. Sure, his style reminds of Chopin—the way that the liquid left in the cocktail shaker reminds of a fresh Martini. . . . just plain dull, I say, and you can try it if you want to doubt me.

Galuppi: Six Concertos for String Orch. Milan Chamb. Orch., Gerelli.
London Telefunken LGX 66057.

Ever read Browning in school? Maybe you'll remember his *A Toccata of Galuppi's*. Mr. B. was a bit indefinite as to the music itself, not being much of an expert in that field. Here you have Signor G. in person, and he turns out to be a robust and pleasingly popular composer of middle-18th century concerti grossi (a tiny part of his huge output in many fields). He belongs in the juicy late-Baroque period, dressed-up Vivaldi and Handel, with slightly Mozart-like overtones here and there.

The Italians are experts at misinterpreting their own music (or at least that's the way *we* feel about it) and this Milanese group plays minus harpsichord, in a bouncy style, with incorrect ornamentation. Doesn't hurt the music much but it could be better. Recording rather distant in the miking.

Guitar Music of Villa Lobos, Torroba. Julian Bream.
Westminster XWN 18137.

You'll be surprised at how many of these items turn out to be familiar ditties that you've heard again and again. Was it Segovia who used to play many of them? Bream, who also plays Elizabethan music on the lute as well as Bach on the guitar, is a fine musician and an able guitarist. Lovely record.

Heroes, Heroines, & Mishaps. From the famous Allison Collection. John Allison et al.
Ficker C10001

A mishap, all right. (Maybe you like corny ballads sung boisterously and out of tune. I don't.)

4. Big Moderns

Shostakovitch: Symphony #10 (1953). Philharmonia Orch., Kurtz.
RCA Victor LM 2081.

This is already the third recording of this recent symphony, which testifies to Shostakovitch's continued pulling power. It's long—a consistent Shostakovitch feature—and it rambles no end, time and modern-type conciseness never having been his worry. I simply got lost in the first movement (and this isn't my first hearing of it, either) which lasts almost a whole LP side, with close groove-spacing at that.

But the second, the usual fierce scherzo, is easy to hear and the slow movement is strangely catchy with an odd, quirky little folksongish tune and a strange, eerie quality of quiet tension. No doubt about it, in the world of Shostakovitch, given his peculiar idiom, this is a strong, unbombastic work, much more cogent and economical than the big war-time noise-makers despite its length. The playing is suave and beautiful, by the great British orchestra, and you'll remember Kurtz as the man who conducted those first sensational hi-fi recordings of the *Gayne Suite* and other modern Russian items, on Columbia.

Bartok: Sonata for Two Pianos and Percussion; Contrasts. Wilfred Parry, Iris Loveridge, pfs., G. Webster, Jack Lees, perc., F. Grinke vl., Jack Brymer, clar.
Westminster XWN 18425

Here is a British performance of one of that group of powerhouse hi-fi percussion pieces that Bartok turned out in the thirties; it preceded the *Music for Strings, Percussion, and Celesta* by a year, and has the same furious intensity, wildly complex scoring—and utter classical purity. Contrasts, written for (and recorded by) Szigeti and Benny Goodman before the war, features clarinet, violin, and piano and is a milder piece though with plenty of Bartokian energy on its own.

Both performances are played accurately, furiously, musically, with what seems to me just a wee trace of British reserve. Or maybe it's in the recording which, for once, is reasonably conservative and places the percussion as well as the other parts of the music somewhat more than a foot or so from the mike! Good results and I like *Contrasts* better here than in the old original Goodman-Szigeti version.

Bela Bartok at the Piano, Vol. 1.
Bartok 903

Here, for those who know Bartok, is the very interesting spectacle of Bartok himself playing Liszt and Scarlatti, as well as a large batch of Bartok. He was a tremendous pianist (I once heard him, hi-fi, in person) and the good ear will catch the power of his playing in spite of the low fi of these old recordings which, I guess, are mostly instantaneous acetates belonging to Peter Bartok. Bela Bartok even speaks on one of them.

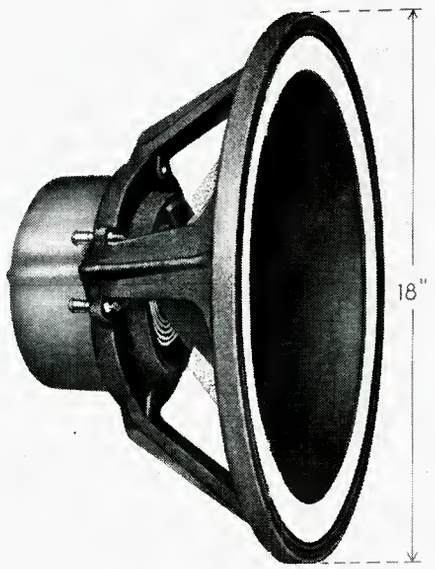
Prokofieff: (Piano Concerto #3); Violin Concerto #1. (Gilels), Oistrakh, State Radio Orch. U.S.S.R., Kondrashin.
Westminster XWN 18178.

Would have made a nice pair, but my copy, sporting a lovely and lyric *Violin Concerto* on one side (played, again, with that peculiar present-day Russian sweetness and coolness of tone)—got mispressed on the other side. Instead of Prokofieff's piano work there's an American musical comedy of apparently ancient vintage, done by what sounds like an amateurish group. I couldn't spot it for the life of me but guess it is (was) of the "Pins and Needles" vintage! Better check on your copy. Might be fun to buy it, as is.

Bartok: Concerto for Orchestra (1943). L'Orch. de la Suisse Romande, Ansermet.
London LL 1632.

My favorite interpretation of this now very popular piece is that by Reiner, on an old Columbia and again on LP and stereo for RCA Victor. It crackles, sings, is full of that high-voltage Bartok quality and peculi-

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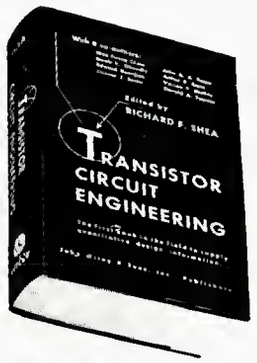
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iarly acid—yet gentle—humor that is so fascinating in this music. However—don't think that is the only way it can be played, Reiner's way.

Ansermet gives this a consistently slower, more weighty, less crackling performance. He finds more of a Brahmsish nature in it than Reiner does—and in truth, there is a lot of old-fashioned eloquence in the music. Details, with the very best (and most appropriate) of ffrr recording, come through here which tend to be lost in the electric rush of Reiner's recording. I suspect that interested parties would do *very* well to own both, and to get to know them equally well so that neither seemed the familiar (and therefore "right") version. Both have major things to contribute, in sound as well as msuic.

Prokofieff: Sonatas for Piano, vols. 1, 2, 3. Yury Boukoff.
Westminster XWN 18369/70/71.

These nine sonatas, and especially the last big ones, have become important repertory pieces for many pianists. They are difficult, but in them there's always enough of the warm, human *Peter and the Wolf* spirit of the composer to make them listenable for most uninitiates.

This complete series is splendidly recorded technically, and the idea is an excellent one.

I find Yury Boukoff's interpretations highly proficient but remarkably unsympathetic and, indeed, unmusical. It can't be proved, I know (and the blurbs speak of Boukoff as "in the front rank of young piano virtuosos of our time") so you may take it as critic's opinion, and try for yourself. Better check with some other reviewers if you are interested—I haven't.

Hindemith: The Four Temperaments; Five Pieces for Strings, Op. 44 (Educational Music); Funeral Music for King George V. Netherlands Chamber Orch., Szymon Goldberg.
Epic LC 3356.

The name of Szymon Goldberg, violinist, is enough to guarantee interest here. He has been conducting small orchestral ensembles and does a splendid job, often taking the violin solo lead himself. The Four Temperaments, usually heard in its ballet form, is a sort of piano concerto in its non-ballet guise; Fleisher is a fine man to do the piano part. Paul Godwin plays the viola solo in the moving short *King George* music, and Goldberg himself, if I guess right, is heard occasionally on the record via his fiddle. The whole recording, as befits Goldberg's style, is permeated with a fluent, transparent, semi-chamber style of playing—rather than a big-orchestra effect—that is well suited to all the music. Nice.

5. Stereo Corner

(NOTE: Stereo tapes are rated as to specific stereo effectiveness—over and above comparable monaural recording—on a scale of 1 to 5. The rating takes into account both musical and technical aspects contributing to stereo value, to give an idea of stereo worth in terms of the higher stereo cost.)

Handel: The Messiah—excerpts. Adele Addison, Lorna Sydney, David Lloyd, Donald Gramm, Handel and Haydn Soc., Zimbler Sinfonietta, Thompson Stone.
Boston (Livingston) BO 7-9
Stereo Rating: 4 (solos: 2)

Here are excerpts from the complete Messiah issued on LP by Unicorn, which won considerable praise the world over. I hadn't heard it before this tape arrived. The excerpts show it to be a good compromise between the old-style huge and sprawling Messiah performance and the new demands for greater conciseness and more authentic instrumentation and style. There is a harpsichord here—but there are also the clarinets which (I think) Mozart added, and a great deal of orchestral doubling not in the strict original. No matter—the music always can come through here if given the proper chance; it gets a lively and fresh treatment from this chorus and orchestra, a smaller, more flexible group than the usual heavyweight forces that weigh Messiah down to stodginess. The solos are more conventional though on a fairly respectable plane of conventionality. The chorus makes up in liveliness for some amateur bounce and harshness.

Stereo? A big space (Symphony Hall in Boston) and the proper stereo vastness. But though the strings and chorus are right down there on the big, wide stage, the woodwinds sometimes seem unnaturally close—the clarinets are oddly about ten feet away to the ear, though not at all unobstrusive, whereas the strings can be imagined at concert-seat distance, as can the chorus. The net result is an occasional feeling of aural confusion, as one tries to build that stereo space in the mind. Not bad, but just enough to bother a careful ear. Better miking would have fixed it. More distant, for uniformity in this big concert liveness.

The solo voices are magnified by solo miking and are more or less removed from the stage performers, in a closed space of their own. Some seem more so than others, though this may be a matter of voice quality. In stereo this solo miking seems to me to be unnatural and undesirable, though we are entirely used to it in monaural pickup. If stereo is to be different—as everybody claims—then let it be different, and with its own laws.

Don't let me stop you—I'm carping mainly for the interest of these technical problems in recording. If you aren't concerned, they won't bother you a bit. I just wish there were more of the Messiah here.

Strauss: Salome; Dance of the Seven Veils and Final Scene. Inge Borkh, Chicago Symphony, Reiner.
RCA Victor CCS-23
Stereo Rating: 4

This item in the growing Chicago-Reiner stereo series would rate a top 5 except for the rather odd treatment of the solo soprano, which I find disturbing.

The orchestra spreads out in all its Straussian beauty across a big stage; the auditorium is as palpable as ever—you can practically feel the great spaces before you, as the echoes bounce back and forth; the various instrumental groups are rightly placed to right and left and center. But the solo—well, she sings in a curious vacuum, as of another place, though to my ear she seems to move about here and there, to right and left. She's not on the stage; she's flying through the air in a special acoustical cloud of her own.

RCA has been using three tracks for stereo recording of late, with one more or less reserved for the solo. The solo track can be distributed later on in whatever volume and proportion may seem desirable between the other two tracks, for the final version. If this is an example of the three-track technique, then I don't like it. It's not the placing in space, which is OK, nor the volume balance, which is also excellent—she isn't too loud, nor is she too faint—but rather an odd sense that the lady is not singing in the same space as the orchestra. Her liveness doesn't match theirs. Don't know how it happened, but I think this type of musical solo can be handled more naturally.

As usual, a superb Strauss performance by Reiner, who can't be beat; and Salome herself, who sings sweet, ghastly words to the severed head of John the Baptist, kisses it and tastes blood—she is excellent, though not as dynamic nor as terrifying as Ljuba Welitsch. I shivered a bit, just the same, when that kiss came along and when the horrid burst of brass, off to the right, signaled Herod's soldiers to squash the dreadful Salome flat like some monstrous spider. Brrr! Strauss is certainly stereo's best friend.

Brass & Percussion. Morton Gould & His Symphonic Band. **RCA Victor CCS-30**
Stereo Rating: 4

I reviewed this awhile back in its LP version and spoke then of a huge, "mammoth cave" liveness which, to tell the truth, I

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didn't like very much. Curiosity led me to try the stereo version and I am duly rewarded—for the same mammoth cave liveness here seems considerably more natural, less exaggerated, easier to take. It makes a good stereo recording.

Evidently stereo's power to widen out and shape up a space, to make it rounder and fuller in the listening, accounts for the fact that the excessive liveness in the LP recording is less of an impediment here. The space itself is more real, more immediate, and the presence of the band is also more compelling; so—your ears are more at ease.

To be sure it's still a pretty big cave we're in. Might be an armory or a skating rink or a railroad station by the sound. But Mr. Gould & His Band are quite at home in it.

A passel of snazzy band tunes, Sousa, Goldman and Gould, plus the inevitable hi-fi percussion piece. Full of pep.

Stan Seltzer's Stereo Steinway. Stereotape 4a

Stereo Rating 2?

I couldn't resist a listen to this one, though the pops-jazz style of keyboard playing isn't anything I can be authoritative about. (It's more than piano mood music though, rich and fluent of its sort.) Just what, I asked myself, does a single Steinway sound like out of two stereo speakers?

Well, after some curious figuring-by-ear, I've decided that this stereo Steinway is an instrument roughly 18 feet long shaped in a thin crescent, like a very large, curved hotel settee. The pianist runs back and forth from one end to the other—the keyboard is spread all the way along one side. That's what my ears say, anyhow. Rather a pleasing effect, if slightly zany. Nice big liveness, but it's all inside the piano.

The piano sound itself is excellent and very natural, especially on monaural.

Guitarra Espagnol. Richard Pick. Concertape 24-1

Stereo Rating: 3

Here's a quite different proposition, also a single instrument—a point-source—playing via stereo speakers. This one comes out better, more realistically. And the classical Spanish guitarist is an unusually fine one, the recording super-hi-fi, very full and big—monaural or stereo.

The first problem in this tape is to get the volume down, for at usual settings the guitar becomes a huge, powerful instrument maybe a yard wide and two yards long. Big, whopping bass, nice, edgy highs—a fine sound, if blown-up. Maybe you won't want to bring it down to normal guitar size.

As to stereo, the engineers have done a good job—there definitely are *not* two guitars here, one in each speaker. A big liveness and careful miking takes care of that. The guitar is to some extent spread across the room—but the nice sense of liveness tends to make you place him more or less in the center of the space—though occasionally you'll hear a fingernail or two over in one speaker cone. Not quite focussed and pinned down in one place.

On monaural the guitar is in the middle between the two speakers. Switch to stereo and he seems to move back a few feet and grow a bit bigger and fatter. Otherwise, not too much difference; but I find the stereo more enjoyable for extended listening. I.e. it works, point-source or no.

JAZZ AND ALL THAT

(*from page 77*)

lindo's *The Sounds of Mariachi* is a reflection, based on the song *La Negra,* of the gay street bands of his own Jalisco. José Pablo Moncayo's *Huapango* takes its name from the rhythms of a dance popular along the Vera Cruz coast.

Homage to Garcia Lorca, by Silvestre Revueltas, is not new to LP, but this is the most vital reading. Daniel Ayala, in his *Tribu,* makes use of aboriginal percussion instruments from Yucatan and its ancient pentatonic music for three Mayan sketches. It is to be hoped that Dr. Mayer-Serra has another disc on the way.

The Day Manolete Was Killed Audio Fidelity AFLP1831

As a friend of Manolete, Barnaby Conrad has relived many times the 28th of August, 1947, the day the matador met death on the horns of the Miura bull Islero in Linares, Spain. With great pains he fashioned a film from still photographs on his friend's long career and last fight for television's Omnibus program. This suggested a record to aficionados Josh Moss and Harold Salkin. After gaining permission from Conrad, they set about gathering a collection of sounds to surround the narrative, from the anticipatory street noises of the crowd to the band as it heralds the event. Also the thunderous "Oles" of a demonstrative audience and the bellow of an enraged bull as he lunges across the ring.

Author of the best sellers "Matador" and "La Fiesta Brava," Conrad is well fitted to convey the drama of the occasion. As a fighter of bulls in Spain and Mexico, he is aware of much that went through Manolete's mind on that day. Accented by the stirring flamenco guitar of John Buckingham, the story he tells is a sensitive and factual insight into the demands made on a great matador by his chosen career.

Packaged with photographs and Conrad's cover painting of Manolete ready for the ring, the original now hanging in the El Matador Café in San Francisco, the record is an excellent example of the expanding horizons of the phonograph. Here is realism, drama, and a fitting memorial in sound.

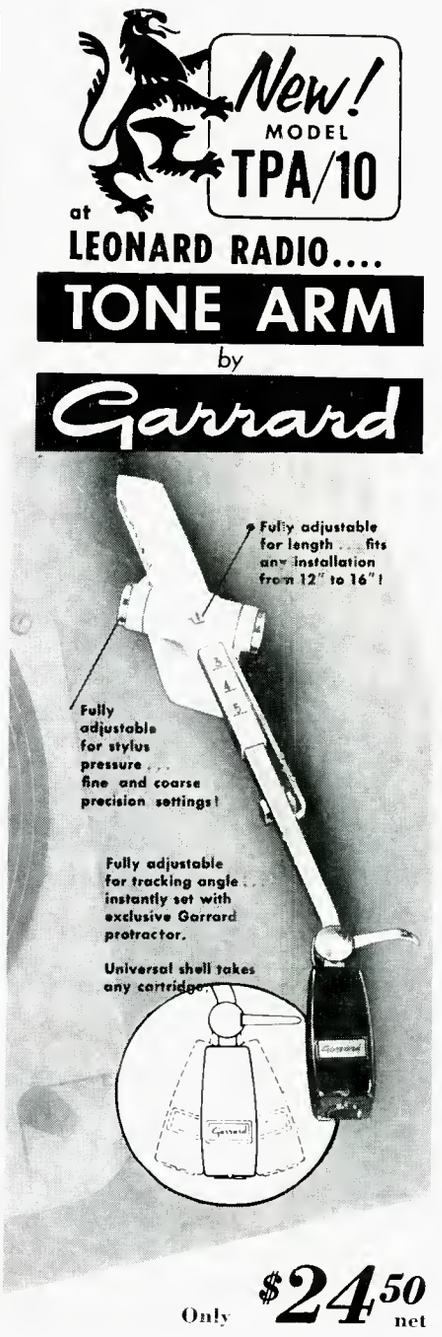
The Marquis De Portago: A Memorial Tribute Riverside RLP5007

A somewhat distorted picture of The Marquis de Portago, and his racing career, was painted in the public press after his death in an accident in the Millie Miglia on May 1, 1957. Undoubtedly, the truest and most valid insight into the man and his intention is contained in his own words, recorded last November in New York. His voice carries a boyish enthusiasm and reveals a modest and wholly likeable personality. It has conviction as he speaks of his determination, balanced by a promise to quit the field at the age of thirty-five, to become the World's Champion driver.

Most striking is a temperamental likeness to Manolete. There is the Spanish heritage, the need to excel, a lack of fear, and an unexpressed fascination with death. It is too bad the chance was missed to sound out Portago on the subject of bullfighting. Tributes by Chinetti, Fangio, Peter Collins, and Count von Trips serve as an introduction. Extracted from tapes made before the tragedy, they have the authentic ring of earned praise. Released at the same time are the stories of Stirling Moss, Phil Hill, and Carroll Shelby.

American Banjo Scruggs Style Folkways FA2314

If present-day folklore is not your forte, you may well wonder at the term *Scruggs banjo style.* It is the method of three-finger picking introduced in 1945 to modernize the five-string banjo and enable it to play the lead or melody. First demonstrated by Earl Scruggs in the "bluegrass" band of Bill Monroe, its popularity spread throughout the South in a revival of old-time music. Mike Seeger, a banjo picker born in New York City, went out in the field to record a sampling of fifteen varied representatives of this style on thirty-one tunes. Think you know American music? Then see how many of the titles you can name, without referring to the labels.



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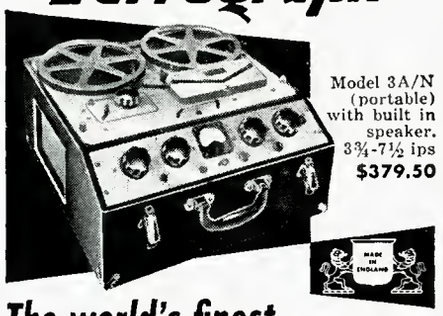
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Teddy Charles: Vibe-Rant **Elektra 136**

As he has the reputation of being able to unravel the most complex score, Teddy Charles is usually on the mind of the progressive jazz composer when he writes for the vibraphone. It is to fill these exacting requirements that Charles is most often called to the studios. Here, for a change, he is given a chance to relax and even hum a bit on a free-and-easy swinging date. He is joined by Idrees Sulieman, a trumpetman with a strong tone and a fund of ideas. A close associate, pianist Mal Waldron, heads up the rhythm section of Addison Farmer, bass, and Jerry Segal, drums.

With a minimum of charted devices, Charles depends upon the empathy of the group in his original *No More Nights, Arlene* and *Blues Becomes Elektra.* Waldron's economical piano makes him an ideal companion in the standards *Old Devil Moon, Skylark* and *How Deep Is the Ocean.* The vibraphone is caught in as fine sound as you are apt to find on records by Dave Hancock and Leonard Ripley.

Stan Kenton: Kenton With Voices **Capitol T810**

Moody Marilyn Moore **Bethlehem BCP73**

Stan Kenton's patronage of the Modern Men and Ann Richards has led him to make his first album featuring vocals. The band does not take a subsidiary role in the dozen numbers, but the stratospheric brass makes way for an interweaving of mellow voices. The Richards' style is along Christy-Connor lines, though less mannered, and singularly effective with the quartet. The repressed power of the band makes a fine sound.

Another record debut is made by Marilyn Moore in a style reminiscent of the youthful Billie Holiday. There is the same careless rapture and fine small-band backing found in the revered Holiday discs of 1938–40. Al Cohn, her husband, plays tenor, beside trumpetman Joe Wilder, on a dozen well-paced arrangements by pianist Don Abney.

Johnny Puleo and His Harmonica Gang **Audio Fidelity AFLP1830**

Johnny Puleo is undoubtedly the most distinguished graduate of Borrah Minevitch's wandering Harmonica Rascals. Where that unflagging entrepreneur gained acceptance for his chosen instrument in variety halls, Puleo uses his gamin-like humor to reap success in supper clubs and television. His is a more subtle and musicianly approach to the unusual personality of the lowly mouth organ, raising it to new heights as an ensemble entity. Like the guitar and accordion, it has a harmonic resonance most fully realized through the riches invested in the bass tones and chords by the faultless recording it receives here.

Among the dozen numbers are three arrangements designed to show off the concert potentialities of the harmonica. They are Offenbachs' *Orpheus,* Ravel's *Bolero* and a charging *St. Louis Blues,* with rolling boogie bass. A startling orchestral quality is achieved, suggesting that Puleo might try his hand at writing an original to exploit the special properties of his group. He is at his best when he lets the brightness of his wit color his work in such familiar tunes as *You are Always In My Heart, Peanut Vendor, Cuddle Up a Little Closer* and *It Had To Be You.* His dramatic sense, evidenced by the memorable performance in "Trapeze," makes them unalloyed delights.

Bobby Short: Speaking of Love **Atlantic 1262**

Bobby Short's specialty is applying his musical imagination to show tunes with intelligent lyrics. Though this factor may keep them off the hit parade, when they are molded into the witty, sophisticated style of this singer-pianist, it is conducive to relaxed listening. For his third album he selects fourteen tunes, going back to 1928 for Rodgers and Harts' *Do I Hear You Saying I Love You,* and up to *This Is What I Call Love* from Happy Hunting. Accompanists are Ismael Ugarte, bass, and Sonny Rivera, drums. AE

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Industry Notes ...

BEL-CLEER TAPE IN EXPANSION PROGRAM. Expansion into the field of magnetic tape for instrumentation and video tape recording (VTR) has been announced by **The Saint Cecilia Company, Ltd.**, Westwood, N.J., manufacturers of Bel-Cleer tape for musical recording. In addition, the company is extending the distribution of its standard tape line to include leading radio supply houses and music stores throughout the country. In line with the expansion program, the company is inviting inquiries from factory representatives in territories where it is not now represented.

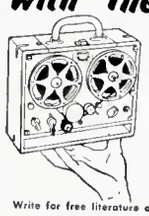
MAGNECORD MOVES TO TULSA. Announcement was made on August 8 of the move to Tulsa from Chicago of the **Magnecord Division of Midwestern Instruments, Inc.** All of the Magnecord management and practically all of the skilled and technically-trained personnel are being moved to the oil capitol with the company taking care of all expenses involved in the transition. The Magnecord Division will occupy 40,000 square feet of space on the ground floor of the Midwestern plant situated on a hilltop overlooking the city.

COLLARO VISITING THE U.S. Maj. Christopher Collaro, chairman of the board of directors of **Collaro, Ltd.**, is scheduled to spend a number of weeks in this country introducing new Collaro developments in record-playing equipment. In addition to being sold as components, Collaro record changers are used in hi-fi music systems made by Magnavox, Altec-Lansing, Stromberg-Carlson, and other quality manufacturers. During his stay here, Maj. Collaro will personally arrange for showings of the new Collaro models to dealers and distributors throughout the country.

BOGEN WINS STYLING RECOGNITION. Two Bogen amplifiers have been chosen as examples of outstanding American industrial design and will be shown at the 1957 Triennale in Milan, Italy, according to Lawrence LeKashman, vice-president of **David Bogen Co., Inc.**, Paramus, N.J. The Bogen units chosen are the Model DB130 high fidelity amplifier and the Model LX60 public address amplifier. Raymond Prohaska of the Bogen organization was the designer of both units, which will be part of the United States exhibit entitled "Communications at Home and at Work."

SOUNDCRAFT SALES HIT NEW MARK. Sales of **Reeves Soundcraft Corporation,** makers of recording tape and discs, for the first six months of 1957 reached a new high, according to a report by Hazard Reeves, president. Frank B. Rogers, executive vice-president, reports that growth of the Soundcraft Magnetics Division has been such that it is now operating on a 24-hour day 7-day-per-week basis. The firm continues to operate with a substantial backlog of orders carrying over into 1958. In order to back up the present sales picture, Soundcraft will increase its advertising and promotional budget this Fall with the most ambitious campaign the firm has ever undertaken, according to Mr. Rogers.

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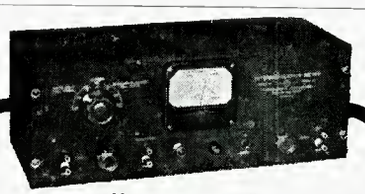
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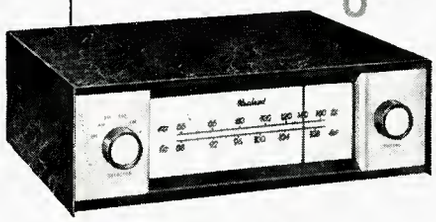
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ADVERTISING INDEX

Acoustic Research, Inc. 70, 71
Acro Products Company 68
Allied Radio Corporation 75
Altec Lansing Corporation 76
AMI Incorporated 42
Ampex Audio, Inc. 83
Amplifier Corp. of America 95
Audio Fidelity, Inc. 59-64
Audiogersh Corporation 6, 7

Belden Manufacturing Company 67
Bell Telephone Laboratories 16
Bogen, David Co., Inc. ..... Cov. IV
Bozak, R. T., Sales Company 47
Bradford & Company 85
British Industries Corporation facing p. 1, 3, 44, 45

Capps & Co., Inc. 35
Carter Motor Co. 94
Classified 94
Collaro Record Changers 50, 51
Components Corporation 95

EICO 77
Electronic Applications 55
Electro-Sonic Laboratories, Inc. 41
Electro-Voice, Inc. 57
Electro-Voice Sound Systems 95
Ercona Corporation 94

Fisher Radio Corporation 66
Fukuin Electric (Pioneer) 86

General Electric 37
Grado Laboratories 87
Gray Manufacturing Co. 90

Harmon-Kardon, Inc. ..... Cov. II
Heath Company 10-13
High Fidelity House 95
Hollywood Electronics 95
Hycor Division of Internation Resistance Corporation 2

Intersearch 88

JansZen Speakers (Neshaminy Electronic Corp.) 73

Key Electronics Co. 95
Kierulff Sound Corporation 95
Kingdom Products, Ltd. 74
KLH Research and Development Corporation 79

Lansing, James B., Sound, Inc. 31
Leonard Radio, Inc. 93

Madison Fielding Corporation 84
Marantz Company 89
McIntosh Laboratory, Inc. 29
Measurements Corporation 95
Mullard Overseas Ltd. 39

North American Philips Co., Inc. 25, 26, 65

Orradio Industries, Inc. 8

Pentron 80
Pickering & Company 15
Pilot Radio Corp. 81
Professional Directory 95

Racon Electric Company 91
Radio Corporation of America 33, 53
Radio Craftsmen 82
Rauland-Borg Corporation 96
Robins Industries Corp. 96
Rek-O-Kut Company 69
Rigo Enterprises 9

Schober Organ Corporation 95
Shure Brothers, Inc. 1, 49

Tandberg 88
Tung-Sol Electric, Inc. 4

University Loudspeakers, Inc. 5

Weathers Industries ..... Cov. III
Wiley, John & Sons, Inc. 92



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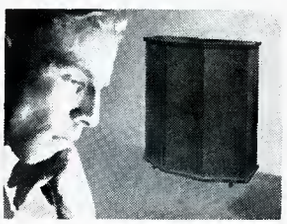
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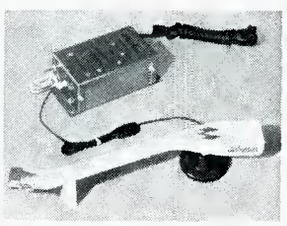
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Improper stylus force can ruin high fidelity qualities of your records at the very first play. WEATHERS, the lightest, professional touch, shows no record wear even after a thousand plays. Your favorite records, your **valuable** records will last a lifetime—and still sound new! A sapphire stylus on a Weathers pickup will last **longer** than a diamond stylus on ordinary pickups.



Distortion-free . . . carefree

WEATHERS FM Pickup System is free of all common causes of sound distortion. It does not pick up hum from motors, it tracks perfectly even if your turntable is tilted to a 45° angle, no leveling necessary! Accidentally dropped, WEATHERS pickup floats with feathery ease onto your record. Weathers pickup is shock-mounted...eliminates mechanical vibration and acoustic feedback.



MORE than a pickup, WEATHERS offers more to Hi-Fi

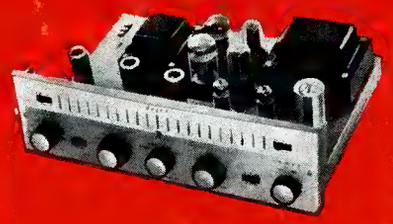
WEATHERS tone arm and pickup is a complete FM system, a virtual miniature FM radio station. Its sole purpose is to pick up and transmit impulses from your record. Your record practically does **NO** work when played with WEATHERS pickup. The result always is a flat response from 20 to 20,000 cycles.

WRITE FOR WEATHERS FREE BOOKLET ON HI-FI FACTS AND RECORD CARE TODAY!

Weathers

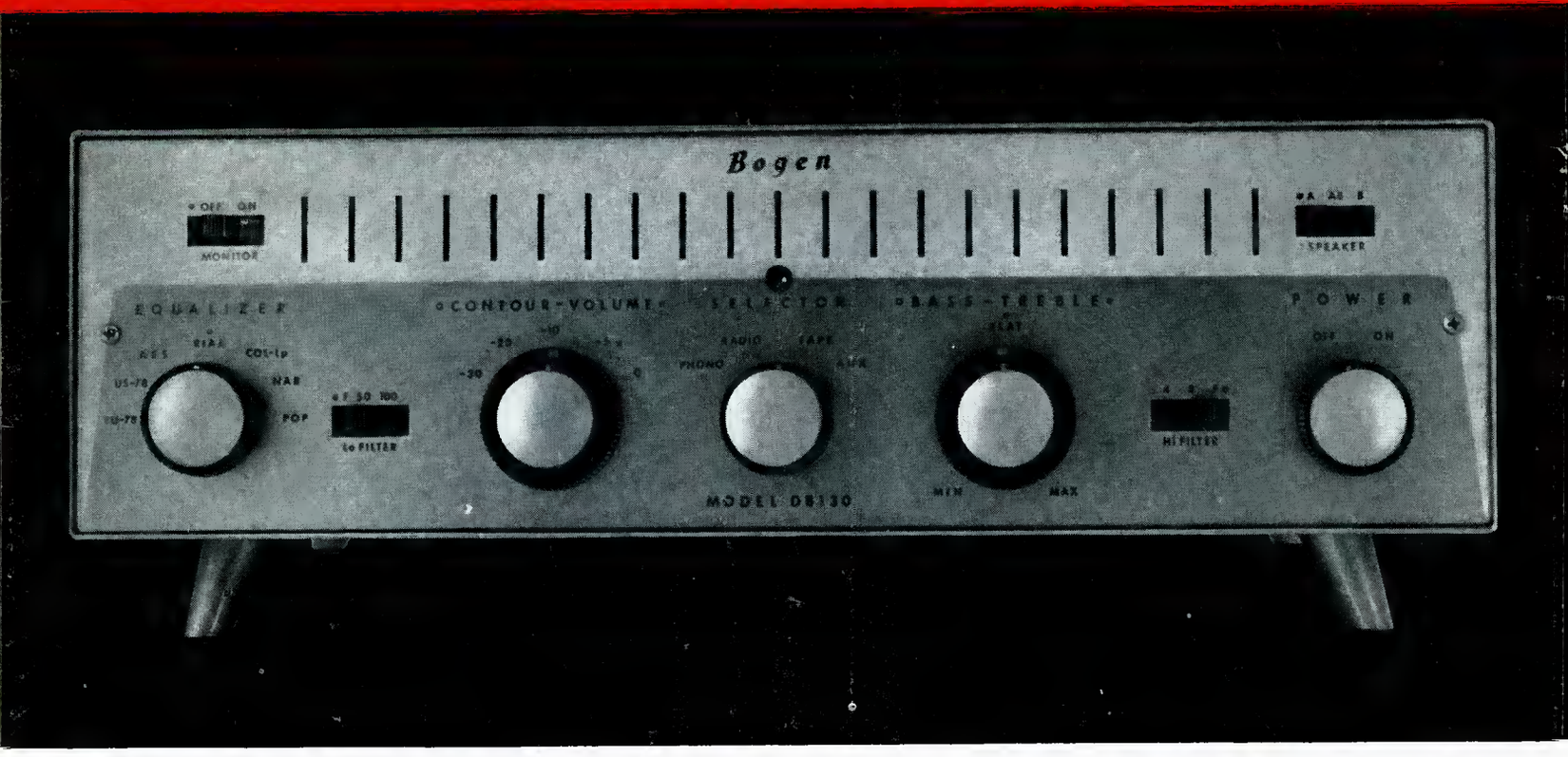
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BOGEN DB130 35 WATT AMPLIFIER

There are good reasons why the Bogen DB130 is preferred by most experts. First, it is the only high-fidelity amplifier and pre-amplifier combination rated by all three independent consumer organizations as "best" regardless of price! Second, it is one of the few high-fidelity amplifiers with sufficient undistorted power output to drive the latest type extended-range speakers.

But, judge for yourself . . . read the adjoining specifications, then put a Bogen DB130 through its paces at your local high fidelity shop

Bogen
HIGH FIDELITY
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DAVID BOGEN CO., INC. — PARAMUS, N. J.

SPECIFICATIONS

POWER: 35 WATTS. **PEAK:** 100 WATTS • **FREQUENCY RESPONSE:** 15-30000 CPS WITHIN 0.5 DB • **DISTORTION:** 0.3% AT 35 WATTS • **INPUTS:** LOW MAGNETIC. HIGH MAGNETIC HI-FI CRYSTAL. TUNER. TAPE. AUXILIARY (2) • **OUTPUTS:** SPEAKER(S). TAPE • **CONTROLS:** POWER (ON-OFF). CONTINUOUSLY VARIABLE BASS AND TREBLE. SEPARATE CONTINUOUSLY VARIABLE LOUDNESS CONTOUR SELECTOR. INPUT SELECTOR (PHONO. RADIO. TAPE. AUX.) 7-POSITION RECORD EQUALIZER. INFINITE DAMPING CONTROL. LO FILTER (FLAT. 50C. 100C). HI FILTER (FLAT, 8KC. 4KC). SPEAKER SELECTOR SWITCH (A. AB. B.) TAPE MONITOR (ON-OFF). AUX ADJUSTER. HUM ADJUSTER • **CHASSIS: $115.00 • BLONDE OR MAHOGANY-FINISHED ENCLOSURE: $7.50**

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