High-Fidelity

SUMMER ISSUE
VOL. 1 NO. 1

Published by Milton B. Sleeper

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MODEL RJ-20A

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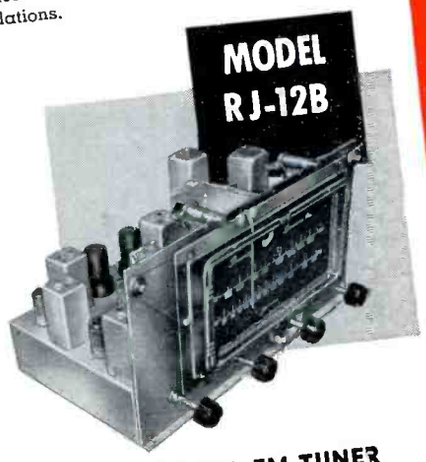

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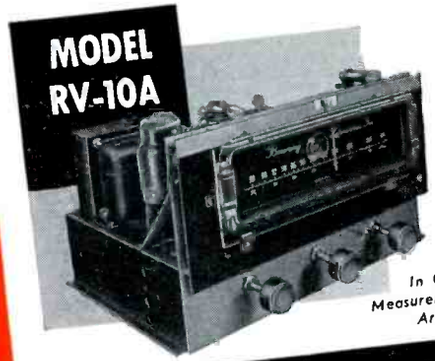

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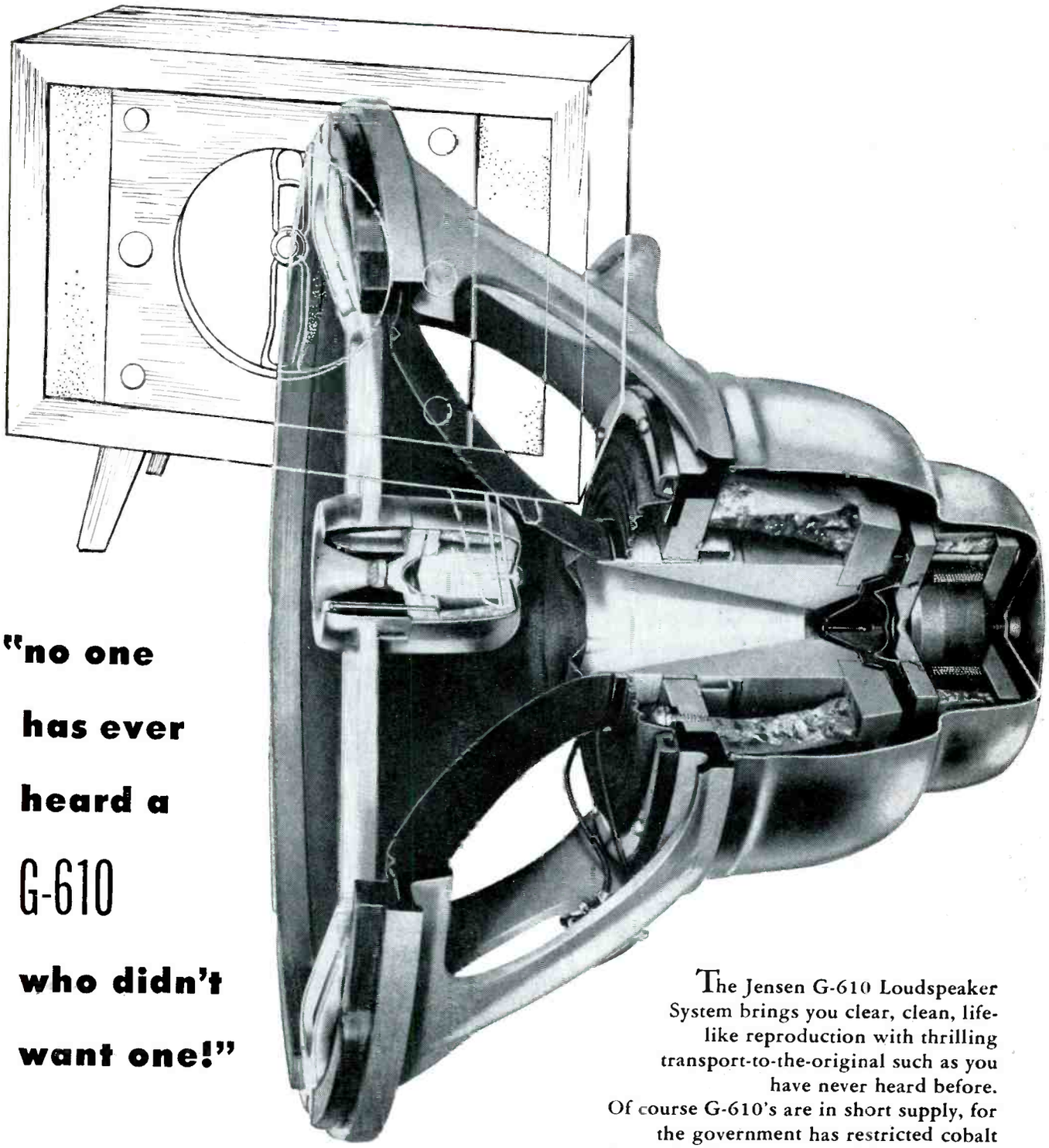

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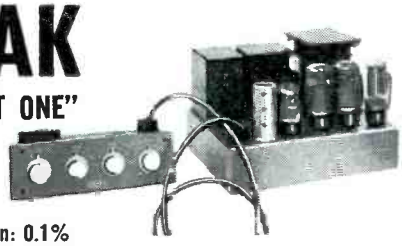

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AROUND THE CORNER

It's customary for magazines to give their readers advance information about articles planned for forthcoming issues. We intended originally to follow that practice in HIGH-FIDELITY, but when we mentioned this to the authors, they said "No" very emphatically. They said it's all right to make such announcements in a monthly publication, but a quarterly magazine shouldn't do so because there would be time for others to find out what is in preparation for HIGH-FIDELITY and rush into print with articles along the same line, thereby spoiling original ideas.

We agreed, as we believe you will, too, that they were right. So, all we are going to say is that the next issue will be considerably bigger than this one, and fairly bulging with original ideas and special features.

Of special interest will be a section devoted to the forthcoming Audio Fair, with an advance report on the exhibitors and the new products they will display. If you go to the Fair, this will help you to find your way around, and to locate the displays you particularly want to see. If you can't go, this section will give you all the news, so that you can write for catalogs and data on the new equipment.

Record collectors will be pleased to know that the Record Section will be expanded greatly, and all releases of major importance will be reviewed both as to musicianship and recording technique. Also, C. G. Burke will continue his stimulating discussion of recorded music.

The Reader's Forum will appear for the first time. There will be plenty of space for you to air your views and comments, and to toss in a hand grenade or brickbat if you choose. The names of the writers will be published, so that everyone will know who said what.

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Editorial contributions will be welcomed by the Editor. Payment for articles accepted will be arranged prior to publication. Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions, nor will HIGH-FIDELITY Magazine be responsible for their safe handling in its office or in transit.

High-Fidelity

THE MAGAZINE FOR AUDIO-PHILES

Volume 1, Number 1 Summer 1951

CHARLES FOWLER, *Editor*

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MILTON B. SLEEPER, *Publisher*

Application for entry as second-class matter filed April 27, 1951 *at the Post Office, Great Barrington, Mass., under the Act of March* 3, 1879. *Additional entry at the Post Office, Pittsfield, Mass. Printed in the U. S. A.*

AUDIO-PHILE'S BOOKSHELF

A list of books which will be of interest and value to you, carefully selected from the many publications related to music, records, and sound. Using our Book Service, you can have your choice by return mail. Just send the coupon with your remittance.

History of Music

TWENTIETH CENTURY MUSIC — Marion Bauer, 480 pages, profusely illustrated, 5½ x 8.

This brilliant explanation of modern music — its development, its characteristics, its composers — serves as an authoritative guide to the vast number of music-lovers who want to listen to the works of twentieth century composers intelligently, and with the maximum of enjoyment. The author, a composer and an authority on contemporary music, presents this material in a simple and direct manner, supplementing the text with many illustrations from the works of contemporary composers, thus making it of interest to the general reader as well as the student of music. Adopted by the National Federation of Music Clubs as the best book on the subject. **No. 1**.....**$5.00**

MUSIC THROUGH THE AGES — Marion Bauer and Ethel Peyser, 646 pages, illustrated, 5½ x 8.

An interesting history of music combining vivid narrative with authentic text, this completely revised edition includes the latest musicological discoveries. Excellent coverage of such subjects as ancient music, Oriental music, primitive music, and medieval music has been supplemented with new material on the music of Latin America and the influence of radio on instruments and music. The history of our own American music has also been brought up to date, making this one of the most thorough books of its kind. The up-to-date bibliography which accompanies each chapter and the detailed cross index are other features invaluable for the student, layman, or teacher. **No 2**.....**$5.00**

OUR MUSICAL HERITAGE — Curt Sachs, 400 pages, illustrated, cloth.

This volume is a short, concise presentation of the history of music from primitive times up through 1948. The author, a former college professor and prominent musicologist, has subordinated biographical details concerning composers and other personalities, to an extensive treatment of characteristic changes in musical language, life, performance, in form, notation, printing, and the construction of instruments. Suitable mention has been made of composers in the light of their contribution to musical history. A generous bibliography accompanies each of the twenty-one chapters. Primarily a text, it will also be of vital interest to music lovers who wish to know more about how their favorite music came into being. **No. 23**.....**$5.00**

Concert Notes

GREAT ORCHESTRAL MUSIC — edited by Julian Seaman, 5¾ x 8½, cloth.

This volume places the radio, phonograph, or television listener on the same footing as if he were taking his seat in any one of the large concert halls in the land, by providing him with informed program notes. The editor has read thousands of symphony programs and has selected the best comment on each selection, whether the annotator was Philip Hale with the Boston Symphony, or an unknown writer for a lesser known orchestra.

The book covers the orchestral music most often played, from Bach through the years to today. Each composer is introduced in a brief biographical sketch. Not only the symphonies and symphonic poems are included, but also popular overtures, concerts, suites, and many shorter works. **No. 17**.....**$5.00**

THE CONCERT COMPANION — Robert Bagar and Louis Biancolli, 750 pages, illustrated, 6 x 9.

Written by the program annotators for the New York Philharmonic Symphony Society, and prefaced by Deems Taylor, this volume is one of the largest and most informative collection of concert notes ever to be made available to music-lovers. It includes more than 750 compositions, the work of 150 composers from Bach, Beethoven, and Brahms to the leading contemporary American and European men of music. **No. 4**.....**$4.95**

Aids to Listening

WHAT TO LISTEN FOR IN MUSIC — Aaron Copland, 281 pages, 5½ x 8.

The art of listening to music discussed by one of our best known and highly regarded contemporary American composers. Written from the composer's point of view, this work presents a fresh conception of just what we hear, and what we should hear, when listening to any piece of music. It is an invaluable aid to a more complete enjoyment of music. **No. 3**.....**$3.50**

THE GOOD HOUSEKEEPING GUIDE TO MUSICAL ENJOYMENT — George R. Marek, 352 pages, cloth.

Here is a work devoted to those of you who want to approach good music more closely through radio, the phonograph, and through occasional concert attendance. The book is informal, but it tells you concretely how to listen to good music, and how to guide your child to music. Also, it gives valuable information concerning the instruments of the orchestra, its makeup, and the duties of the conductor. The author has been music editor of Good Housekeeping Magazine for many years and has written monthly articles with remarkable success. His knowledge of music and his understanding of what the reader wants to know make this a real guide. **No. 18**.....**$3.50**

RELAX AND LISTEN — John Hallstrom, 5¾ x 8½, cloth bound.

The author, an executive of RCA Victor Records, has written, in a humorous and down-to-earth style, a book which provides the average reader with a clear understanding of the basic nature of music, its major forms and their definitions and functions, and an acquaintance with many composers. He casts his definitions in everyday terms assuming no musical knowledge whatsoever on the part of the reader. The value of the book is further enhanced by a comprehensive phonograph record listing, organized with reference to the subject matter of the text, and a glossary of musical terms and pronunciation guide. This book will be an invaluable aid to those who are building record libraries as well as to concert goers. It is a fascinating reading experience. **No. 19**.....**$2.50**

LISTENING TO MUSIC CREATIVELY — Edwin J. Stringham, 479 pages, illustrated, cloth.

This book presents in an absorbing and ingenious way not only the history of music but a method by which the untrained listener can find pleasure and meaning in music, and develop his own critical capacity. Dr. Stringham covers all the forms of music, analyzing simply and clearly a specific example of each type, and making additional suggestions for listening. In so doing, he furnishes an excellent guide — with program notes, so to speak — for building a well-balanced record collection. Copious illustrations accompany the text. This book skillfully integrates biography, social history, and the other fine arts with the main stream of music. It should appeal to both the scholar and the novice. **No. 20**.....**$5.35**

Opera

OPERA LOVER'S COMPANION — edited by Mary Ellis Peltz, 385 pages, illustrated, cloth.

This book will serve as a wise, sympathetic, and silent companion, not only for the opera goer, but for those who listen to opera on records and for the vast radio audience of the Metropolitan's famous broadcasts. The articles included represent a careful culling of the best material from the *Opera News*, publication of the Metropolitan Opera Guild. Here is expert analysis and opinion on thirty-eight operas — all perennial favorites — written by a distinguished group of recognized authorities on the opera. In a style which is thoroughly intimate and free from pedantry they discuss the plots, the composers, the librettists, the sources, the varying interpretations, and little known facts about the histories of the operas you love to hear. **No. 22**.....**$5.00**

THE COMPLETE OPERA BOOK — Gustave Kobbe, 1,000 pages, 126 illustrations, 5½ x 8.

This careful, scholarly work, by an author long recognized as a leading critic, is one of the most comprehensive handbooks to the opera yet published. At the same time, it is an entertaining, thoroughly readable volume with a direct appeal to all music lovers. This new and revised edition presents the stories of over two hundred operas, four hundred leading airs and motives in musical notation, short biographies of many composers, with illustrations, and sixty-three illustrations of operatic stars in costume. This book is in its nineteenth printing and has established itself as a standard work in the field. **No. 5**.....**$6.00**

Technical

THE RECORDING AND REPRODUCTION OF SOUND — Oliver Read, 364 pages, profusely illustrated, 6 x 9.

A complete authoritative treatment of the entire subject of sound, this book covers all aspects of recording including a complete analysis of recorders as well as full data on reproduction equipment such as amplifiers, speakers, microphones, and phonograph equipment. The completeness and accuracy, and the up-to-the-minute treatment which is given to the subject by this book, make it an indispensable volume for everyone interested in sound. **No. 7**.....**$5.00**

POST-WAR AUDIO AMPLIFIERS AND ASSOCIATED EQUIPMENT — compiled by Howard W. Sams & Co., two vols., vol. 1: 368 pages; vol. 2: 352 pages; both profusely illustrated, 8½ x 11, paper-bound.

Volume 1. The initial volume was the first publication to present a uniform and thoroughly accurate analysis of the important sound equipment appearing on the market following the war. It covers a wide variety of well-known audio amplifiers, FM and AM tuners, plus data on important wire and tape recorders.

Volume 2. A continuation of the excellent coverage of the preceding volume, this manual provides complete information on 104 well-known audio amplifiers and 12 important tuners.

These two volumes which include hundreds of pictures and diagrams will provide a complete and authoritative sound library for their owners. **No. 8** (Vol. 1).....**$3.95**
No. 9 (Vol. 2).....**$3.95**

AUTOMATIC RECORD CHANGER MANUALS — compiled by Howard W. Sams & Co., Vol. 1: 400 pages, hard binding; Vol. 2: 400 pages, paper or deluxe; Vol. 3: 286 pages, paper; all profusely illustrated, 8½ x 11.

Volume 1. Gives complete data on 40 different post-war models of leading record-changers and wire, ribbon, tape and paper disc recorders up to 1948.

Volume 2. Covers 45 models made in 1948, including new LP and dual-speed changers, plus leading wire and tape recorders.

Volume 3. Covering 44 models of 1949-1950 changers and magnetic recorders, this volume gives an accurate exposition of new designs in multi-speed operation, dual purpose rotatable pickup systems and double track tape mechanisms.

No. 10. Vol. 1.....**$4.95** **No. 11.** Vol. 2 (de luxe).**$6.75**
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ELEMENTS OF SOUND RECORDING — John G. Frayne and Halley Wolfe, 686 pages, 483 illustrations, 6 x 9¼, cloth.

Two experts in the field of sound recording present a technical discussion of the basic problems in recording and reproduction of sound. An excellent book for the designer, engineer, technician, and student, this volume covers the principles, methods, and devices involved in all types of recording and reproduction. Space will not allow a description of even the general topics discussed in this work. **No. 14**.....**$8.50**

Semi-Technical

MAKE MUSIC LIVE — Irving Greene, James R. Radcliffe, and Robert Scharff. Profusely illustrated, 7 x 11.

A complete guide to the installation of a quality reproducing system in the home, this book describes all you need to know to bring into your living room flawless sound reproduction. Written by three experts — a consultant on high-fidelity equipment, an industrial designer, and a home-building adviser — it includes detailed explanations on how to buy and select components, complete installation instructions for all equipment, data on types of woods, woodworking joints, hardware specifications and finishes, and methods of concealing components in existing furniture. **No. 15**.....**$4.50**

ACOUSTICS OF MUSIC — Wilmer T. Bartholomew, 242 pages, illustrated, cloth.

The physical basis of musical tone is explained in this book in simple, everyday terms. Here is a clearly presented explanation of the link between sound waves and the artist's technique in producing them. The book explains the technicalities of sound origination for the musician and music lover. Language is simple and explicit throughout. *Acoustics of Music* fills the need for a book clarifying the fundamentals of acoustics, and gives to music lovers in readable form the materials for understanding acoustical problems of composition, performance, teaching, and appreciation. The various types of sound — percussive, vibratory, etc. — are discussed in separate chapters. Ample illustrations and a very complete bibliography make this book particularly useful.
No. 21.....**$4.00**

AN INTRODUCTION TO MUSIC — Martin Bernstein, second edition, 446 pages, profusely illustrated, 6 x 9, cloth.

In a concise and engaging manner the author introduces the basic musical concepts and forms, and discusses musical instruments and their respective tonal qualities. After laying the groundwork, the author then proceeds to sketch biographies of the major composers from Bach to Stravinsky. Accompanying these sketches are analyses and descriptions of the composer's best works. The analyses are accompanied by a wealth of musical examples which may be played at the piano. The chronological treatment of the composers helps to show the contribution of each to the development of music. The book is an extremely practical one, which will help the reader to more appreciative listening to the music heard today — in the concert hall, in the opera house, over the radio and on recordings. **No. 24**.....**$5.65**

For the Young Reader

HOW MUSIC GREW — Marion Bauer and Ethel Peyser, 664 pages, illustrated, 5½ x 8.

A fascinating story of music from its earliest inception among savage races down to its reception by millions over the radio, this book is written for younger readers without technical and foreign terms. It has been written in a most interesting fashion which has aroused the praises of many experts and critics. Walter Damrosch has said of it: "Its style is delightful, and, in most simple and often witty fashion, it imparts a tremendous amount of valuable information." **No. 6**.....**$5.00**

Miscellaneous

SELECTIVE RECORD GUIDE — Moses Smith, 5½ x 8½, cloth.

Here a famous critic and former director of a recording company helps you select your record library, guiding you through the great emotional and aesthetic pleasures of recorded classical music. It is far from being a mere catalog of works obtainable — which might prove more bewildering than useful — but is a truly selective, and practical, guide. And it emphasizes economy, leaving out expensive and hard-to-get foreign records and expensive domestic records. Besides emphasizing economy, the author also emphasizes quality of performance and recording. He shows his preferences among recordings, besides supplying a running commentary on composers and their place in the historical scene, and on the music itself. This book will prove a wonderful discovery for all who wish to make a discriminating collection of classical records. **No. 16**.....**$4.50**

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By way of INTRODUCTION

ONE OF THE most intriguing aspects of undertaking to publish HIGH FIDELITY is the number of widely divergent opinions held by the devotees of the field this magazine will serve.

As you might expect, the first announcements of this Magazine brought forth a flood of comments and questions, delivered by mail and in person. A large number, of course expressed gratification over the fact that there would be, at last, a publication devoted to all the aspects of and uses for audio reproduction.

Some asked bluntly: "Do you know anything about this subject?" Others, in a more belligerent tone, wanted to know: "What position are you going to take on pentodes vs. triodes?" or about other matters on which deep but conflicting convictions are held by both amateur and professional experts. These are legitimate questions, and so they should be answered here, for the benefit of all our readers:

FIRST, it should be explained that the purpose of HIGH-FIDELITY is not to give expression to the personal opinions of the Publisher or the Editor. The product of such a policy would be pure propaganda. Because this Magazine will succeed to the extent that it performs a useful service to you, the Reader, it must undertake to inform, but not persuade. At this time, as never before in all recorded history, the importance of respecting divergent opinions has been made so clear to us all.

The undertaking to supply information, then, carries the primary obligation of editorial honesty and accuracy. That obligation I am prepared to accept personally, and on behalf of our own staff and our contributors. If that seems too great a responsibility in a field as broad and complex as HIGH-FIDELITY must cover, remember that it does not require such wide personal knowledge, but the willingness to seek and the ability to find those who can contribute information drawn from *their* own specialized experience.

NOW, lest you fear that HIGH-FIDELITY may follow too serious a vein, let me say that we shall not forget the primary purpose of fine audio reproduction, which is to entertain.

The planning of this project, and the preparation of the first issue has been a big job for everyone involved. But we've had a lot of pleasure and satisfaction from it, too. If you get as much enjoyment from reading this Magazine as we did in producing it, then our effort was well spent.

In case you need additional information, a Reader's Service Bureau, announced elsewhere in this issue, is available to you at all times. Or if you want to correspond directly with the author of any article, letters addressed in care of HIGH-FIDELITY will be forwarded promptly.

ONE final note: In the matter of personal opinions you, the Reader, have an advantage over the Publisher. You are privileged to express your convictions in comments, suggestions, and criticisms. You are cordially invited to exercise this privilege. Be perfectly frank; don't pull your punches. Whatever you have to say, you can be certain of an attentive audience here at HIGH-FIDELITY.

MILTON B. SLEEPER, *Publisher*

Noted with Interest:

Say it with Flowers

If we are to encourage more widespread interest in realistic reproduction of sound, we should use a bit of applied psychology. So when neighbors and friends are around, let's stop saying "turn on the radio" or "play a phonograph record". Instead, let's "listen to a program" or "hear some music". After all, if our audio systems approach realism, we may turn on the radio but what we really do is hear a program or listen to the music . . . faithfully reproduced for all to enjoy.

Television Sound

Although no doubt most audio-philes know it by now, it's worth reminding the world at large that television sound is often startlingly good, at least when it starts out. (Live talent shows transmitted via noise-free FM is a basic reason.) It may be ruined by many a commercial set, with a 6-in. speaker tucked in the side somewhere, but the engineers are doing their best for us.

With a wide range reproducing system, all the goodness is preserved, with the result that a violinist a few nights ago was definitely not on the stage, but right in our living room.

We also suspect that some of the TV sound engineers count on the abbreviated frequency response range of most TV sets to do some of their work for them. At the moment, we are experimenting with an FAS reflex Air-coupler, and if there is any bass to be had, that will bring it out. Which makes it particular fun to listen to the Bert Parks show, which is full of the thumping of feet and scenery which the engineers, no doubt, are sure does not reproduce.

It's Murder

At the other end, far from the highly enjoyable, brilliant sound of most programs, is the doctored up glop which characterizes some telecasts. A prize example was a Phil Spitalny show a while back, in which not only the sound was murdered, but the composition itself.

It might have been all right if he hadn't chosen Kabalevsky's *Comedian's Galop*, which was recently recorded by London (LPB 146) and which has since become one of our demonstration records. Both sound and musicianship are magnificent in the record . . . tingling xylophone, singing strings, thwapping drums, a piece full of lilt and verve and dash. Mr. Spitalny, for all his baton flailing, managed to make the selection sound like a rendition of *Old Black Joe* by a pack of beagles baying at the moon. And no amount of shots of a raven-haired beauty flashing her long locks and smiling at the TV camera could make up for the fact that she couldn't play the drums, and even if she could have, the sound engineer finished her off by feeding everything through a beer barrel!

Card of Thanks

To the hundreds of people who have written in wishing us luck and success with our publishing venture, our most sincere thanks and appreciation. It has been a heart-warming and rewarding experience.

AS THE EDITOR SEES IT

ABOUT three weeks ago, the reporter for our local newspaper paid us a visit:

"I hear you're going to publish a new magazine."

"That's right."

"What's it about?"

"It's a magazine for audio-philes."

"For *whom*?"

We shall stop repeating the conversation right there. It took the reporter the better part of an hour to get a word in edgewise . . . and you, the readers of HIGH-FIDELITY, know only too well what an audio-phile is.

But . . . what an audio-phile is, is extremely important. This is very fundamental, because the success or failure of our effort to give *you* a magazine which is interesting and helpful to you depends on our ability to understand who and what an audio-phile is.

That's why we have taken time during these past couple of months to look over every subscription order which has been received. It has helped to answer the question, "Who is an audio-phile?" It is certainly apparent that an audio-phile is anybody and everybody: the butcher, the baker, the candlestick maker. The man who is publisher of two newspapers and owner of a big radio station; a well-known movie actor; the owner and operator of a tourist motel; the head cashier in a bank in a neighboring community; and so on, and on, and on. Who? A cross-section of America, united in a common interest: music, and the improved reproduction of music. We can get out the dictionary and define audio-phile technically: a person who is friendly to the sense of hearing.

But why? Or more explicitly (if less grammatically) how come you got that way? Any number of reasons. The basic interest in music, a characteristic of the majority of audio-philes, grew up for the same multitude of reasons which give birth to an interest in any social or cultural activity. The interest in better reproduction of music seems to have been aroused generally by "hearing a friend's installation".

Before we go any further, we would like to ask your help. HIGH-FIDELITY is your magazine. It is, very specifically, your responsibility to assist us in making it the kind of magazine you want. In subscribing, or in buying this first copy, you are not taking a look at a long-established publication, to see if what it says and writes about is of interest to you. You are examining an *idea:* that there is a need for a publication devoted to your interests in "the sense of hearing", and you are examining a *suggestion* from us: that this is the type of material you want. Exactly how we can serve this need, and with what material to fill the pages of this publication, is up to you. Because you have invested in one or more copies of HIGH-FIDELITY, you are, as it were, a stockholder in a company. And the board of directors of that company needs the help of the stockholders in guiding the future of the company. We sincerely want to hear from every reader; we want to know who you are, what your interests are, what we can do to help you as an audio-phile, what you want to see in this, *your* magazine.

We know only the general background picture: that you are part of a great movement surging throughout the country. Just how great, we did not realize until we began to search for the answer to a question: are there enough music lovers and audio-philes to justify the publication of HIGH-FIDELITY? We knew that there was no magazine devoted specifically to such interests. We had a rough idea of what these interests might be because we ourselves have always enjoyed music, we've been annoyed by the way it sounded when reproduced at home, and we had enough of the tinkerer in us to like fussing around with amplifiers and speakers. An average audio-phile. But how many more, like us, were there?

The upsurge of musical interest in America is literally astounding. Here are just a few statistics. According to David Ewen[1], there were 13 major orchestras in America in 1901. *Musical America* listed 159 for 1950! In addition, there are today over 10,000 community orchestras — semi-professional groups performing locally and primarily for their own enjoyment. Further, *Holiday Magazine* estimates that there are over 20,000 school orchestras and groups.

And while we are talking about the amount of live music available, let's kill once and for all the old saying that "In summer, no one bothers with music." We particularly resent this remark, because we live so close to the Berkshire Summer Festival at Tanglewood. Last summer, more than 14,000 turned out for a single concert! Average attendance has been 9,000 to 13,000. In other parts of the country, there are at least 23 firmly established summer series in the states of California, Massachusetts, North Carolina, New York, Indiana, Illinois, Wisconsin, Louisiana, Pennsylvania, Oklahoma, New Jersey, and Washington, D. C. . . . in addition to innumerable summer music schools and smaller, less well-known music groups.

That is a glimpse of the "live music" picture. The story of recorded music is so astounding as to be beyond belief. 50,000,000 records a year would be an underestimate. Ewen guessed at a figure of 10,000,000 serious-music discs way back in 1940. For what this phenomenal output means in terms of new musical experiences and the bringing back to life of a vast and unperformed repertory, see C. G. Burke's article on page 25.

And on the air? The WQXR program guide for April scheduled the performance of 277 *major* compositions. WNYC scheduled over 1,000 serious and semi-serious selections in a two-month period! And these are but two stations!

[1] *Music Comes to America*, by David Ewen, Thomas Y. Crowell, 1942.

On the side of improved home reproduction, the picture is equally dramatic. Every manufacturer and every supplier reports sales of custom equipment to be beyond every expectation, and mounting steadily.

This is but a cursory glance at the movement of which *you* are a part . . . a movement in which there is a keen community of interest which we hope we can foster and encourage . . . with *your help*.

PERHAPS the best summation of who are audio-philes, and why we are publishing HIGH-FIDELITY, is to be found not in our own words, nor even in the words of an audio-phile, but in a letter written by — who could do it better! — the *wife* of an audio-phile:

Gentlemen:

I am enclosing a check, $3.00, for a year's subscription to be sent to my husband, Col. Russell G. Barkalow.

My husband is a very critical listener and very technically minded, period! He started as a youngster with a crystal set. Then, when he got to radios, he would sometimes have four of them in the house at once, making comparisons to determine which was the best. In Alaska, in 1947, he got completely fed up with radio reception, as it was very poor. He tried record players, big speakers, amplifiers, needles, etc., each time making an improvement.

We came here to Virginia in July '48, and he started all over again. He has finally wound up with a 3-way Webster changer, McIntosh amplifier and equalizer, Altec speaker, Pickering compensator, diamond-tip needle, and goodness knows what else (I do not have a technical mind so can not remember all the equipment!) This I do know, he gets wonderful reproduction — one can hear every instrument in a band or orchestra. He will not have a noisy record nor one that does not have full range. As you well know, the piano is the most difficult instrument to record, but it has now graduated from the "Silver Dollar Saloon" type to where it sounds as though it is right in the room and sounds — like a piano! This I think is a very good test.

My husband has made everyone who hears his system very unhappy, because it is so much better than that with which they are familiar. I was disturbed at first, but he explained that people do not know what high-fidelity reproduction is, and therefore they have to be shown. I now see his point and agree one hundred percent.

He has said that sooner or later someone would come out with a publication such as yours, so when he saw your advertisement, he was delighted.

You are in on the ground floor and so can do much to help make people realize that they can get high fidelity in both radio and records. Of course, all people cannot afford the more expensive layouts, but there are some modest ones which are good.

I am telling you all the above so you can understand why my husband is so interested in your new publication. He feels that this is the only way that the manufacturers can be persuaded to put out high class records and equipment: there has to be a public demand. This is where you can stress that thought to the very great advantage of all of us. More power to you!

Helen H. Barkalow
(Mrs. R. G. Barkalow)

Thank you, Mrs. Barkalow. We hope that we can live up to your expectations and can meet the challenge of serving you, and all audiophiles.

***Departments in* High-Fidelity**

In addition to regular features such as the Record Review Section, we have several departments planned which, since they are reader departments, will not appear until the next issue. The one we shall be most interested in personally is —

THE FORUM

Here's the place to sound off about sound . . . about music . . . about whatever is on your mind . . . about high fidelity or HIGH-FIDELITY. Here's the place to pass along to other audio-philes your thoughts and suggestions on records, music, broadcasting, and, of course, audio. Whether there's something that should be done, or shouldn't, or if you just want to start an argument, The Forum is the place where you can make your ideas known to the largest group of audio enthusiasts gathered into the readership of any magazine.

TRADER'S MARKETPLACE

With audio equipment becoming somewhat scarce, and certainly more expensive, there's a ready market for any surplus equipment you may have. If you will take stock of audio items you own but don't use any more, you will probably be surprised to see how much cash it represents. And — the other way around — if you are looking for a particular bit of unusual equipment, or a special record, an item in the Marketplace will probably find it for you. See the advertising section for complete details.

BOOK SERVICE DEPARTMENT

One of the common queries is, "Where can I get a good book on such and such a subject?" The answer is on pages 4 and 5. We have gone through a bibliography of hundreds of titles and have tried to select a representative group of current ones. The selection is heavy on the music side, for the simple reason that there are many more books on this subject. There are not too many good books of a non-technical or semi-technical nature on audio (one more reason for publishing HIGH-FIDELITY!). If you have favorite titles, please tell us about them and write us for any particular books which are not listed. There will be a revised list in each issue, in which new books released between issues of HIGH-FIDELITY will be reviewed at length.

READER SERVICE DEPARTMENT

Theoretically, the Reader Service Department can give you the answer to any problem that may arise in connection with your audio installation. At least, it's set up that way. However, we don't challenge you to stump

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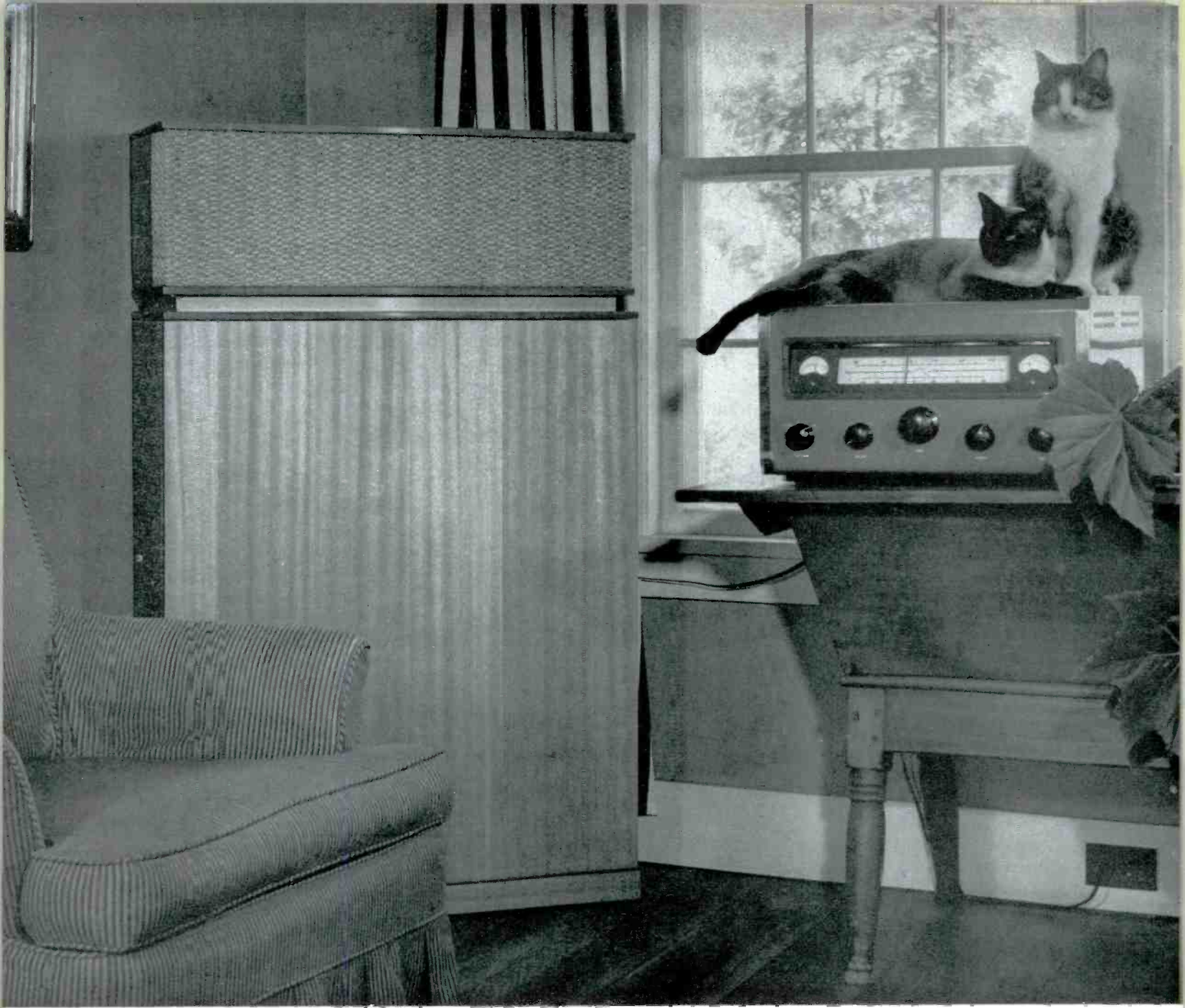


HOW TO GET BEST RESULTS FROM A KLIPSCHORN

PAUL W. KLIPSCH

Unlike other equipment used in high-fidelity installations, the development of the corner speaker has been virtually a one-man job, carried on over a period of years by Paul W. Klipsch at his laboratory in Hope, Arkansas. We asked him for his ideas of equipment to use with the Klipschorn, so that optimum results could be achieved. Here is his full and very interesting reply.

ORIGINAL generation of sound requires large generating sources for bass tones, and relatively smaller sources for treble tones. Compare, for example, the piccolo with the tuba. The piccolo is an instrument only a few inches long, of less than 1-in. bore, playing a tonal range corresponding approximately to the top three octaves of the piano. The tuba plays in the bottom octaves of the tonal range, and is made up of nearly 20 ft. of pipe with a bell or mouth nearly 3 ft. in diameter. Compare the short and long strings of the piano; compare the small and large pipes of the organ.

The bottom note of most pipe organs is the third octave below middle C, and is referred to as a 16-ft. tone. This means it is a tone which would be generated by a resonating open pipe 16 ft. long. As we go up one octave, we find the corresponding pipe only 8 ft. long, another octave 4 ft., and so forth. This leads to the concept that the lower the *pitch* of a tone, the longer its *wavelength*. Actually, physicists have known for a long time that the wavelength produced by an open organ pipe is about twice the length of the pipe (exactly twice the effective length of the pipe). The fact that it requires a certain *length* of pipe to produce a certain *pitch* leads naturally to the thought that producing deep bass tones requires a certain amount of size of tone-generating medium.

Basic Principles of Speaker Design

The same principle applies to a loudspeaker. Trying to produce any appreciable amount of sound power in the deep bass register with a small speaker is like trying to produce organ pedal tones with a saxophone. To carry it to extreme, try feeding a 6-in. cone speaker with electrical power derived from a big organ pipe, picked up by a good microphone and fed through a wide-range amplifier. The result will be merely a rattle. To produce a loudness at the ear corresponding with what one would hear at an organ recital, a 6-in. speaker cone would have to travel a foot or more to pump enough air to generate the deep bass tones. It is apparent that the 6-in. speaker is not an adequate device to reproduce the bass range in music.

But merely increasing the size of a cone speaker is not the answer to producing the bass range. True, one might build a cone about 3 ft. in diameter and get some bass, but such a large cone would fail at the treble end of the scale. Hence the concept arises of using several cones of different sizes to radiate appropriate parts of the complete tonal range. But the cone itself presents numerous peculiarities. It is impossible to make a large cone stiff enough to act as a rigid piston over a wide tonal range. Cones have some weight and inertia to motion. They must be suspended in such manner that they can vibrate, and the suspension therefore entails compliance or springiness. The combination of weight and springiness gives rise to the phenomenon called resonance, which makes the loudness of some tones greater than others. Furthermore, second-order resonances, generation of tones not present in the electrical power fed to the cones (distortion), tendency toward directivity so the loudness is different at different directions from the speaker — all these put the cone at a disadvantage in reproducing sound. Further, the cone speaker is inefficient; that is, it transforms only a small part of the electrical power received into sound power, the rest being lost as heat.

The horn speaker overcomes many of the limitations of the open cone or direct radiator speaker.[1] By loading a diaphragm (usually a more or less conventional cone speaker) by means of a horn, the diaphragm can be made small enough to retain rigidity, while the horn performs the function of a ratio gear to transform low velocity cone motion at high pressure to high velocity at low pressure, with the result that a 15-in. cone speaker, when horn-loaded, becomes the equivalent of a 6-ft. cone for bass radiation, and at the same time makes efficient radiation possible over a range of several octaves. And note the expression *efficient radiation*. The horn may permit an increase in efficiency from the 5% typical of an open cone speaker to 50%. This is a fact not to be overlooked, because it can be demonstrated that as efficiency is increased distortion is decreased. Doubling efficiency reduces distortion by a factor of ¼; increasing efficiency by a factor of 10 decreases distortion by a factor of 1/100. It also reduces the necessary power rating of the amplifier associated with the sound-reproducing system. Since as much as 800% distortion has been measured in a good speaker, it can be appreciated how important reduction by a factor of 1/100 would be.

Unfortunately, the complete range of tones audible to the human ear encompasses about 9 octaves, and so far, horn design has not achieved better than about a 5-octave range without loss of the other desirable features of a horn, such as low distortion and high conversion efficiency. Hence, two or more horns are necessary to cover the entire audible tonal range.

Theater speakers for sound movies are horn speakers. These are bulky systems occupying from 100 to 250 cubic feet or more. Obviously, they are not something for the home! But as early as 1930, work was being done with corner location of speakers, whereby the physical size could be reduced without sacrificing bass range. Dr. Kellogg described a horn speaker for corner use in the technical literature of 1930, and Mr. Sandeman was issued a patent in 1934 on a corner horn speaker. These ideas offered a vast increase in bass range per cubic foot of speaker size, but they were not exploited for home use; indeed it is doubtful if they would have been practical for home use in view of the peculiar shapes involved.

Better Bass Reproduction

In 1940, the writer undertook a new approach to the corner horn and eventually developed a speaker system to cover the tonal range down to the 16-ft. organ pitch, small enough to fit in a living room. During the last few years, this bass range has been extended below the limits of hearing and available measuring devices without requiring more than 16 cubic feet of occupied space for the main horn. A second small horn is added to cover the

[1]Note the distinction between an open-cone speaker — one in which the cone radiates directly into the room from a simple baffle board, and the horn type, in which the cone (or diaphragm) feeds through a horn or other enclosure.

upper tonal range to a point beyond the limit of human hearing. Refinements have reduced distortion even at loud listening levels and have resulted in a uniform response without resonances. There being no resonances in the speaker system, the resonances of the original sound are preserved. This system was facetiously dubbed the "Klipschorn"[2] by some experimenters in New York. The name stuck and was adopted as a trademark.

With the development of a speaker system of wide range and low distortion, it was realized that the better the reproducer, the more it brought out the sources of noise and distortion fed to it by the driving amplifier. At each stage of development of the speaker, it was found necessary to work on amplifiers, phonograph pickups, radio tuners, and the like before advantage could be taken of the extended tonal range of the speakers. Whereas 5% distortion was the accepted standard back in 1930, amplifiers are now being built with a fraction of one percent distortion, and the listening pleasure derived from such a modern amplifier is vastly greater than from amplifiers that were regarded as good a dozen years ago.

Today, the art of sound reproduction is entering on a new era. The *means* of sound reproduction are approaching perfection. But just as much of the equipment in use today falls below this standard, so too, many recordings fall below present day potentialities of the *recording* art.

To digress into the quantities again for a moment; the 16-ft. pitch corresponds to 32.7 vibrations per second, or 32.7 cycles. This is the third C below middle C. The second C below middle C would be 65.4 cycles.

When it is pointed out that recording practice in this country is largely standardized on response down to 50 cycles, it is realized that a sizable chunk is omitted from the bottom octave. A few records, probably recorded under what were considered substandard conditions, retain the original depth of the pipe organ. Two notable examples are Columbia 7356-M (recorded in England) *Gypsy Princess* and *The Merry Widow* played by Sidney Torch on the organ in the Gaumont State Cinema, Kolburn, England, and Columbia Gramaphone ROX 149 *Prelude and Fugue in G Major* (Bach) played by Albert Schweitzer, recorded at All Gallows, Barking by the Tower. These releases, by accident or design, appear to have retained the powerful sub-bass bourdon tonal depth which one associates with a pipe organ, and which one senses as much by feeling as by hearing. As one listener inelegantly, but effectively, expressed it: "It shakes your stomach."

Radio transmission suffers the same lacks as do the records. Network lines appear still to be limited at the low end to about 100 cycles even though the upper end has been extended in some instances to 8,000. This represents about one octave short of the limit of hearing at the upper end, and nearly 2 octaves short of what would be considered a truly full-range bass. Even live programs of local origin are most likely to be deficient in bass range due to inadequate microphones and associated apparatus.

Hence our new era has been reached only to the extent that the apparatus is now available for a full tonal range, and that some few — very few — sources of program material represent a near approach to the ideal. With the increasing number of high-quality home installations, it is fervently hoped that more program material, in recorded and broadcast form, will become available for full appreciation.

Amplifier Requirements

In the previous section it was pointed out that the inclusion of 16-ft. organ tones requires a lot more speaker than the simple direct radiator paper cone units. It was mentioned that the 16-ft. C_3 (3 octaves below middle C) is a frequency of 32.7 cycles per second. If the upper limit of human hearing is regarded as 16,000 cycles per second, there are approximately 9 octaves of tonal range to be covered by a speaker system.

Every time developments permitted adding an octave to the speaker reproduction at either end of the tonal spectrum, problems of noise and distortion had to be solved all over again. In the development of the Klipschorn, which covers the full 9 octaves, as much work was done on amplifiers and other associated apparatus as on the speakers. It is the purpose of this study to point out the requirements for apparatus associated with a speaker system of truly wide range and low distortion.

Let it be said there is no advantage in increasing the tonal range of the speaker, and decreasing its distortion, if remaining apparatus is of restricted range and high distortion. To repeat: The better the speaker, the more it emphasizes the deficiencies of the associated apparatus.

First, consider the amplifier. A dozen years ago, the typical advertising claims of better amplifiers were directed to the fact that from 30 to 60 watts of power were available. Distortion, if mentioned at all, was claimed to be some stipulated amount, without indicating at what frequency the distortion was measured, and sometimes without mentioning the power output at which such distortion would occur. Distortion measurements were often made at 400 cycles where any amplifier, however cheap, would probably give a good account of itself. But it happens that the lower the frequency, the greater the distortion in any amplifier. This is due to the all-important but necessary evil, the output transformer, where large amounts of distortion may be generated at low frequencies. Hence, to be valid and useful to the owner of a full-range speaker, the distortion and power rating at some low frequency like 30 cycles should be specified.

In the days of the 30- and 60-watt amplifiers, speakers of the direct-radiator class were typically 5% efficient; that is, 5% of the power fed to the speaker electrically would be converted to sound power. Hence a 30-watt amplifier driving a typical speaker of 5% efficiency would deliver about 1.5 acoustic watts maximum, and to hold distortion to tolerable levels would require backing down the gain control to keep the electrical power output of the amplifier down around 10 electrical watts, or 0.5 watt of

[2]For those interested in the technical aspects of the Klipschorn and the theory relating to its design, an extensive bibliography is available in a paper describing it, "A High Quality Loudspeaker of Small Dimensions", Journal of the Accoustical Society, January, 1946.

acoustic power. Now that wide-range low-distortion speakers exhibit around 50% efficiency, less electrical power is needed. An amplifier rated at 10 watts may deliver 5 watts acoustic power, and if one needs only 0.5 watt of acoustic power, the amplifier can be operated at only 1 watt output with extremely low distortion.

The favorite amplifier of 1940 consisted of a pair of 6L6 or 6V6 beam power tubes of high efficiency but unfortunately-high distortion even at low power output levels. These amplifiers put out tremendous power, and were cheap to buy. But they would not serve in a wide-range sound system because of the intolerable distortion. By adding feedback to such systems, distortion was reduced, but even with large amounts of feedback, resulting in measured distortion of very low level, it appears that there remained some almost immeasurably small high-order distortion which could not only be heard but proved irritating to listeners, whether of the golden ear or tin ear category.

This called for the expenditure of much effort on development of amplifiers of inherently low distortion. Triode tubes instead of pentode and beam tubes were chosen, and then, to bring distortion to vanishingly low levels, feedback was applied to them just as it was to the beam tube systems. Output transformers, previously mentioned as a necessary evil, were studied, and now have been developed to the point that they no longer constitute the weak link.

Amplifier for a Klipschorn

Very frequently, the author is asked: "What amplifier do you suggest as being able to give maximum performance from my Klipschorn?" That is the type of question an engineer answers with reluctance, not only because it is impossible to label any one make as *best*, but because most of the manufacturers are doing an admirable job of continuous improvement. On the other hand, people sometimes attempt to drive Klipschorns with amplifiers that were never intended for that particular job. It can be said from experience that the Brook, Leak, and Williamson types perform admirably. These have correctly designed transformers and associated equipment. For the home constructor, there are output transformers available that hold distortion to tolerable levels.

If the above appears to be a diatribe against beam tubes, reconsider. The beam tube in conventional amplifiers has never found wide acceptance by the users of top-quality wide-range speakers. But note the adjective: beam tube in *conventional* amplifiers. There is one beam tube amplifier, decidedly not conventional, in which the beam tubes are used in a peculiar combination utilizing the advantages of the cathode follower while at the same time preserving the high-efficiency principle and high output capability of the beam type tube. This amplifier is the McIntosh, which exhibits such low distortion even at high power outputs that it is doubtful if distortion measuring equipment with sufficient resolving power is available to detect the actual quantity of distortion produced. And this is not a case of eliminating the measured distortion while leaving high-order distortion to irritate. Listeners say it is as clean as the best amplifier against which they have compared it.

At the risk of getting commercial in an article of this nature, several amplifiers have been mentioned by name. It is not the author's purpose to rate one amplifier over another. However, for the benefit of those readers who still insist on knowing the author's personal preference for an amplifier to use with the Klipschorn, here is the answer: the Brook. Not that this is a better amplifier than the others mentioned by name, but for the following reasons: 1) it is a good, low-distortion wide-range amplifier, 2) it has a rather definite upper power limit which prevents damage to the delicate high-frequency speaker driver used in current Klipschorn systems, 3) it has a very highly refined preamplifier with proper equalization provisions, and 4) it is amenable to a very slight revision for full bass extension applicable to Klipschorn (referred to as K-1 re-equalization). The specific designation of this amplifier is the Brook 12A3-K-1 and is rated at 10 watts output. Significant is the fact that it has been found to deliver 9.5 watts of clean output at 30 cycles. This is more than adequate power for driving high efficiency, horn-type corner speakers. Probably, for home use, peak amplifier output of 1 watt would suffice to feed a Klipschorn. At one gathering, a Chamber of Commerce dinner, nearly 1,000 guests were served dinner music at comfortable listening level with the Brook 10-watt amplifier; previous calibration of the gain control indicated that this was attained with 1.5 peak watts input to the speakers. An estimate of the size of the auditorium indicated it to be about 600,000 cubic feet, or about the size of a large aircraft hangar.

It should be understood that these remarks about specific amplifiers are to be considered in the light of the author's experience. Limitations of time and expense have made it impossible to test all the models available. There are certain basic features which should be checked in selecting an amplifier to drive a Klipschorn. These are: triode output with feedback, or the beam tube arrangement exemplified by the McIntosh design should be a criterion; the correct design of lower-level stages so that they will be as distortion-free as the output stage; an adequate output transformer; at least 35 decibels of available loss in the pre-amplifier to permit that much linear bass-boost to equalize velocity-type phono pickups; and equalization to a linear range down to 30 cycles, and preferably down to 25 cycles or below.

Pickups, Tone Arms, and Turntables

Since an audio system starts with the pickup, this device must be considered here, too. The original phonograph consisted of a stylus tracking a groove, the shape of which represented the wave form of the original sound. The stylus forced a diaphragm to move, and air compressed on one side of the diaphragm was forced into a horn where the high-pressure, low-velocity air motion was transformed into the proper pressure-velocity ratio to be emitted into the listening area. All the power eventually

turned into sound was derived from the groove, and the stylus had to be driven with considerable force. Stylus pressures of the order of half a pound or more were required to drive the diaphragm to sufficient amplitude of motion to achieve a moderate degree of loudness.

With the development of the vacuum tube amplifier, and about 1925, the settlement of the question concerning tube bias requirements for stipulated distortion, it was recognized that the record groove would not be required to deliver so much power if a little power fed to a magnetic pickup could be amplified to drive a speaker. The result was the reduction of stylus pressures to a matter of 4 ounces or so. Developments in crystal pickups brought this down to 3, then to 2 ounces. By 1940 crystal pickups were on the market with recommended pressures of 1 ounce. Meanwhile, sound-on-disk motion pictures had served as a proving ground for other types of pickups, and reversion to the magnetic type offered possibility of lower distortion. During the past decade, pickups have been developed which utilize the following principles: strain-gage, magnetostriction, capacitance variation (frequency modulation), variable dissipation (amplitude modulation of an oscillator) and others. A rather important stride in reducing stylus pressures was exemplified in the photo-electric pickup.

The problems in designing a pickup are of a mechanical nature, regardless of what principle is used to transform the mechanical motion into electrical changes. This is a highly involved study, and there is as much engineering and mathematics in the stylus problem involving a few milligrams of weight as there is in a locomotive weighing thousands of kilograms.

The experience of this writer dictates the following criteria for a pickup: the stylus should be short, but slightly compliant; the motion of the tip rather than the shank or some other part should be transformed to electrical motion; and the stylus should be horizontally disposed rather than vertically (this is important as it determines the ability to track the up-and-down pinch effect motion as well as the lateral motion of a laterally cut groove without distortion). As the pickup head and arm on which it is mounted are functionally inseparable, and as the compliance of the stylus and the weight of the arm determine the lowest frequency that can be tracked, it is logical to conclude that the arm must be adequately heavy, yet counterbalanced to maintain proper stylus pressure. It appears from current knowledge that stylus pressure cannot be reduced below about 14 grams for standard-groove records, or 5 grams for microgroove records, without sacrificing one or more of the requirements of frequency range, tracking, wear, or distortion.

It was this writer's ill fortune to be faced with speaker development at a time when there were no means of playing phonograph program material at sufficient quality level to permit the speakers to be evaluated on a practical basis. Therefore, over the past decade, experiments were made with several types of pickups including some of the types mentioned above. The most successful of these consisted of a sapphire tip attached to a steel spring about ¼ in. long, with the tip end vibrating between a pair of magnetic pole pieces. The vibrating spring was substantially parallel with the record, so that it was compliant in both a vertical and a lateral direction. It was noted that stylus chatter with this arrangement was vastly lower than with other stylus type. While planning a tentative production program for this pickup, Mr. W. S. Bachman of the General Electric Company described substantially the identical arrangement in Electrical Engineering of March 1946. As his paper had been submitted before the author's development work was well under way, it was decided to drop the idea of producing the pick-up, and to wait patiently for the commercial introduction of the General Electric Reluctance pickup, as it has come to be known. This pickup incorporates all the features found to be necessary and sufficient in a pickup, and has become the author's choice.

Specifically, it is the RPX-046 professional model GE head, with a .0025 tip of either sapphire or diamond for standard groove records (shellacs and transcriptions). For microgrooves, where the recorded level is lower, the RPX-041 head is preferred as this head has a higher output and also a higher inductance whereby the high-frequency or treble response is attenuated slightly, and the pre-emphasis of the microgroove recording is compensated for in the head itself. Using this combination of heads as a matched pair, it is possible to change from one type of record to the other with little or no change in volume control setting, and generally no change in treble control setting at all, except in the case of old, noisy shellacs, where the treble control would be rolled back in any case.

After designing and building a large variety of tone arms, some good, mostly bad, the author settled on the Gray 103 and 106 arms, and these are still highly regarded. However, the fact that the tone arm weight and stylus compliance comprise a resonant system, and the resonance may cause mistracking on radially warped records, it has long been realized that some form of damping is needed. The early GE cartridge made a good approach to the damping problem with their jelly mounting. But in 1950 Gray introduced the 108B arm which has proved to be a very successful damped arm.

It is beyond the scope of this article to consider turntables and motors, but a brief mention will be made of their requirements. For wide-range speaker use, the rumble and wow must be minimized, and this appears to limit consideration to systems not containing gears or governors. Likewise, it eliminates changers of all known types except for applications where a certain amount of noise can be tolerated. Many Klipschorn owners report that they use changers for low-level listening (dinner music) and for applications where a little noise is not particularly objectionable (dancing).

The Rek-O-Kut T-12 is a very quiet table. By remounting the motor of a General Industries type DR table, it is possible to lower the hum and rumble level to a point below that which is present in most, if not all, records.

It should be noted that not all the rumble comes from the turntable. Floor vibration has proved very annoying, particularly so with microgroove record, and especially

Continued on page 80

For live music broadcasts, WQXR (FM and AM) has studios like the one shown above. In addition, 25,000 records are available.

MUSIC ON THE AIR

Dual transcription turntables and control equipment at WQXR

IF YOU lived in the New York City area in the early 1930's, and had an AM receiver capable of being tuned to 1550 kc., perhaps you heard the first broadcasts of a high-fidelity concert station, W2XE. It operated on an erratic schedule, and conducted innumerable tests to determine listeners' preferences, but it transmitted music — and more music. By 1936, it had matured to commercial operation, had been assigned the call letters WQXR, and transmitted on a regular schedule of 2 hours a day. By 1950, it was on the air 18½ hours a day, broadcasting its music programs through a network of 15 FM stations covering all of New York State, part of Connecticut, and the eastern section of Pennsylvania. Its program guide, originally mailed to 710 families in late 1936, was mailed to 60,000 in January, 1951. Music . . . on the air!

Most of you — the readers of HIGH-FIDELITY — know

Interest in educational FM is typified by campus broadcasting at Beloit College in Wisconsin. Excellent programs are transmitted.

where to find on your FM (or AM) dial those stations which bring an abundance of good music to your locality. So let's go behind the scenes, to visit some of the concert stations, to study their programs and the way in which they are drawn up, to see how and where the music originates and, most important, to see how *you* can help them to provide more of the music which you enjoy.

What Is a Concert Station?

There is no sharp definition for a concert station. In recent years, it has come to mean a broadcast station which devotes a major part of its program time to classical or semi-classical music. The distinction of devoting a *major* part of air time is made because many stations, including the network affiliates, provide occasional hours of symphony music, but it takes careful study of the newspaper to find out when and where. On the other hand, you can tune to a concert station at any time and be 90% certain of hearing good music. The further criterion of classical music is given because quite a number of FM stations in the metropolitan areas are programming light and popular music for storecasting or transitcasting. (Incidentally, they are wonderful sources of this type of music. They are probably not listed in your local newspaper, so the best way to find them is to take a run up and down your FM dial.) Between the extremes of all light-music and all classical-music, are stations which devote varying portions of their time to fine music, filling the remainder with educational or cultural programs. WNYC in New York is an example. So, too, is WFDR, and so are the many educational FM stations throughout the country.

Control room in station at Beloit has full professional facilities.

Why Do We Have Concert Stations?

The simple answer to that question is: to give you the kind of program material which you want. But, naturally, the answer is not quite that simple! Pleasing your tastes is certainly a major reason for the existence of concert stations. You — the music lover and audio-phile — have continued to ask for good music, broadcast with maximum fidelity and minimum commercialism. If there are a sufficient number of listeners in any area who ask loudly enough for programming of this nature, it is probable that a way can be found to provide it. This is the direct point of view, and it's an important one. But let's go deeper.

Specialization of one form or another has crept into almost every field of endeavor, bringing with it all its inherent disadvantages as well as its advantages. Contrary to popular opinion, radio broadcasting is by no means an exception. Scattered over the country today, there are many radio stations which devote a large proportion of their broadcasting schedule to the tastes of a specific group of listeners. Such specialized interests as sports, popular music, and classical or semi-classical music are among those served.

In many cases, this specialization is merely a matter of convenience to the station, although it may be ballyhooed as a service to the listening audience. A disc-jockey show, for instance, can occupy a sizable amount of broadcast time, and through the use of a series of these purveyors of jazz and "hot licks", a station can provide itself with sufficient program material to fill its broadcast schedule. Furthermore, this type of program is ideally suited to handle the infinite number of spot commercials which provide such a station with its revenue.

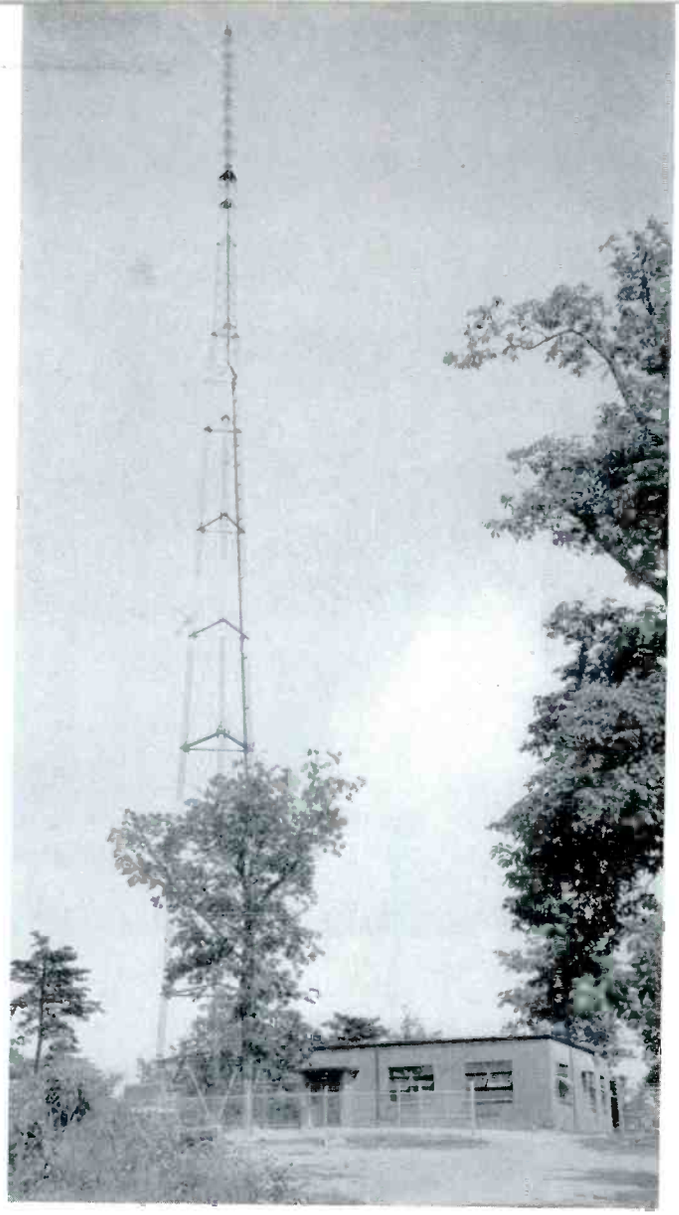
On the other hand, many stations engaged in specialized broadcasting are making a thoroughly sincere attempt to provide the listener with a wealth of program material which cannot be obtained from national network stations. Network programming today appears to be an attempt to hypnotize simultaneously 150,000,000 Americans so that the slogan of "For itches . . . buy Glitch's" can be ineradicably imbedded in their subconscious. Also, the assumption has been made by network programmers that all listeners have tin intellects as well as tin ears. We are inclined to suggest the old adage, "who judges others, condemns himself". As a result, the specialized interests of many listeners have been ignored. The abandonment by CBS of its live broadcast of the New York Philharmonic is typical of the casualties inflicted by this type of policy.

Appeal to the interests of the mass public has been highly profitable for the majority of stations. But it is becoming increasingly apparent that it can also be profitable to appeal to specialized interests. Hence: the concert stations, the store casting, and the educational stations.

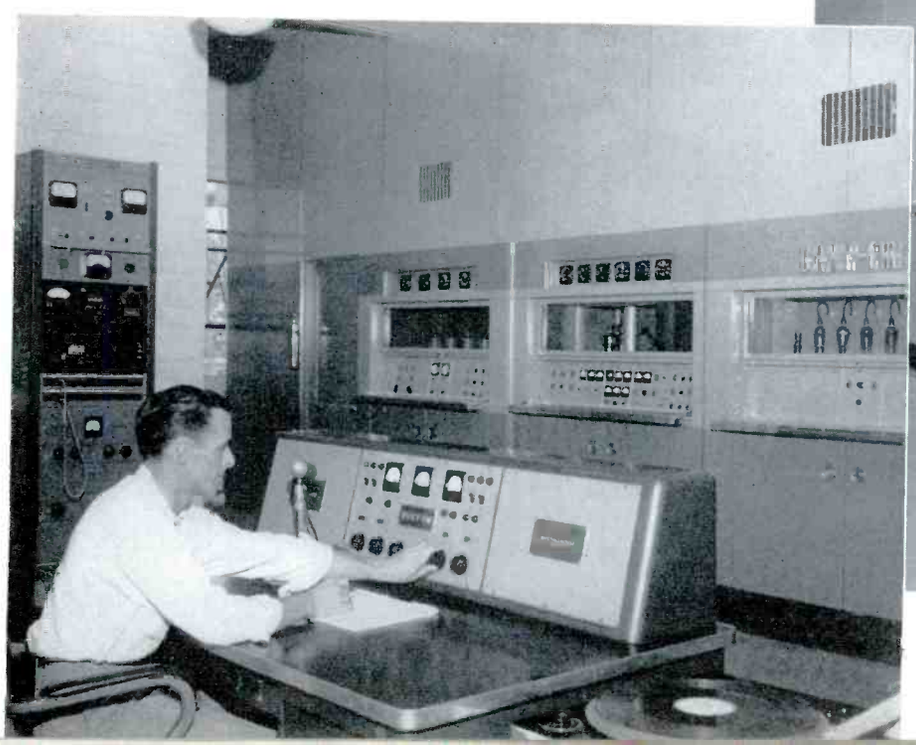
How Is a Concert Station Supported?

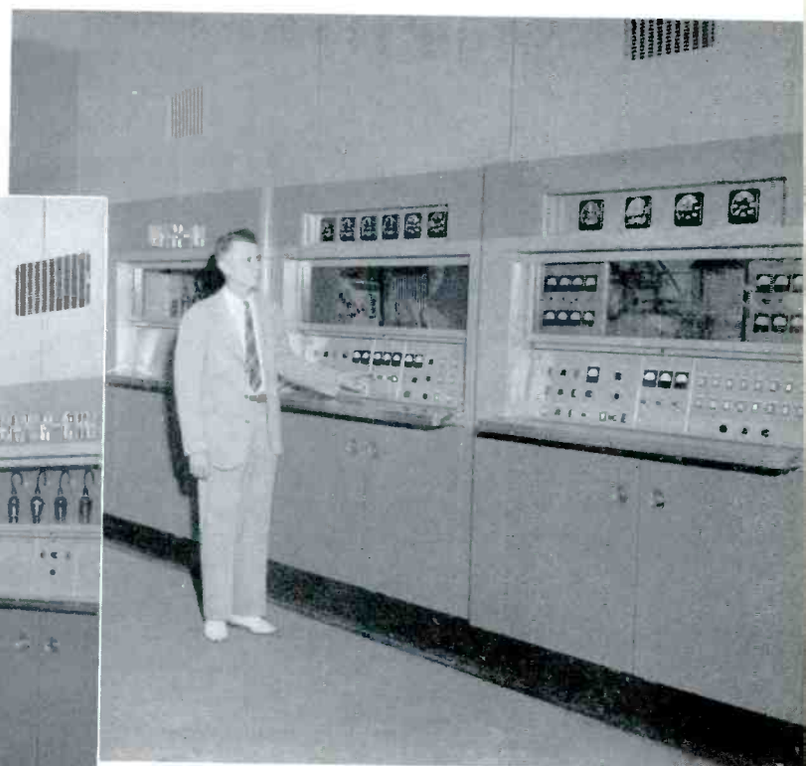
If you scream "For itches, buy Glitch's" at enough people, often enough, and loud enough, the chances are that a sufficient number will actually begin to itch, and go out and buy Glitch's, so that the sponsor's sales will rise appreciably and, alas, he will continue the program, screaming ever more lustily. And the broadcaster will continue to make money. If, on the other hand, the broadcaster adopts a policy of catering to specialized interests, of recognizing the extreme annoyance that tire-

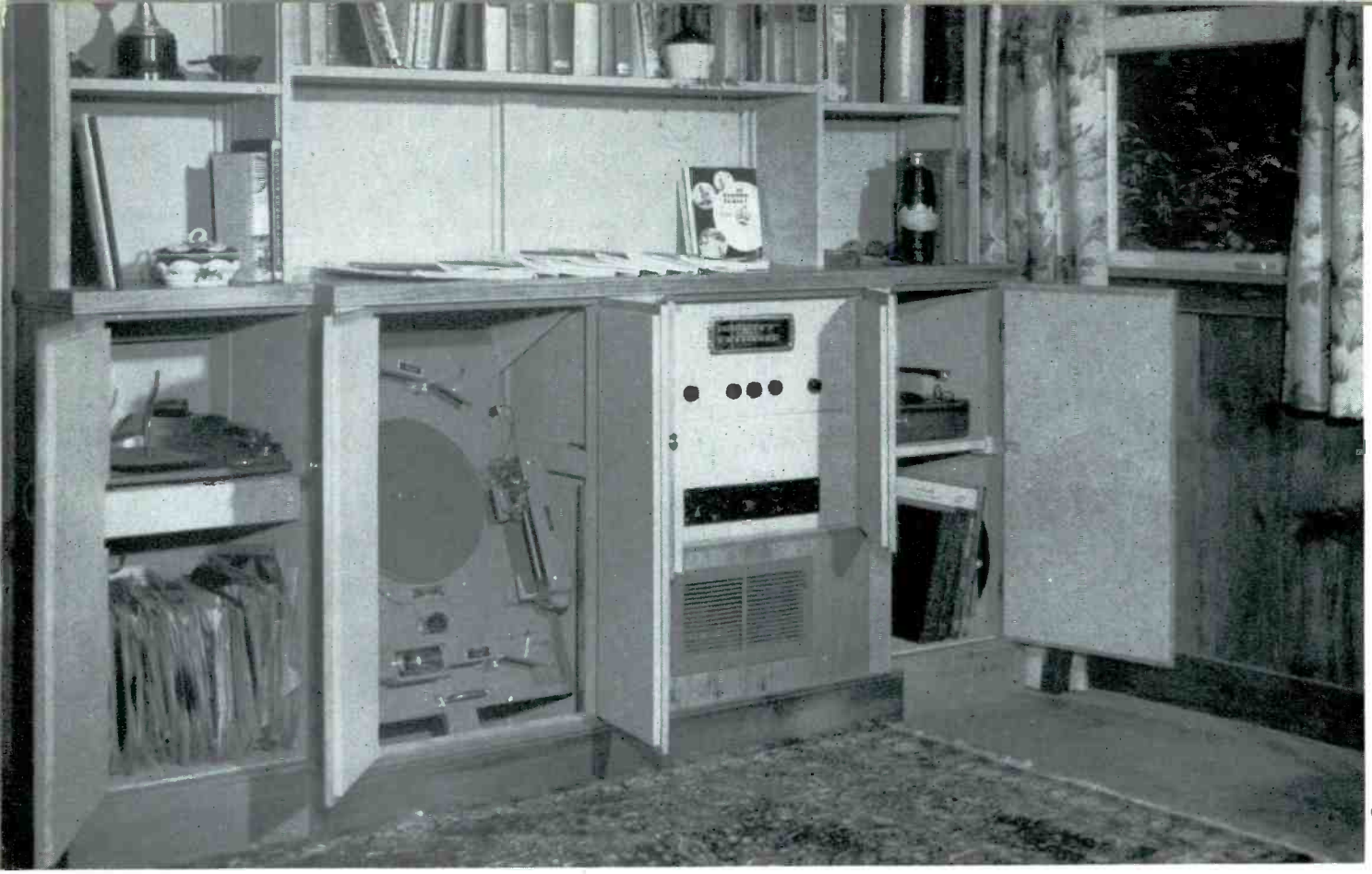
Continued on page 64



WHKY at Hickory, N. C., is typical of FM stations. Facilities include control and monitoring equipment, below, and transmitter and antenna tower, shown at right and above.







In the modern high-fidelity installation, preamplifiers and control units are the

AUDIO NERVE CENTER

ALAN C. MACY

THE nerve center of a modern radio-phonograph system is the preamplifier-control unit. The trend is more and more to simplify both the input and the output ends of the overall sound reproducing system: many of the best modern amplifiers do not even include an on-off switch, let alone a volume control. Similarly, radio devices, such as AM or FM tuners, which are used as sources of input to the amplifier, will often include no more than volume and tuning controls.

It is the purpose of this article to discuss the functions performed by the preamplifier-control unit as the nerve center of the entire installation, and to review typical equipment of this nature. Given an amplifier input source such as an FM tuner without any control other than a single tuning knob, being used with an amplifier which is similarly devoid of controls, the following list gives an idea of the large number of operations which must be handled by the control unit:

On-off switching of AC power
Input selection
Volume control
Preamplification for low-level inputs
Separate compensation for recording characteristics at both bass and treble ends
Bass boost and droop
Treble boost and droop
Noise suppression

Examination of the detailed list above will reveal that three basic operations are to be performed. The first is switching. That is to say, the fundamental on-off switching of the necessary pieces of equipment as well as switching from one input source to another. This may seem

simple, but a glance at Fig. 1 shows the number of separate units involved in a typical installation. Fig. 1 is, as a matter of fact, a block diagram of the illustration used on the opposite page, plus provision for a television tuner.

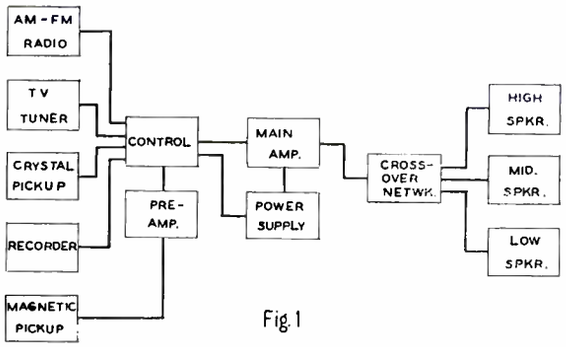


Fig. 1

The second operation may be called input compensation. We shall go into this in more detail subsequently but, essentially, it is adjusting the output of a phonograph pickup (or other program source) so that this output is fed into the amplifier with a flat frequency response characteristic, balanced to match the other inputs to the amplifier.

The third operation is what we may call response control. A few years ago this was simply a tone control, very often confined to one single adjustment on the amplifier which gave either bass or treble boost. Today response control includes not only bass and treble boost and droop, but also such refinements as noise suppression, dynamic range expansion, and high frequency cutoff to accommodate old phonograph records.

Switching Control of AC Power

One of the nuisance operations in a custom installation is that of turning on and off the various pieces of equipment. For instance, to play phonograph records, it is often necessary to turn on the phonograph motor, turn on the preamplifier for the reluctance cartridge, and then turn on the amplifier. Also, it may be necessary to turn some sort of a rotary input selector switch until the phonograph output is connected to the amplifier input. Manufacturers are beginning to take cognizance of this problem; several now provide one or two AC outlets which work in conjunction with the master amplifier switch.[1] But we have yet to see a commercial unit which includes a channel-selector switch operating simultaneously with an AC outlet-selector switch, so that when the former is turned to radio, the FM set and the amplifier are both turned on automatically without unnecessarily burning tubes in the television set and phono preamplifier. In the writer's own installation a series of six toggle switches are required, some with pilot lights. The whole thing, when illuminated, looks like a Christmas tree. Although it is not particularly convenient, it seems to be the only way to get the right things on at the right time.

The Need for Preamplifiers

With the trend toward amplifier units which can be tucked away in a corner and on which there are no controls whatsoever, manufacturers are producing basic units with a standard amount of gain. This is ordinarily about 70 db, which is to say that when the amplifier is fed with the average output of a tuner or crystal pickup, it produces full rated volume. The need for preamplification, or additional amplification ahead of the main amplifier, arises from modern use of reluctance pickup cartridges and other low level inputs which do not deliver nearly as much voltage to the amplifier as a radio tuner or crystal pickup.

A crystal type pickup may have an output voltage in the neighborhood of 2 volts, while a magnetic unit will produce 10 to 20 millivolts. If the amplifier is designed to operate from the output of a crystal pickup, some compensation must be made if it is to work equally well with an input which is only 1/100 as great. When a magnetic pickup is used, the preamplifier supplies amplification sufficient to raise the output voltage of the reluctance cartridge to that of a crystal pickup, thus providing an adequate input voltage to the amplifier itself.

Compensation for Recording Characteristics

The second function of the preamplifier is to compensate for characteristics which are inherent in the cutting of records. Fig. 2 represents an enlarged view of two adjacent grooves of a laterally engraved recording. In lateral engraving (which is used exclusively for commercial records), the cutting head transforms electrical impulses into mechanical side-to-side motion which is cut into the disc.

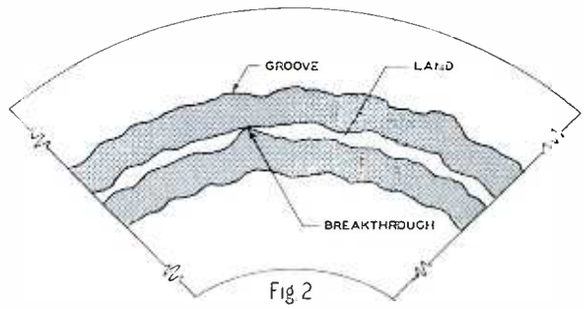


Fig 2

When the method of cutting known as the constant-velocity method is used, the extent of this side-to-side swing of the cutting stylus in the groove is determined by two factors. The first is the frequency of the sound being recorded. The second is the volume or intensity of that sound. Normally the amplitude of stylus swing is inversely proportional to frequency, as shown in Fig. 3, and directly proportional to volume.

A practical problem enters the picture at this point: the groove in the record must not be cut so wide as to break over into an adjacent groove. Note the breakthrough in Fig. 2. A certain ratio must be maintained between the maximum width of grooves and of lands (or space between grooves). This is usually in the neighborhood of 60-40 in favor of the grooves. Normally, a

[1]Philip Kelsey, whose article appears elsewhere in this issue, tells us that he used relays to handle this problem.

frequency around 500 cycles will require this maximum width, and any frequency lower than this, recorded by the constant velocity method, will exceed the width limitations. Therefore, a correction or control is applied when recording low frequencies. This is accomplished by adopting the constant-amplitude method. As the name implies, when this method is used, the amplitude of stylus motion remains constant regardless of frequency. This is shown graphically in Fig. 4. The predetermined frequency at which the shift from constant velocity to constant amplitude takes place is known as the turnover frequency and is not standardized among record manufacturers. The 500-cycle turnover shown in Fig. 5 is quite commonly used.

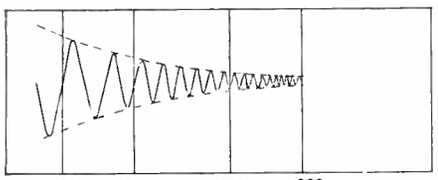


Fig. 3

The end result of this shift from constant velocity to constant amplitude is a reduction in volume in the frequency range below the turnover point at a rate of about 6 db — or roughly 50% — per octave. The frequency response characteristics of the pickup and its associated equipment must compensate for this loss. In the case of the magnetic type pickup, this need is acute since with such a device, the voltage output is proportional to the combination of velocity and magnitude of needle excursion. This means that throughout that portion of the record which was recorded at constant amplitude, reproduced volume corresponds with recorded volume, and bass boost must be applied to equalize the bass droop characteristic of the record. Since this droop is at the rate of 6 db per octave below the turnover point, it is customary to incorporate in preamplifiers used with reluctance type pickups, a boost circuit operating at the same 6 db per octave.

Preamplifiers range from extremely simple, straightforward units, such as the Pickering and GE types, to complete control units which incorporate elaborate compensating circuits. Both the Pickering and GE preamplifiers serve the primary purpose of raising the overall output of a reluctance cartridge to the proper level for direct input to the main amplifier. They also incorporate bass boost circuits to provide 6 db of gain per octave below an arbitrarily selected turnover point. This turnover point is normally chosen in the region of 450 cycles, and represents an average of the recording characteristics of leading record manufacturers. It is recommended practice to use a preamplifier designed to match a specific pickup since the response and impedance characteristics of the GE, Pickering, and other reluctance cartridges are not identical. Some of the more elaborate preamplifiers provide separate inputs, or switch controls, to compensate for differences in these magnetic cartridges.

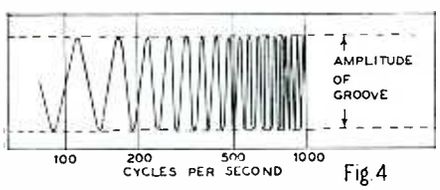


Fig. 4

Crystal Pickup Cartridges

In the case of crystal cartridges, preamplification is not necessary for most makes, since their output is sufficient to drive the standard amplifier of 70 db gain. The output of the crystal cartridge depends primarily on stylus excursion and not, as in the case of reluctance or magnetic cartridges, on the combination of excursion and velocity. Hence, it is not as necessary to compensate for recording characteristics in the constant amplitude section of the frequency spectrum.

There is, however, considerable variation in the overall response characteristics of crystal cartridges, most having slight bass and treble droop. Although not absolutely necessary, it is good practice to compensate for such characteristics by inserting a simple combination of capacitance and resistance between the cartridge and the grid of the first input tube of the amplifier. The exact values of resistance and capacitance are recommended by each crystal manufacturer for specific model pickups.

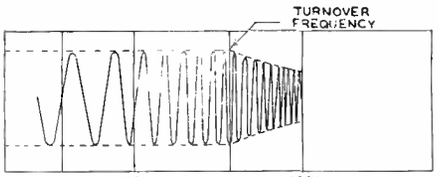


Fig 5

Variable Turnover

It was mentioned above that the simple preamplifier provides compensation for the bass droop in the constant-amplitude section of the recording, and starts to boost the bass at an arbitrarily selected turnover point. A refinement is provided in preamplifiers made by such organizations as Hermon Hosmer Scott, McIntosh, and others, which allows the frequency at which compensation starts to be varied. McIntosh provides a switch to give bass boost beginning at either 300 or 600 cycles. H. H. Scott goes one step further by providing 300-, 500-, and 800-cycle turnover compensation.

Controls to Adjust Input Levels

Several manufacturers provide individual level controls for one or more input channels. This means that tuners, phonographs, and other units can be balanced so that, with a specific setting of the master gain or volume control, all inputs to the amplifier will produce identical volume levels coming from the amplifier.

Treble Compensation

One additional compensation for recording characteristics is required for optimum fidelity to original sound. At the low frequency end of the audible spectrum, bass boost is needed to compensate for the switch from constant-velocity to constant-amplitude recording. At the other end of the frequency range, a slight treble droop is necessary because record manufacturers use pre-emphasis to raise the recorded level of high frequencies. Originally, this was done to make up for the inadequacies in both record-

ing and reproducing equipment. Record scratch was high: The high tinkle of the triangle would have been lost if pre-emphasis had not been used. Further, reproducing equipment was poor in the extreme-high range. With the development of modern recording techniques and high-fidelity reproducing equipment, the need for pre-emphasis is much less and recordings are being made with more nearly flat characteristics. Nevertheless, the standard NAB curve requires a 15 db boost at 10,000 cycles. Each record manufacturer uses a different degree of pre-emphasis, and — what's worse — changes this degree from time to time!

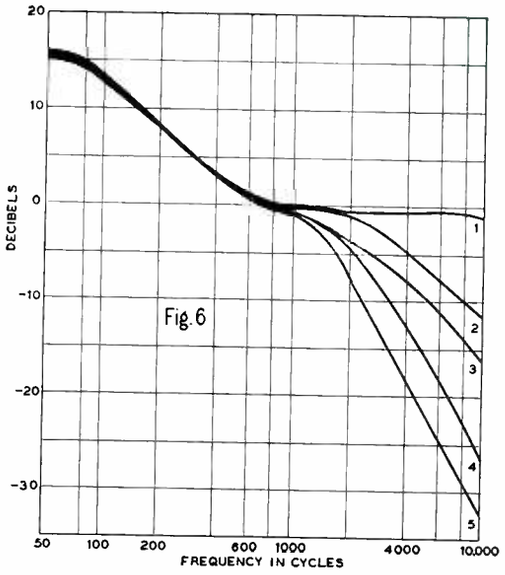


Fig. 6

Several record compensators or equalizers are available to counteract pre-emphasis. Designed for use by broadcast studios is the Gray equalizer, which provides five positions ranging from "flat" to "poor records". Fig. 6 shows the amount of compensating droop provided by the use of this unit. The Pickering compensator performs essentially the same functions, except that it has six degrees of droop. A unit is now available from Radio Shack which is specifically designed for use with GE cartridges.

It will be observed that each of these units has a "poor records" position. This is for old, scratchy records, from which it is desired to eliminate as much record scratch as possible. This problem will be discussed in more detail later.

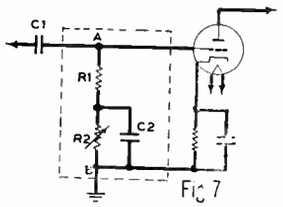


Fig. 7

Tone Controls

The many pieces of equipment which have been discussed so far are all designed to feed signals into the amplifier which are identical insofar as frequency response and volume level are concerned. The next step in audio reproduction is to change this frequency response to provide the most pleasing sound to the individual's ear and to permit variations to suit room acoustics and speaker characteristics. This is an elaborate way of describing tone controls — those knobs with which most all are familiar.

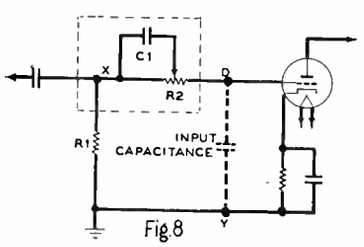


Fig. 8

The simplest type of tone control requires a single knob to adjust for bass boost in one position and treble boost in the other position. A more adequate and much more common system is to have two controls — one for treble and one for bass. Each should provide both boost and droop.

Two fundamental types of circuits are used, but the variations on each of these circuits are legion. A reference text[2] will show some 30 variations of circuits using only resistances and capacitances. In addition, there are combinations of inductances and capacitances. Practically any response curve can be designed by using correct values of RC (resistance-capacitance) or LC (inductance - capacitance) combinations.

A somewhat more complicated RC network will provide treble and bass droop as well as boost.[3]

Let us consider the simple bass boost circuit shown in Fig. 7. The grid-to-ground impedance is made up of R_1 in series with R_2 and C_2 which are in parallel. The voltage to be impressed on the grid of the tube will exist between the points A and B. The value of C_2 is chosen so that its reactance is much greater than R_1 at low frequencies, but smaller than R_1 at middle and high frequencies. The variable resistance R_2 covers a range from zero to a value much higher than the reactance of C_2 at low frequencies. When R_2 is at maximum, there is negligible shunting of C_2 causing maximum boost. As the frequency approaches the point at which the reactance equals the resistance, the impedance from grid to ground increases greatly and the gain of the tube rises accordingly.

The RC principle can be used equally well to achieve treble boost. At high frequencies, the loading effect of the input and output capacitances of the tubes becomes appreciable and causes a reduction in the gain of the tube. The input capacitance is represented by dotted lines in Fig. 8. The RC circuit employed in Fig. 8 compensates for the drop in the highs while not affecting the middle and low frequencies. The signal voltage appears across the R_2-C_1 combination in series with the input capacitance at high frequencies. The combination of these three elements acts as a voltage divider tapped at D with the grid voltage appearing across the input capacitance. The smaller the impedance of R_2-C_1, the larger will be the input voltage to the grid of the tube. This action applies only at high frequencies, since the input capacitance and C_1 are equivalent to open circuits at low frequencies. The value of C_1 must be low enough to block low frequencies and yet high enough to be large compared to the input capacitance of the tube. In most cases 100 mmf. is suitable.

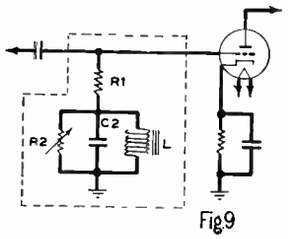
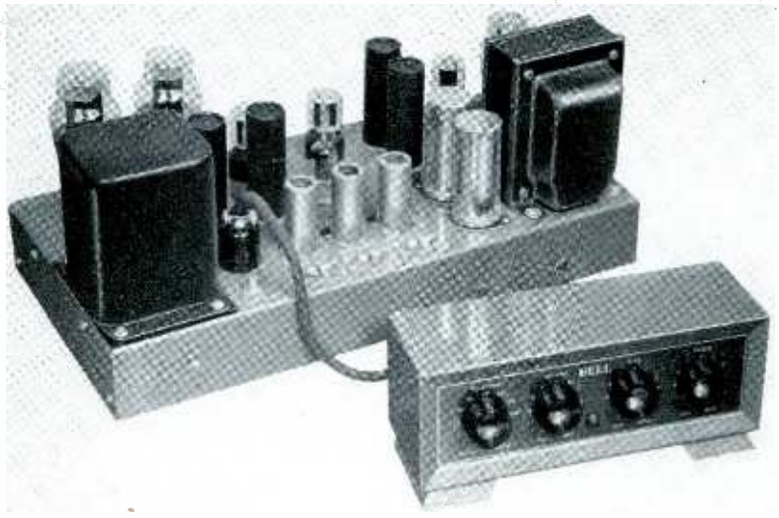


Fig. 9

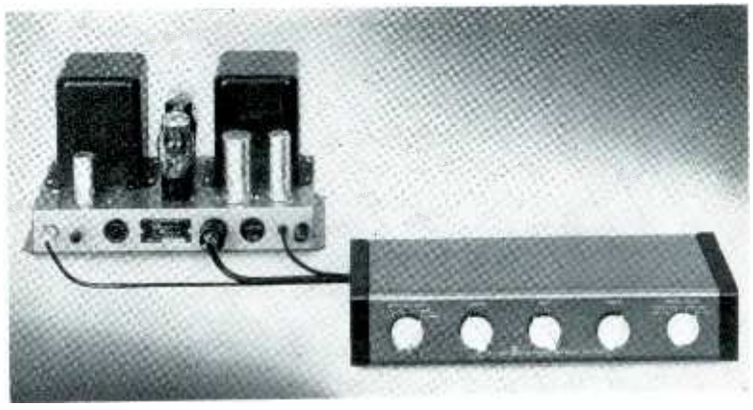
A second type of boost circuit uses inductances and the principle of resonance, and is shown in Fig. 9. Such a circuit has a very high impedance at or near resonance,

[2]Such as Annual Buyers' Guide Issue of *Electronics*, June, 1950.
[3]For a suggested circuit, see *FM-TV Magazine*, February, 1951, p. 36.

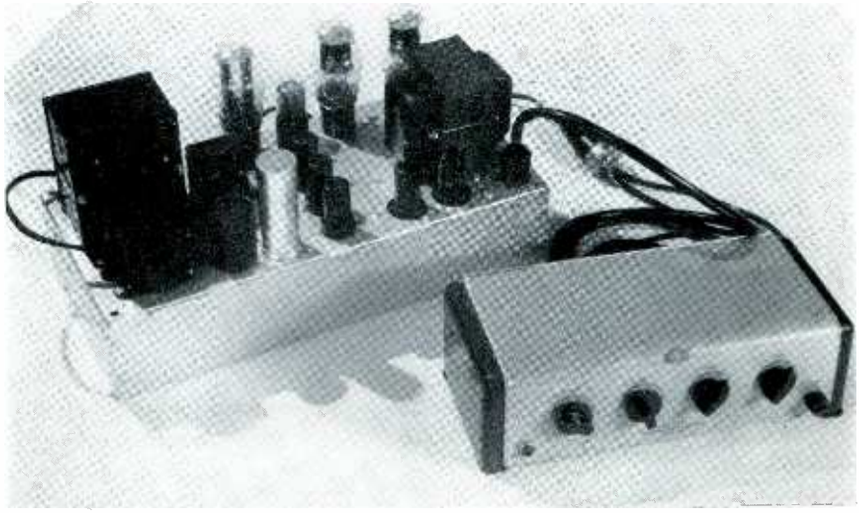


The amplifier developed recently by Bell is typical of chairside or remote control systems. The control unit provides a 7-position selector switch working in conjunction with a treble compensating network on phono positions, as well as the customary bass, treble, and volume controls. Unit must be used with its associated amplifier.

Unusual flexibility characterizes the Electronic Workshop preamplifier-control unit: each of four input channels has its own level control; compensation on the master volume control can be switched in or out; turnover boost operates at either 300 or 500 cycles; the usual tone controls are supplemented by a variable-frequency treble cut-off filter. Output can be fed to either an amplifier or a recorder, and a noise suppressor can be plugged in just ahead of the output.

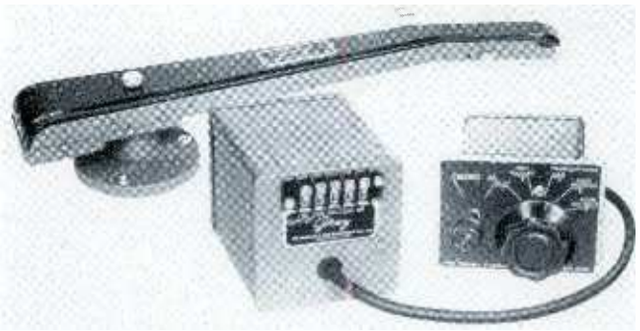


USING THESE REMOTE CONTROLS, ARMCHAIR LISTENERS CAN MAKE ALL AMPLIFIER ADJUSTMENTS WHILE RELAXING IN COMFORT



Remote control for Brook amplifiers provides switch selection of 5 input channels, with individual level adjustments; preamplification with 6 db per octave boost at average turnover frequency; compensated master volume control; and wide range bass and treble boost or droop.

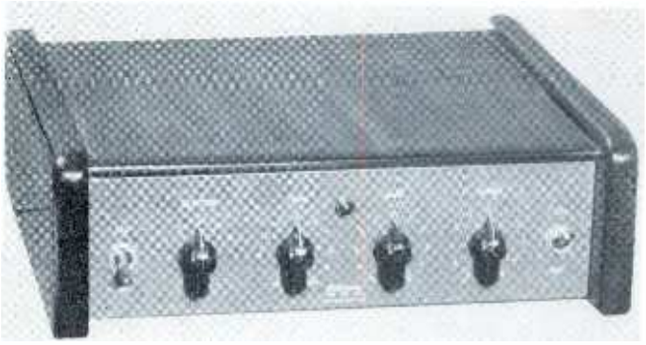
The Pickering unit is a good example of pre-amplifier-only equipment. Self-powered, it compensates for pickup characteristics and for average turnover-point droop.



Gray unit provides 5-position treble equalization, and input matching for G-E and Pickering cartridges. Viscous damped tone arm "floats" on record.

Equalizers, from Pickering and Radio Shack (Boston), compensate for pre-emphasis of treble used in commercial records. Radio Shack unit matches G-E reluctance pickup.

By adding a separate power supply, the McIntosh preamplifier can be used with any high-fidelity amplifier. A switch permits operation of turnover control at either 300 or 600 cycles. A 5-position input selector switch, and treble and bass controls, are provided.



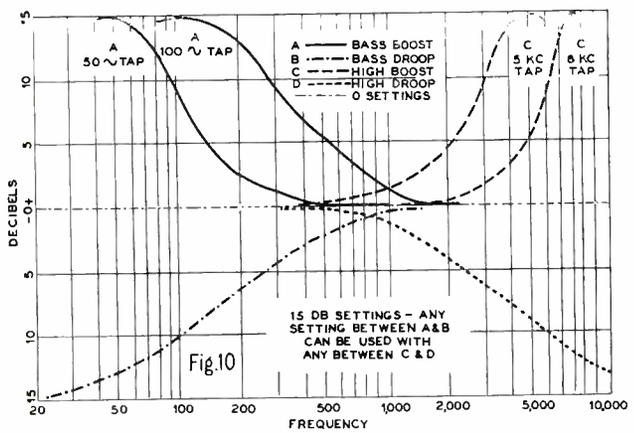
In addition to its primary feature of noise suppression, the Scott preamplifier incorporates turnover control at 300, 500, and 800 cycles, and an input level control.

AUXILIARY AUDIO CONTROLS INCLUDE THESE PREAMPLIFIERS, TURNOVER CONTROLS, AND THE NOISE SUPPRESSOR

but decreases at non-resonant frequencies. If, then, the L-C_2 combination is chosen to resonate at a frequency just below the lowest frequency to be amplified, the impedance will be high in these lower frequencies, and will become less as the frequency increases. This added impedance increases the gain correspondingly. The same circuit can be used as a treble boost if the components are chosen so as to cause resonance at a frequency just above the highest frequency to be amplified.

Resonant circuits are also used to reduce as well as boost both low and high frequency response. UTC, for instance, manufactures a complete unit which can be inserted between plate and grid to provide the response variations shown in Fig. 10.

One point in connection with the use of these circuits must be mentioned, however. When boost circuits are



used they cause an overall reduction in gain, called insertion loss. Therefore, the amplifier with which they are to be used must be designed with a higher gain than would otherwise be necessary.

One of the characteristics of tone controls is that the boost or droop acts at a fairly slow rate and starts in the middle of the frequency range. That is to say, it may operate at 3 or 4 db per octave from a mid-range of 1,000 to 1,500 cycles. Treble droop is sometimes used to reduce the scratch noticeable on older recordings, but a more adequate solution to the problem is provided by filters or cut-off circuits which are designed to operate at specific frequencies and, by causing a very rapid droop, to eliminate all response above that frequency.

A treble cut-off filter, such as the one incorporated in the Electronic Workshop amplifier, provides four positions: 3,000, 5,000, 8,000, and wide open. Treble response in each of these positions is shown in Fig. 11. Such controls are frequently called scratch eliminators, and all are static. That is to say, once set in a given position, they cause the same amount of droop or cut-off at all volume levels and affect musical frequencies as well as scratch. Thus, if set for a 4,000-cycle cut-off, everything above this frequency will be eliminated as completely as possible.

Dynamic Noise Suppressors

One of the aspects of scratch suppression is that it isn't necessary all the time. When the music is soft, scratch becomes noticeable and, to many people, very annoying. On the other hand, scratch cannot even be heard in the forte passages of a selection. Hence the ideal answer to the problem would be a scratch eliminator which operates only part of the time: when the music or sound level falls below the scratch level.

Scott developed the dynamic noise suppressor to operate exactly this way.

The noise suppressor is a device which controls the bandwidth (or frequency range) of reproduction automatically and continuously according to the volume and frequency characteristics of the music. During a loud passage, the band is extended, while during a soft portion it is contracted, this extension and contraction being independently controlled at both ends of the spectrum. Thus the noise is reduced when it would be most noticeable (low volume passages) and full bandwidth is used when it is most necessary (at high levels).

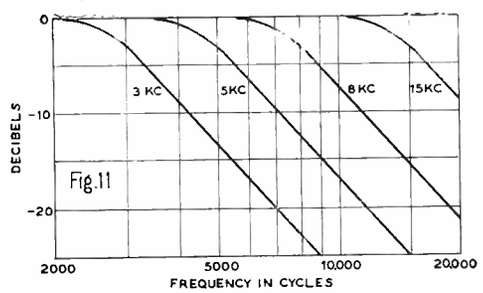
Circuitwise, the system consists of reactance tubes acting as gate circuits controlled independently by diode circuits which are so designed as to give a response approximating that of the human ear.

The dynamic noise suppressor solves many annoying problems. Since some designs operate at both low and high frequencies, they reduce hum and rumble on the low end and scratch on the high end. Other noise suppressors, such as the Somerset, provide suppression only for the high end.

Last, but far from least, in this list of equipment comprising the nerve center of a reproducing installation, is the volume control. Generally, this is a simple device, one with which all are thoroughly familiar.

Compensated Volume Controls

Recently, compensated volume controls have come into more widespread use. They are not new; in one form or another, they have appeared in a few commercial sets for twenty years. But it is only the increased interest in high-fidelity sound reproduction that has focused attention on their value. The desirability of such a volume control arises from a peculiarity of human hearing: as overall



volume level is reduced the extreme lows and highs are not as well heard. A graph of human hearing sensitivity shows a hump in the middle frequencies under all conditions. As the intensity of the sound decreases, the height of this hump increases.

Hence, the compensated volume control circuit, which introduces slight bass and treble boost as the volume level is reduced, becomes a desirable feature.

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One of the foremost authorities on recorded music explains the reasons for the limited repertory of the great symphony orchestras, and discusses the rapidly growing wealth of seldom-heard classical music which is now becoming available for home enjoyment through the activities of the recording companies. Some specific releases are listed as outstanding examples.

REPERTORY UNLIMITED

C. G. BURKE

EVERYONE nowadays fears a survey, particularly when a company buys one that is biased to demonstrate some preposterous advantage of its cure-all, and then sickens us by calling it "impartial". So we shall not call this a survey. We shall just take a look. We are not going to try to prove anything, but we are going to see if we can discover something about the enduring attraction of the most highly-organized sounds. The great writer, Anatole France, rationally called music organized noise; and there is no reason why we should not accept the generality in its broadest implication. That was not a definition, and it conveyed a sneer, which comforted the great skeptic for his extreme tone-deafness, almost as complete as Macaulay's. The poor devil was unable to take pleasure in the results of the organization, and was not interested enough, because of his rudimentary aural sense, to examine its complexities.

These, as in a Richard Strauss opera, can surpass the intricacies of any other art. In a simple wordless vocal air there are no complexities at all. Between the two — the child's uncertain *la-la-la* and Strauss's *Elektra* — are a thousand formal mutations in as many degrees of complexity. The American people, for better or worse, through a combination of causes not essentially or purely musical, have a greater familiarity with the complexities offered by the modern symphony orchestra than with any other "organized noise" except such as is basically utilitarian.

Now utilitarian music is certainly the most widespread of all, but it will not be considered here precisely because it is utilitarian: that is, subordinate to nonmusical purposes. It includes military music designed to facilitate marching, college yells and songs intended to inspire halfbacks to self-immolation; dance-music which is slave to dancing, popular songs functioning like a dilution of cantharides; a sizeable proportion of contemporary church music; and last, certainly least, the unspeakable abomination of corrupt cretin jingles extolling soaps, deodorants, and chewing gum. Some of these utilitarian categories escape and pass over into the domain of pure music; there are dance tunes by Jerome Kern and Vincent Youmans that have real musical value; and many military marches have intrinsic interest along with a minority of current church music. These are honorable exceptions. The bulk, like the house-fly, is born, serves a purpose, and dies, without leaving an impression that does not quickly fade.

Of all the lasting musical types, opera is the one intrinsically widest in the scope of its appeal, since it offers, besides music, a plot, characters in dramatic movement, scenery, and other diversions for the eye and mind supplementary to the entertainment of the ear, or in substitution for it where musical passages seem dull. Gluck and Wagner particularly, among others, insisted on the amalgamation of all the arts within a frame of opera. It is plain enough that opera, properly mounted, displays poetry, dance, music, architecture, painting, and acting in varying degrees of prominence and excellence. Naturally, more people are susceptible to the appeal of some arts than of others; but social and financial circumstances peculiar to the English-speaking world have transformed operatic audiences from heterogeneous ones representative of all classes of society to quite special ones representative of the wealthier echelons.

Space is not available to show how this happened. Attendance at the opera curiously conferred prestige by association on the attenders at the very beginning of opera's American history, and the tradition has crystalized so solidly that newspapermen today, referring to the Metropolitan Opera in New York, invariably evoke images of an audience instead of a stage. Our country has one opera company on a permanent basis; Germany and Italy have fifty.

Chamber music, defined for convenience as music that

is played by more than two and fewer than fifteen musicians, is not relatively prominent on the American musical scene. Lacking the spectacular resources of color and harmony possible with larger groups, it demands special efforts of concentration, and its repertory is much smaller than the symphonic repertory. Symphony orchestras are usually heard in auditoriums seating from two thousand people. String quartets cannot attract audiences large enough to fill such places, nor should they, their volume being insufficient to fill great spaces.

Finally, there are recitals given by a single musician, usually with a subdued accompaniment. Here music is definitely subordinated to a singer's or performer's repute. There may or may not be a genuine musical interest at the recital of a celebrated performer; the great audiences are drawn by the bait of ballyhoo, *reclame*, publicity, and by skillfully promoted legends pointed to stress the personality and not the musicianship of the musician. Let us hastily give a rather tired kind of example, offered only because it is so superior in pungency to any other: Suppose Miss Margaret Truman and Miss Elisabeth Schwartzkopf are scheduled to sing the same night in a middle-sized American city. Which of the two houses will be filled? And which will have had the more musical experience? Paderewski, in his last recitals, demonstrating only the ruins of a prodigious ability, attracted myriads come to see a Grand Old Man. He had become a mere spectacle.

THE symphony orchestra, which must appear in the same place week after week, looking much the same — seventy to a hundred and ten men as ordinary looking as any group of similar size must always look, uncomfortable in little chairs, illumination reflecting from bald spots while they blow or saw ridiculously at ludicrous contraptions of wood or metal — soon loses the magnetic force of novelty. There is nothing much to look at. Conductors can aggravate their fame by superfluous antics which the superficial may find entertaining for a time, but ultimately the tricky mannerism palls, the meretricious histrionics are exposed as nothing more, and the orchestra gets a new conductor. For most symphony auditors are regulars who, by repeated attendance through subscription, become veteran and expert. Whatever their sensibilities at their initial concert, they inevitably develop a sense of tonal values. An orchestra on the down grade — and orchestras have their ups and downs — learns it tragically by the grim testimony of diminishing audiences.

There are more symphony orchestras in the United States on a regular basis than in any other country. There are now nearly thirty, and only Germany approaches this American phenomenon. Some are venerable, like the New York Philharmonic-Symphony, more than a hundred years old; the Boston Symphony, seventy; the Chicago, Cincinnati, and Philadelphia Orchestras, all more than fifty. Some are young. One, the Houston Symphony, is just beginning life. In addition, a number of cities with a population of a hundred thousand or more have orchestral associations which give a small number of symphony concerts annually from a membership whose livelihood comes from other sources. Naturally, such concerts do not exhibit the polished proficiency of the organizations on a permanent footing, but they do contribute substantially to the country's musical experience.

Since this contribution — by all the orchestras, permanent and intermittent — consists not of merely being, but of playing, we can obtain a very good conception of American musical taste by an examination of the repertory of the orchestras. We note at once a nation-wide resemblance: the programs of the San Francisco Symphony are in essence like those of the Boston; Pittsburgh's do not differ much from Chicago's. Local peculiarities produce some minor differences: the French conductors at Boston and San Francisco include more modern French music in their programs than is customary elsewhere; Philadelphia has a slight Hungarian bias, as Pittsburgh had when Reiner was there. Boston is more hospitable to the music of Leonard Bernstein, Rochester to Howard Hanson's and Philadelphia to Harl McDonald's, than other cities are. But those are subordinate flavors inserted by the pinch, hardly modificative of the basic recipe which could have been composed by the same chef for the whole Country.

Analysis of the programs of the three most prominent orchestras — at Boston, Philadelphia, and New York — yields an epitome characteristic of all. Over a three-year period of more than a thousand concerts by this trio, we find the following composers most frequently performed: Beethoven, Brahms, Tchaikovsky, Wagner, Mozart, Schubert, Richard Strauss, and Bach. About half the music played was composed by these eight men. The works of nearly a hundred composers were drawn upon for the remaining half. The great preponderance is German, and Nineteenth Century; both to be expected, although not to be approved in their margin of leadership. At the beginning of the Nineteenth Century, the symphony orchestra, steadily developed by Haydn, was expanded by Beethoven along lines that Haydn had implied but Beethoven followed by personal compulsion. Thereafter, the orchestra throughout the century received successive violent stimuli from Berlioz, Wagner, Rimsky-Korsakov and Strauss to achieve the magnificent instrument we now take for granted. The period of nearly a hundred years required to complete the orchestra was also the period of acknowledged German musical domination, if not necessarily of the best German music, the preceding century having nourished an incredible and unprecedented procession of masterpieces from Bach, Handel, Gluck, Haydn, and Mozart.

There was never another century like it. Those five composers have had no superiors and very few peers. The greatest men who followed — Beethoven, Schubert, and Wagner — were no better, although they benefited from richer resources and the restless freedom conferred by romanticism.

It is precisely those richer resources which impose on our symphonic programs a far larger proportion of the great music written after Beethoven's *Eroica Symphony*

than of that composed before. Beethoven himself is well represented on our programs: over a three-year period, about half of his orchestral production may be heard. Brahms is the most favored, with nine-tenths of his orchestral work performed. Tchaikovsky, Wagner, Strauss, Stravinsky, Prokofief, Ravel — composers characterized by brilliant orchestration — receive generous treatment. The symphonies of Sibelius, employing a full-throated Tchaikovskian orchestra, are played in greater number than those of Mozart who wrote five times as many — in a much simpler instrumentation. Haydn wrote more truly great symphonies than anyone who has lived or will; but the number performed in America in three years barely exceeds that of our noisy contemporary Shostakovich. It is true that the name of Bach appears with considerable frequency on our concert programs, but in connection with a woefully restricted list of works selected from a huge abundance unperformed. Gluck's best music is in opera. Magnificent excerpts are available; all, except two or three, neglected. Handel's huge masculine utterance is confined to the repetition of a few familiar statements.

Italian, French, and English contemporaries of the great Germans are neglected to an even greater extent. It is fair to say that our great symphony orchestras play less than one percent of what is available from the masterpieces created during the most fecund, most diversified, and least ephemeral of musical epochs.

This, indeed, is a pity, but the conditions under which symphony orchestras exist make it — although perhaps not to such an inclusive degree — inevitable. The modern orchestra must play basically music written for its tonal wealth. An orchestra like the Boston Symphony has a string band of sixty-six, three each of flutes, oboes, clarinets, and bassoons joined to piccolo, English horn, bass clarinet and contra-bassoon; six horns, four trumpets, four trombones, tuba, and two harps; and a percussion section banging away at kettle-drums, bass-drum, snare-drum, triangle, cymbals, glockenspiel, chimes, gong, tambourine, and intermittent added oddities. Thus it cannot play such fragrant emanations of the human spirit as Haydn's delectable symphonic triad *Morning, Noon and Evening* (Symphonies 6, 7 & 8) with out silencing most of its expert mass, expensively assembled and trained, ready on the stage to play. For these early Haydn symphonies call for a flute and bassoon, two oboes and two horns, with a string body that does not need to exceed twenty or thirty. When thirty are called from a hundred available, seventy are wasted.

Sometimes we see them wasted, when half of the orchestra's complement will play a Mozart or Haydn symphony or a Bach suite. More often we go months without the Haydn, Bach or Mozart.

The Seventeenth Century has not even been mentioned, because the conditions which militate against performances of Eighteenth Century music are of even greater force in denying expression to earlier music. We find then that the American musical experience in public performance is in general rigorously limited to the orchestral production of one century, plus those few works of our own dubious Twentieth which have established themselves, and a greater number possessing the evanescent value of novelty.

The paradox is that we here in America may now hear a greater wealth of Eighteenth Century music — and an incipient treasury of the Seventeenth Century — than has been presented here throughout the three hundred years of our continent's Europeanization.

The unprecedented quantity is not, of course, available through public performance. It is a wealth suddenly and almost miraculously created by electro-mechanical means. It comes to us over the air, from certain special and selective radio stations or at special and selective hours; or we have it at our whim and convenience if we have a phonograph good enough to reproduce its virtues.

The long-playing, 33-RPM microgroove disc, whether played at home or heard by broadcast, has brought the hidden realms of music into prominence. We have had records for more than fifty years, and for twenty-five had been slowly amassing a musical repertory of very respectable scope when the advent of microgrooves, not three years ago, brought an uncontemplated and bewildering acceleration of the rate of recording masterpieces, along with a great improvement in the quality of reproduction. The pre-LP repertory had come to include all the standard works that we hear in concert, besides a number seldom heard, but the simplified technique of recording on tape before transferring to disks lured a number of new companies into the promotion of records, and some of these have shown a sensitivity to the requirements and the lacunae of recorded repertory that the older and larger manufacturers had never considered.

One new company, the Haydn Society, has issued twenty-five Haydn symphonies *never before recorded*, most of

Of all the masterpieces created during the 18th and 19th centuries, music's most fecund and diversified epoch, not more than one percent are ever played by our great symphony orchestras. Why? For a reason primarily economic: the modern symphony orchestra is composed of seventy to one hundred highly trained and well paid musicians. When only thirty are called from a hundred available, seventy are idle and wasted. Hence the symphony orchestra must play music written for its full tonal wealth. But the economics of recording operate in the reverse direction. The advent of tape and of LP records has opened to us a vast treasury of compositions which otherwise would not be heard in centuries. Thanks to improved recording techniques and the fast-spreading appreciation of better reproducing equipment, we now have at our fingertips a musical repertory truly unlimited.

them never previously performed in America. Another newcomer, the Westminster Recording Company, specializes in first recordings of both Eighteenth and Nineteenth Century music. Allegro and Mercury records emphasize lesser-known works of the greatest composers, regardless of their epochs, which is also the policy of EMS. A number of new organizations record in Europe for American consumption compositions of an interest so special that it is felt the larger American companies will not bother with them. London, in repertory the most inclusive of all, ambitious and aggressive, maker of the best 78-RPM records we knew, ignores no composers, recognizes all periods, and records all over Europe. The predilection of Centra-Soria is for discs made in Italy of Italian operas which are worth more frequent hearings than they receive. The titans of the industry, Victor and Columbia, are more cautious than their new colleagues, and a great deal more cautious than titans. Their records incline towards music already pretty familiar in performance, despite issuances of such things as Debussy's *Jeux* for the first, and Beethoven's neglected *Serenade*, Op. 25 for the second.

This LP torrent, whose velocity and volume rise as the months pass, is establishing a musical reservoir immediately at hand, and vast beyond the optimistic expectations of a few years ago. It is possible now for Mr. Jones and Mrs. Smith to hear more music than Toscanini ever heard, more than Bach imagined could be, more than is publicly performed by all the musicians in any country in a decade. Mr. Jones and Mrs. Smith have at hand not only the symphonic but the operatic repertories in large measure, the greatest works of chamber music, and everything a recitalist ever sings or plays. They have Bach on records, not only J. S., but J. Christian and K. P. E.; they have Beethoven in all his aspects; a dozen works of the appealing Boccherini and nearly as many by the formidable Bruckner. They can hear Carissimi, Cimarosa, Couperin le Grand and Arriaga; ten slighted works of Dvorak; Handel in some diversity; more than a hundred major compositions of Haydn, and a very generous display of Hindemith. There is at the moment a tendency to admire Charles Ives: he is available in greater quantity than Berlioz on LP.

Where can fifteen symphonies and twenty-five concertos by Mozart be heard? In the concert hall, over a period of twenty-five years; on LP, now. Ravel and Prokofieff are lavished almost beyond their deserts. The two Scarlattis, Schonberg, the younger Johann Strauss, Richard Strauss, Stravinsky, Tchaikovsky, Telemann, Viotti and Vivaldi receive more deference in the recording room than in the concert hall.

Thus the catalog, even in these early days of LP, is impressive enough to evoke respect. The fifteen hundred records so far issued are equivalent to nearly seven thousand old short-playing records. The extent in so short a time is amazing, and the repertory is sensational. How well do the records capture the repertory? To what degree is the lavish profusion justified in terms of quality, not only of performance but also of reproduction?

Both have been extraordinarily variable. Many of the newer companies, in their rush to mount the LP bandwagon, perpetrated recordings of extreme technical ineptitude. Others employed the first musicians available, regardless of their affinity or talent for the work to be recorded. In a few cases the worst performers were given the worst possible recording, resulting in disks cherished by collectors of the bizarre. Many of the earliest LP's were mere dubbings from 78's, and were not only limited by the quality of the originals but added some defects in the process of transfer.

Contrariwise, some of the first were sensational successes which assured the triumph of the microgroove method. As a rule, every company has had to undergo a period of trial, error, and correction. In some cases, the period was protracted, and the emerging records remained obstinately mediocre. It now seems to be true that all companies which have been in operation for at least six months are capable of turning out excellent LP's unblemished by gratuitous failings. Columbia, the pioneer, produced at first very uneven work, but for more than a year has turned out consistently good records with a notable tendency towards regular, slight improvement. Victor profited from the Columbia experience and made first-rate LP's after a delayed start. Capitol has shown consistent skill in transferring from 78 to 33. An initial engineering intoxication with high frequency for its own sake, resulting in records of appalling shrillness and distorted balance, has been slept off and left no hangover. Westminster records used to suffer from this disability, but effected a spectacular cure: in the fall of 1950 they revealed, without any warning, a sudden expertness in orchestral recording which has put their subsequent discs into the very highest technical class.

Examples of the high standards achieved, which we may certainly assume will not deteriorate, are abundant. A few are mentioned to serve as a basis of comparison:

EIGHTEENTH CENTURY ORCHESTRA

HAYDN: *Symphonies No. 42 & 47* (Haydn Society HSLP-1026). This almost tangibly places the small orchestra in the living room.

HAYDN: *Symphonies No. 95 & 100* (Westminster WL-5045). Notable for balance, solidity, and detail, this record is in a special class for music of the period.

SCHUBERT: *Symphony No. 2* (RCAVictor LM-41). Unspectacular but faithful demonstration of the cohesive unity of the Boston Symphony Orchestra.

STANDARD ORCHESTRA

BIZET: *Suite from Carmen* (Columbia ML-4287). Generally rather sensational, and most admirable in transparent clarity of the wood.

BRAHMS: *Symphony No. 4* (London LLP-208). Contrives to roll up dark and heavy tonal masses into a solid and smooth wall of sound.

TCHAIKOVSKY: *Nutcracker Suite* (RCA-Victor LM-46). This features a startling delineation of the various orchestral choirs, each in sharp distinction from the others.

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The author of this article has engineered some of the finest custom installations in the New York area. Photographs of a few of his more recent ones are presented here for your inspiration, and to suggest methods of handling your own installation. Major problems are discussed in the text of Mr. Kelsey's article.

The installation illustrated on this page is at one end of a high-ceiling room 30 by 40 ft. Equipment includes a Browning RJ20 FM-AM tuner, H. H. Scott amplifier, Radio Craftsmen TV chassis with a 19-inch picture tube, and Webster record changer with a G-E cartridge. An Altec 604-B speaker is mounted on a very heavy baffle behind the grille, above the TV screen. Ventilation is provided by air coming in behind and under the record storage drawers, under the amplifier and changer. The partition behind the bookcase is 12 ins. deep and completely open, thus allowing additional ventilation and facilitating work on the equipment when necessary. The antenna installation is on a 90-ft. pole.

. . . For your INSPIRATION

PHILIP C. KELSEY

NOT SO MANY years ago, radio sets were made up of separate instruments mounted on breadboards, and phonographs were mechanical devices powered by spring motors. Remember the Victrola cabinets (they seemed so graceful!) that came into fashion as a means of hiding the earlier morning-glory horns? And the six-legged highboys that concealed the loudspeakers of the twenties? They seem almost totally unrelated to the trimly inconspicuous custom installations of today. Even the big, expensive consoles, once so highly prized, are incongruous in comparison, and certainly unnecessary!

Why are custom installations, such as the ones illus-

trated on these pages, so popular? Why are people, all over the country, discarding pieces of furniture[1] in favor of what appears to be simply a bookcase, a closet, or even nothing but a wall?

Advantages of Custom Installations

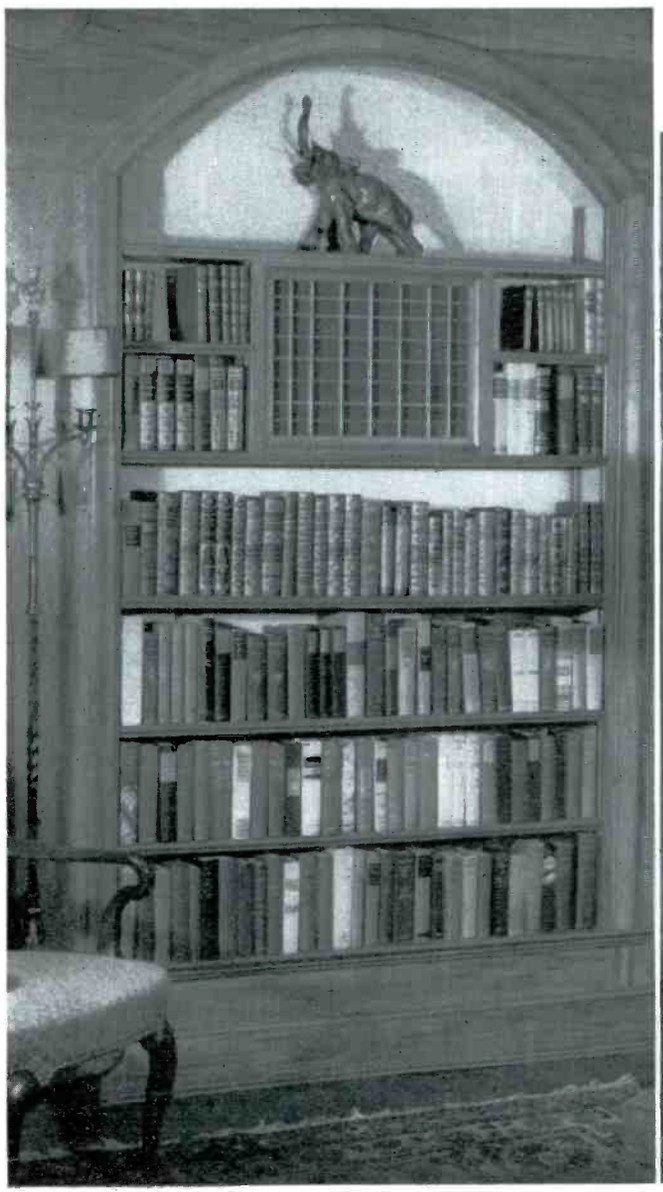
The advantages of a custom, or built-in, installation over a commercial radio-phonograph console are many. They can be realized in a complete system costing several thousand dollars, or in one whose cost will not exceed a hundred. In this article we shall review major advantages and supplement the discussion with illustrations of several relatively elaborate installations. We have excluded photographs of simple installations purposely: it is easy to simplify but difficult to elaborate. It is more difficult to figure out ways and means of handling a complicated arrangement of equipment than it is to reduce a complex one to two or three basic ingredients. Furthermore, every installation should be planned with a very definite idea in mind of its final arrangement. Even though at the beginning all that is required is space for a turntable, amplifier, and speaker, provision should be made *at the beginning* for the ultimate inclusion of a television receiver, FM tuner, and whatever other equipment can be foreseen.

[1] The oft-repeated story of the husband and wife examining the dealer's finest consoles comes to mind. Husband asked wife if the cabinet were period furniture, to which wife replied scathingly, "That isn't furniture, period!"

Functionalism in Design

Certainly one of the reasons why custom installations are becoming increasingly popular is that the public appreciates functionalism in architecture, furniture, and decoration far more today than it did even ten years ago. The big console radio is most certainly not functional. It is seldom even decorative, and often presents a major problem of furniture arrangement. Furthermore, with the trend toward compact living quarters, the console unnecessarily occupies valuable floor space.

From the functional point of view, a radio or phonograph is the exact reverse of the saying about a child: it is to be heard, not seen. The fact that a console is impressive to look at does not correlate with its impressiveness to the ear. More and more people now realize that there is far more to be heard from a phonograph, for instance, than they had been led to believe from prior experience with commercial consoles.



Better Audio Performance

Probably the outstanding advantage of a custom installation[2] is the superior audio performance which may be achieved. The specific reasons for this are complex, involving not only acoustics but industrial economics as well. In regard to the latter, it must be remembered that the problem of the radio manufacturer is to sell his products in a highly competitive, mass market and still allow a whole series of organizations and individuals a fair profit. As an example, the radio cabinet itself goes through a whole series of steps. The manufacturer probably does not build his own, so he buys them and must allow the cabinetmaker a profit. Then the cabinets have to be shipped to the assembly plant, uncrated, the equipment put in place, recrated, reshipped to a wholesaler, to a jobber, to a dealer, and finally to the consumer. There are labor charges and profit mark-ups in every step. Yet there is no alternative, and it is a remarkable aspect of our industrial economy that radio sets can be bought at such relatively low prices. On the other hand, when an amplifier is purchased for a custom installation, there are probably only two steps, instead of a dozen: from manufacturer to jobber to installer. Thus better quality can be secured for the same number of dollars, and better quality means not only better acoustic performance but, because components are superior mechanically and electrically, longer life and less servicing.

Speaker Placement

It certainly is not an understatement to say that no reputable designer of speakers and their associated enclosures would consider the average radio-phonograph cabinet and speaker unit worthy of even careless use of the term "high-fidelity". From the usual combination of AM tuner, pickup and amplifier housed in such a cabinet there is not much chance of anything very high in the way of fidelity reaching the speaker. Even if it should, the very low

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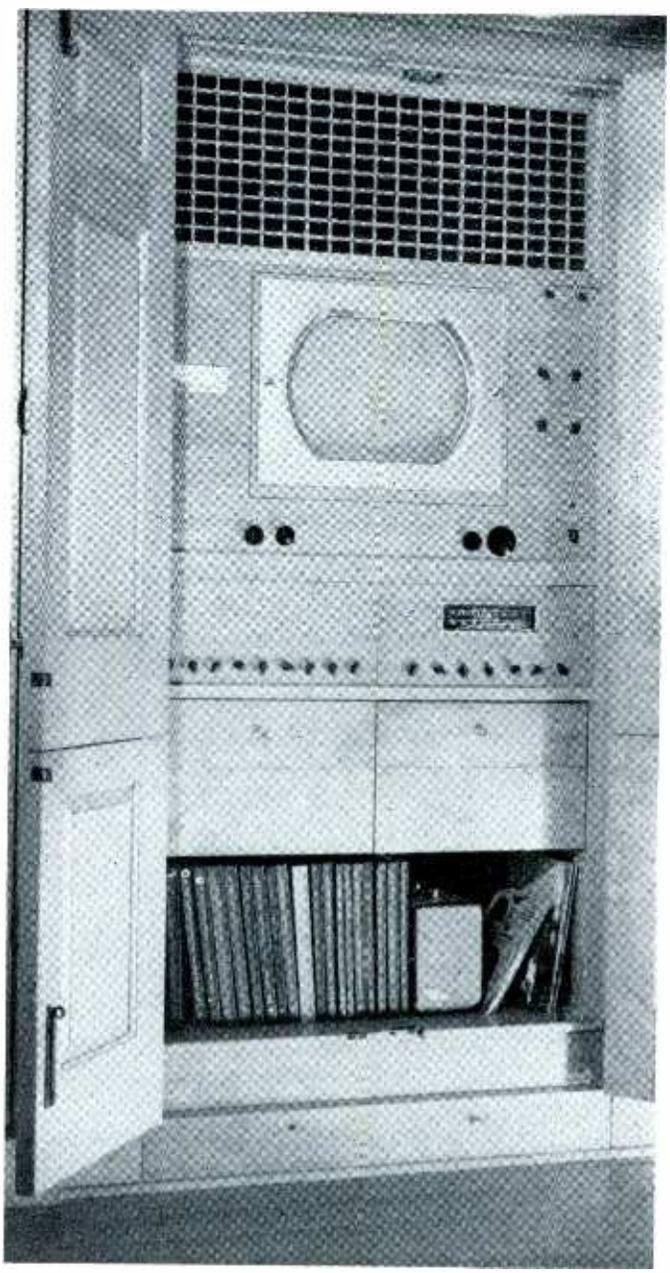
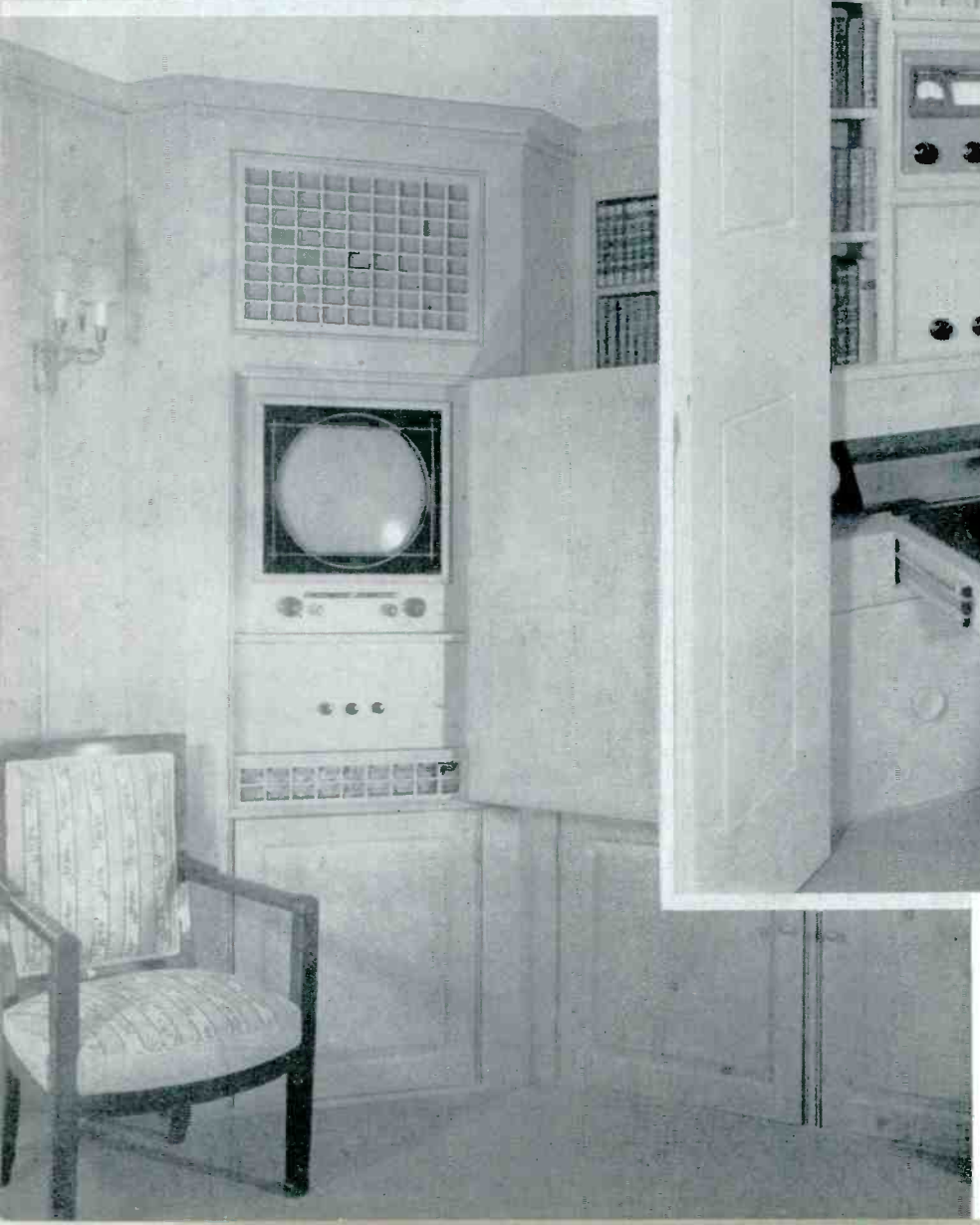
[2] The term "custom installation" is used loosely throughout this article, to include the whole range from wiring an amplifier oneself, through the relatively simple connecting together of units, to the hiring of an engineer to design and supervise the installation of a complete system.

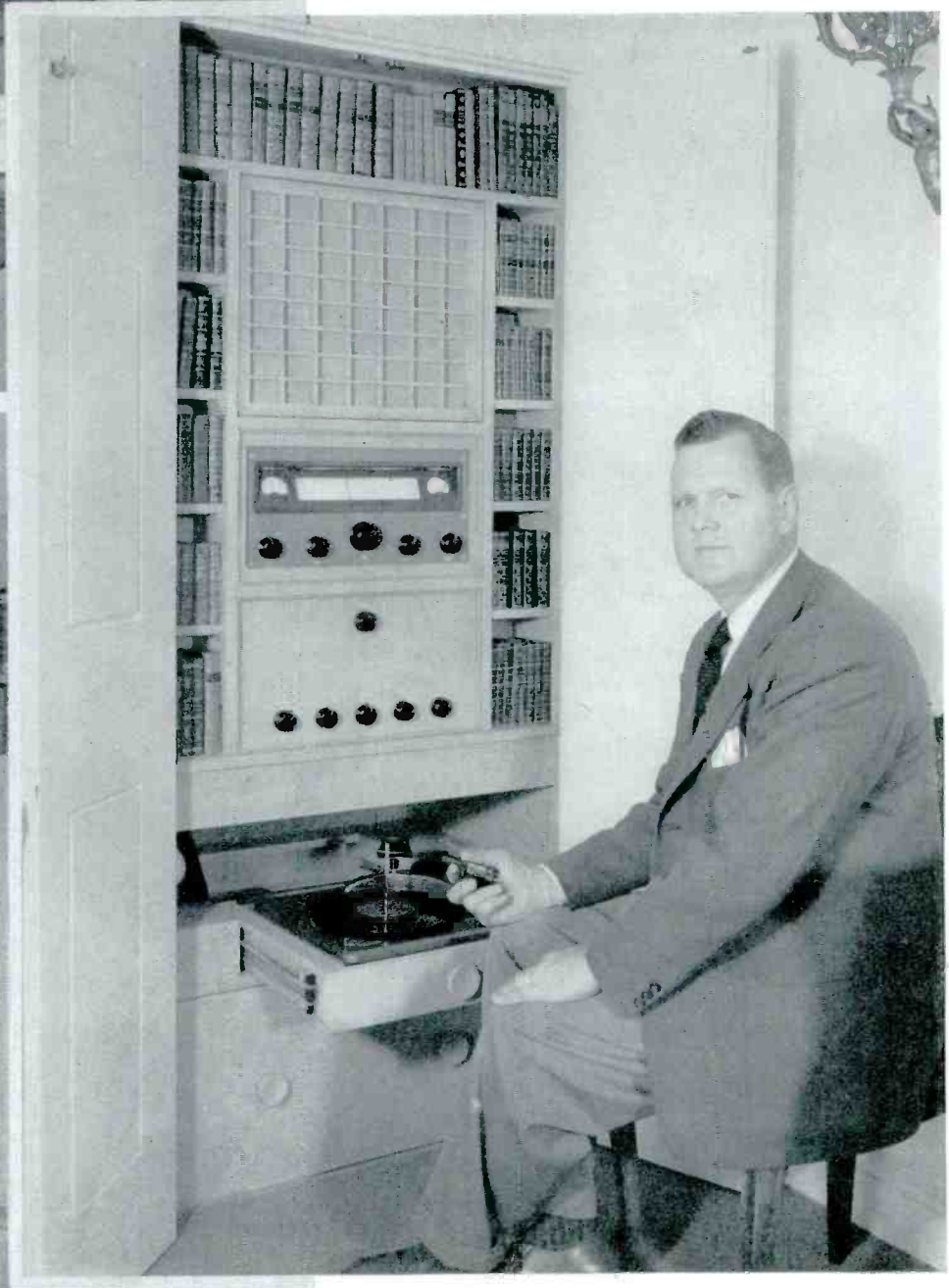
In the installation shown below, the only standard equipment is the FM-AM tuner and the record changer equipped with a reluctance cartridge. The TV chassis is of the familiar 630 type, preceded by a special two-stage booster. The amplifier is custom-built; a preamplifier unit provides a high degree of control over record reproduction characteristics. Because as many as 68 tubes may be in operation at one time, the equipment is cooled by forced air. Three Workshop antennas are used: a 6-element array for channel 2, a VV for the remaining TV channels, and another 6-element array for FM. A Simpson antenna compass meter, decoupled from the picture tube by a cathode follower stage, assures optimum positioning of the antenna array.



This is a dual installation, with speakers in the living room (left) and in the study (right). The basic equipment is in the study and includes a Browning RJ20 FM-AM tuner, H. H. Scott amplifier, and a Webster changer with G-E cartridges. Both speakers are Altec 604-B's, partially controlled by T-pads concealed in the bookshelves. In spite of the totally-enclosed appearance of the installation, ventilation is exceptionally good because the bookcases in the study are backed by two large closets. Air comes in through louvres in one of the closets and escapes to the attic through the partition. This closet makes it possible for the speaker to operate under infinite baffle conditions.

This is another dual installation. The TV set, a special audio amplifier and separate speaker, are installed in the study. An FM tuner, record player, amplifier, and second speaker are hidden behind a pair of doors in the living room. The photograph (upper left) shows the appearance with the doors closed; below is the equipment itself (and also the author!). The two amplifiers and speakers are interconnected so that living room programs can be heard in the study. In this case, the amplifier, tone control, and volume control on the TV set are used.





A pilot light below the speaker grille shows when the TV amplifier is on. When the TV tuner is turned on, the light goes out, and program material originating in the living room is automatically shut off.

In connection with the dual installation illustrated on the facing page, the antenna system also deserves mention. The television antenna is mounted on a 1¼-in. tube and is rotator-operated. Inside this tube is a smaller tube which extends through a weatherproof fitting at the top. The FM antenna is mounted on this smaller tube and is, in turn, operated by a rotator mounted below that for the television antenna. This arrangement gives considerable strength to both antennas and at the same time takes up a minimum of space. The entire assembly is carried on a 20-ft. wooden mast. Signals are fed to the receivers by coaxial cables.

In the installation pictured on this page, a considerable amount of equipment has been compacted into a small, built-out cabinet. Two changers, Garrard and Webster, and the Browning FM-AM tuner are fed into the amplifier.

A unique feature of the installation shown on this page is the inconspicuous method of mounting the speaker. A large, heavy panel was mounted in the wall. The speaker hole was covered by a knick-knack shelf backed by light cloth, and the rest of the panel papered to match the room. Thus the speaker is in a good location for best sound reproduction, yet is completely disguised. An additional speaker is provided in a cellar rumpus-room.

This installation utilizes a chairside cabinet to house the FM tuner, the amplifier, and the volume and tone controls. The cabinet is unique in that the corner nearest the sofa pivots on a metal tube 1-in. in diameter which goes completely through the floor. The other three corners are supported by rubber casters. Antenna, phonograph, speaker, and AC wires enter the cabinet through this 1-in. tube. Thus there is no exposed wiring, yet the unit can be swung around in front of the sofa for maximum operating convenience. The record-playing equipment is located in an adjoining room which was formerly a pantry. In view of the owner's large library of records, this makes an ideal arrangement. There is ample shelf space, and the records can be spread out on the pantry cabinets for easy handling. The loudspeaker is mounted in the wall. The grille can be seen just above the sofa on the far wall. The antenna is a Workshop 6-element array connected with RG8/U.

A particularly trim appearance is achieved in this installation. When the cabinet doors are closed, only the television screen and speaker grille show. Furthermore, by utilizing a closet directly in back of bookshelves, space occupied in the room itself was held to a minimum. This closet provided accessibility to the equipment as well as ample ventilation. TV chassis, FM-AM tuner, and the amplifier are Radio Craftsmen units. The antenna, mounted on a pole near the house, is oriented by a rotator.

This is how a Public Library handles

RECORDS ON LOAN

DOLORS G. MOGAN

DURING the month of March, the main branch of our Pittsfield, Mass., library loaned out not only thousands of books, but also 2,450 78 RPM and 850 LP records! To those acquainted with the operation of the music sections of the large metropolitan libraries, these figures may seem small. But if it is pointed out that Pittsfield is a medium-sized community of 55,000 and that only twelve years ago its Public Library had a collection of exactly no records whatsoever, then the statistics become a significant indication of the tremendous increase of interest in music and, more specifically, in recorded music. There are at least a thousand cities in the small and medium size classification (from 10,000 to 100,000 population) whose public libraries can and should include a record library section, yet it appears that only a small percentage of them now provide this service.

Over 3,500 records per month are loaned by the Pittsfield Library.

It is with the thought that our experience in Pittsfield might be of help to other libraries that this article has been prepared. There is little doubt that the upsurge of interest in music throughout the country has brought countless requests to librarians for the institution of a record loan section; it is also likely that public-spirited members of many communities have wondered how they could encourage the creation of such a service in their local libraries. It is hoped that the material presented here will be of help to both sides.

The Pittsfield Library itself was founded in 1872, and operated without phonograph records for 67 years. In 1939, the Pittsfield Junior League started a project to collect records for a loan service, and the Music Section of the Library gracefully agreed to accept the records and handle their distribution. Although exact fact is buried in the darkness of past history, it is doubtful that the Library foresaw that, in 1951, it would have a collection of 3,500 78's and 250 LP's, would have to provide a separate section of the building, a record listening booth, and the services of a full-time librarian and assistant to handle this phase of its library activities. What was a novelty in 1939 has become an important service today, with 2,300 borrowers on the active list and new registrations being signed in at an average rate of 25 per month. Furthermore, the whole music section has expanded. Books on music are in increasing demand; the current loan rate is 65 per month. In addition, music scores and opera librettos are available on loan, as are twelve sound films for children. Even the Library's Bookmobile, which circulates in the outlying districts of the community, carries 10 record albums, and accepts requests for specific records.

At the present time, the Library budgets $1,000 a year for the purchase of new and replacement records by its main branch. This permits an expenditure of $83 a month for records, almost all of which are new. From time to time, replacements are necessary. This budget is augmented by gifts of both money and records. Library supplies, music, and books are charged separately.

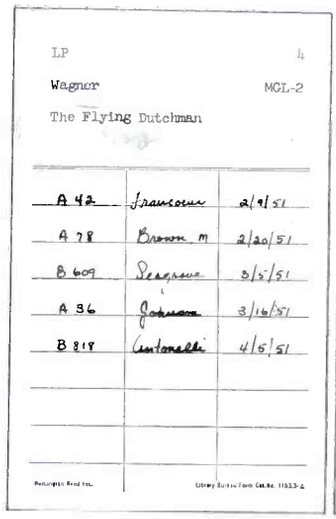
Records are selected partly in accordance with demand,

and partly in accordance with the music librarian's personal judgment, which, in turn, is based on study of record reviews in current periodicals. Although the 78's far outnumber the LP's on the shelf today, the trend is heavily toward LP records. The librarian's judgment is also guided by knowledge of the type of music taken out by borrowers; there is, for instance, steady and heavy demand for Bach and almost none for Shostakovich. Demand can also be predicted by study of musical events planned for coming months. Thus, during the Berkshire Festival at Tanglewood, every record of compositions scheduled for performance will be out on loan. Similarly, the radio broadcasts of the Metropolitan Opera bring forth a rush of interest in opera librettos and books giving the stories of the operas.

The practical problems of cataloging the records, of issuing borrowers' cards, and the like, have been worked out over the past few years to a point where an almost completely foolproof system has been developed.

Since it has been found that borrowers prefer to look over a rack full of albums rather than study a card file, all records are kept on shelves. The collection is divided into three sections: LP's, 78's, and children's records. The last are mostly a collection of Young People's Records, and of albums to supplement the music books used in the schools.

Single records are kept in manila folders supplied by Gaylord Bros. in California, or in their original albums if the records comprise a set. Single LP's are taken out of their jackets and inserted in the manila folders; descriptive matter on the original jacket is attached to the folder. Whenever available, scores or librettos are added to the folder. A record card, Fig. 1, is kept in a pocket in each album or folder. To facilitate filing, different colors are used for LP and for 78 RPM records, but as a double check, an LP card carries the notation "LP" in the upper left corner. The upper section of the card also shows the number of records in the set or album, composer, composition, and record number. In the ruled spaces below the title section of the record card, and on the reverse side, the borrower's registration number and name, and date the record is due, are inserted. This information is valuable in giving an indication of the condition of the record and

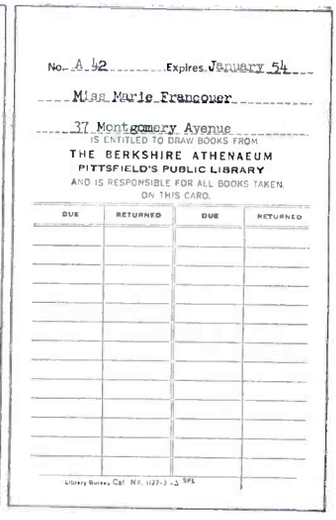

LP 4

Wagner MGL-2

The Flying Dutchman

A 42	Francoeur	2/9/51
A 78	Brown, M	2/20/51
B 609	Seagrave	3/5/51
A 36	Johnson	3/16/51
B 819	Cantonelli	4/6/51

Fig. 1. Record card.


No. A 42 Expires January 54

Miss Marie Francoeur

37 Montgomery Avenue

IS ENTITLED TO DRAW BOOKS FROM

THE BERKSHIRE ATHENAEUM

PITTSFIELD'S PUBLIC LIBRARY

AND IS RESPONSIBLE FOR ALL BOOKS TAKEN ON THIS CARD.

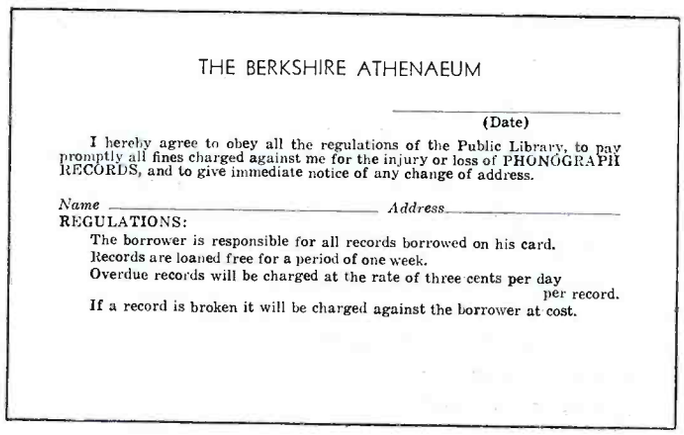
DUE	RETURNED	DUE	RETURNED

Fig. 2. Borrower's card.

the possible need for replacement, as well as of the popularity of the composition. No definite rule has been established on the question of how many times a record may be borrowed before it needs replacement. Generally speaking, a record is checked for serious wear after a second card has been filled. That is to say, after it has been borrowed 35 to 40 times. This card is kept in the folder or album except when on loan. It is then held in the library and a date due card put in the album.

The borrower has a special record loan card, Fig. 2. Although the card was originally used for books, it is no longer used by the regular library loan section and is entirely adequate for phonograph records. Registrations are for a three-year period, and the expiration date is made to coincide with that of the book department registration card. A separate registration card, Fig. 3, is held by the Library at all times, and states the conditions of loan: free for one week (which may be extended for a second week if the record or album is not on reserve), with a fine of 3c per record per day thereafter: broken records are charged at cost, although a fair amount of depreciation is allowed for records which have seen considerable circulation. Reserve cards may be made out by the borrower for 2c a request.

Fig. 3. Borrower's registration card.


THE BERKSHIRE ATHENAEUM

(Date)

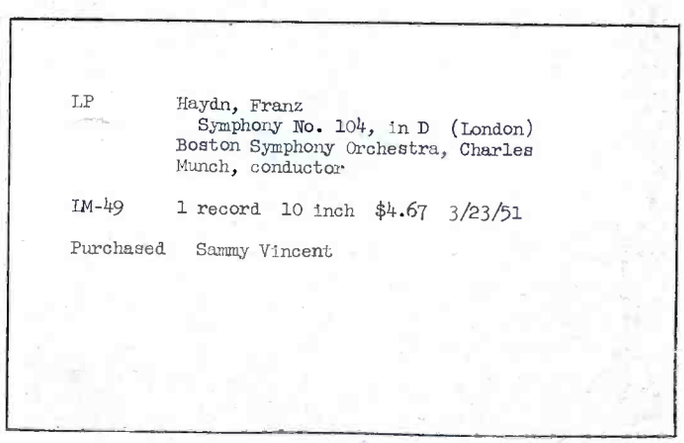
I hereby agree to obey all the regulations of the Public Library, to pay promptly all fines charged against me for the injury or loss of PHONOGRAPH RECORDS, and to give immediate notice of any change of address.

Name _____ *Address* _____

REGULATIONS:

The borrower is responsible for all records borrowed on his card.
Records are loaned free for a period of one week.
Overdue records will be charged at the rate of three cents per day per record.
If a record is broken it will be charged against the borrower at cost.

Fig. 4. Catalog file card shows all record data.

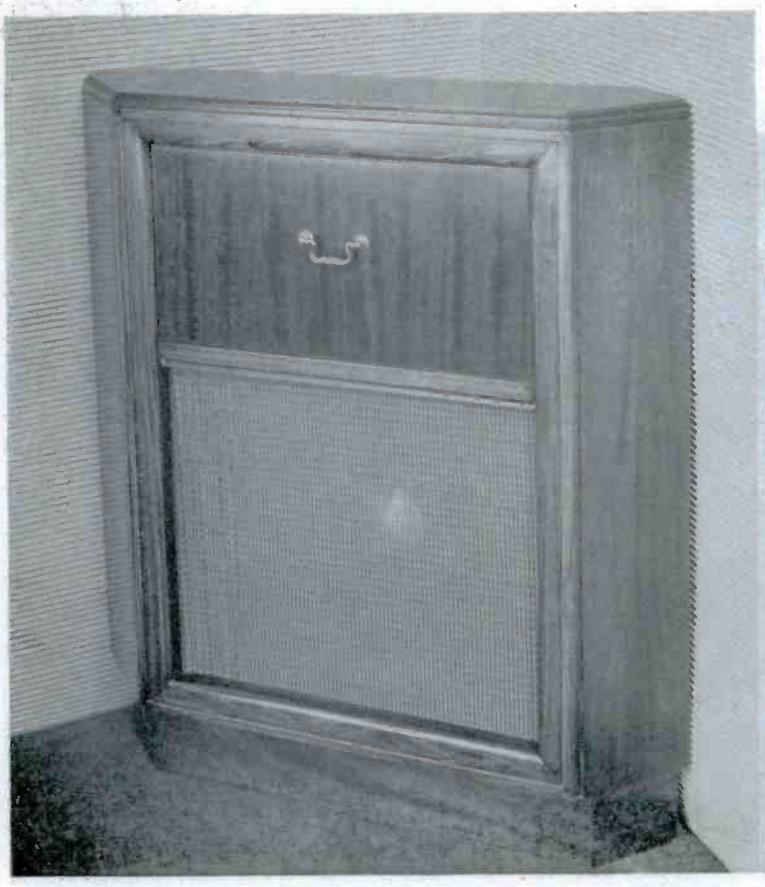

LP Haydn, Franz
Symphony No. 104, in D (London)
Boston Symphony Orchestra, Charles Munch, conductor

IM-49 1 record 10 inch $4.67 3/23/51

Purchased Sammy Vincent

Continued on page 70

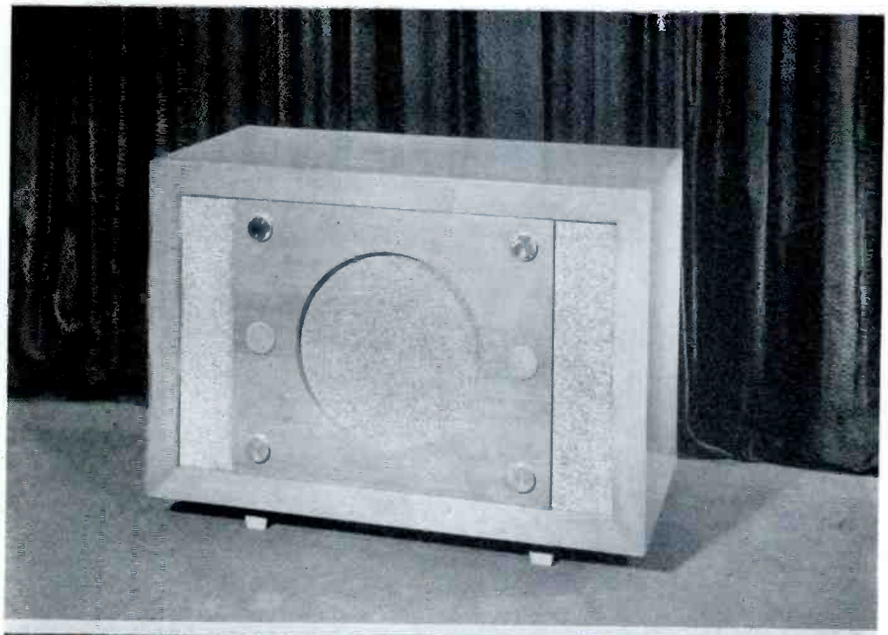
HOUSING THE SPEAKER

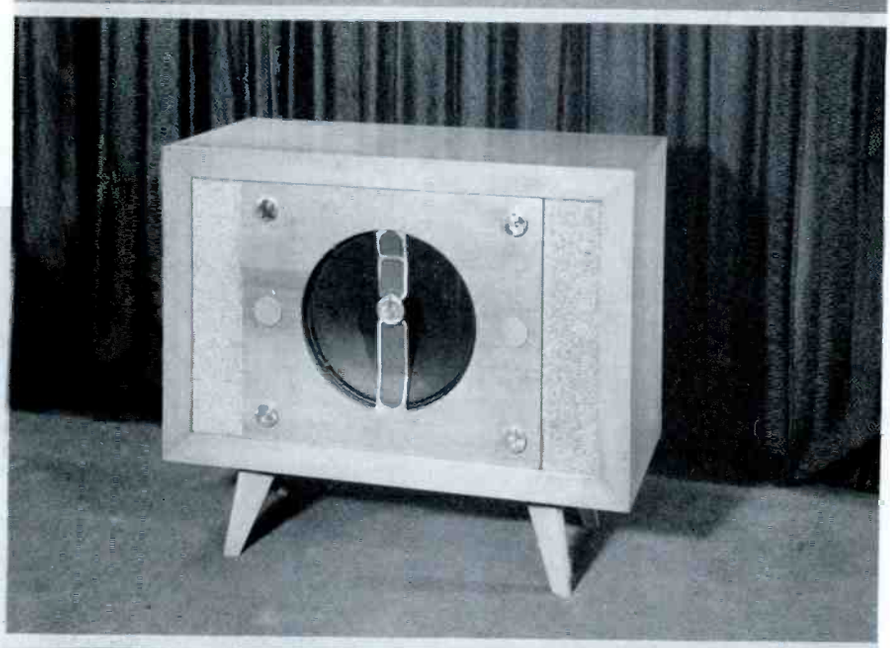


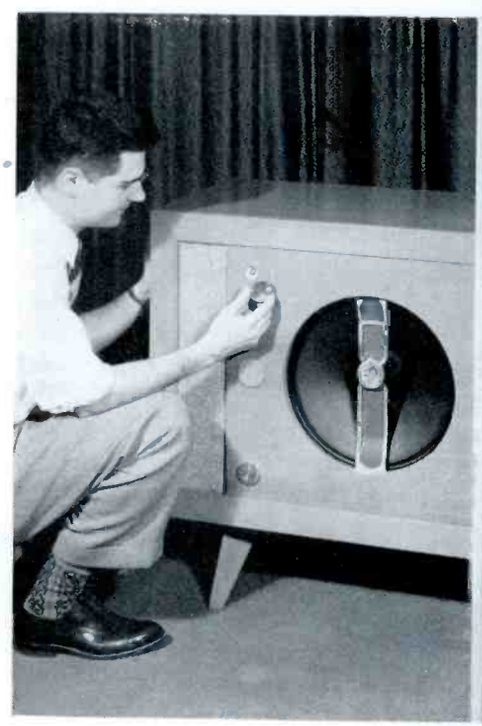
On these pages is a selection of current and novel speaker enclosure designs which are available as packaged units.

The Brociner enclosure (upper left, facing page) is designed for use with coaxial speakers. A special *folded* duct loads the low-frequency cone acoustically and is said to make possible performance substantially superior to that provided by standard bass reflex designs.

The Jensen Customode series of cabinets are well known for their flexibility of arrangement. A new method of speaker mounting is now available which greatly facilitates installation. As shown on this page, instead of a *fixed* front panel to which the speaker is screwed from the rear of the cabinet, the front panel, with speaker attached, is bolted into place. Thus the speaker can be worked on without the necessity of pulling the entire cabinet away from the wall.







Sun Radio in New York has just announced a new cabinet for two-speaker installations. As shown in the photographs at the bottom of the opposite page, a 12-in. woofer is mounted to face out into the room, and an 8-in. cone projects the high frequencies upward and into the corner. Sound dispersion is reported to be excellent.

If you have had enough experience with equipment to acquire your own convictions, you may not agree with the author, but if you are planning your first system, or if you're dissatisfied with what you have now, you will probably find these suggestions very useful and highly practical.

What to look for when you buy an

AUDIO AMPLIFIER

ROBERT E. NEWCOMB

Under ordinary circumstances, the writer prefers to sit on the side-lines and play the role of listener when the subject of selecting an amplifier comes up for discussion. Loyalty to a particular type and make of amplifier is as much a matter of deep-seated conviction among audio-philes as that of a baseball fan for his chosen team, or a fisherman for his favorite rod.

Therefore, this examination of amplifier designs is intended for those who seek guidance in buying their first equipment, or who are not satisfied with what they own now.

By way of introduction, it should be explained that this discussion will not lead to any conclusion as to the *best* amplifier. Rather, the purpose is to help you determine which of the available types and makes will meet your particular requirements, and prove most satisfactory for day-to-day enjoyment.

Performance Curves

In this writer's opinion, performance curves contribute more confusion than information to most high-fidelity enthusiasts. Amplifier performance is influenced by many factors. Data obtained by laboratory instruments have much value to an engineer when he is working on a particular amplifier design. And they are useful as a guide to design changes, or as an analysis of the possible reasons for changes in listening quality noted as a result of design changes. But it should be understood that characteristic curves of different amplifiers may bear little relationship to the audible differences in their performance.

If you were to take six competent engineers and give each the project of designing his conception of a perfect amplifier, you would probably find, upon making laboratory measurements, that all six were excellent. Yet the chances are great that each would sound different from the others in some respect. Only many years of actual experience can guide the audio engineer in designing amplifiers that will produce natural listening qualities under conditions of actual use. This is not meant to imply that such things as low distortion and wide frequency range are unimportant. They are, up to a certain point but, in the end, an amplifier is only as good as the impression made on the listener.

The Factor of Compromise

All engineering work must deal with compromises. Any given design or system represents a whole series of compromises. There will always be a conflict of thinking as to which compromises should be made. Those which only achieve fine-appearing printed data for a particular piece of equipment may not be the ones the engineer would make were he taking into account the whole system, including the record, the pickup, the loudspeaker, the average room size, probable volume level, and the peculiarities of the human ear. Further, where cost is a factor, the design engineer may be easily influenced to compromise in manners inconsistent with the overall requirements of the audio system.

For these reasons, published performance data on an individual piece of equipment, however truthful they may be, sometimes prove misleading. Therefore, the safest course is to make a selection from the products of reputable manufacturers, relying for your final choice on careful listening tests. That will often settle arguments that cannot be resolved by discussion.

You might be persuaded, for example, as to the importance of getting big power output with minimum current drain from the power mains. While high efficiency is desirable, a careful listening test might disclose that the effort put into reducing power consumption for a few hours a day, amounting to the difference between a 100-watt bulb and a 50-watt bulb, might better have been spent on improving audio reproduction.

Or it might happen that the engineer who was carried

away with the efficiency of his output circuit forgot that this efficiency was gained at an approximately equivalent increase of power consumption in other portions of the amplifier, in order to make the output design function adequately.

Sometimes engineers, in their efforts to outdo their fellows may be as mistaken as the layman who takes medicine on the theory that if one pill is good, ten must be better. This applies particularly to the amount of feedback in a given amplifier.

There can be no argument against the value of feedback, but it does not follow that the more feedback the better the audio performance. Few modern speakers are designed to operate efficiently from zero driving impedance. Most people enjoy the reproduction more if the amount of inverse feedback is enough to produce the desired reduction of distortion, but not so much as to effect loudspeaker performance adversely. Until loudspeakers are designed with the intention that they be driven by zero-impedance devices, excessive amounts of feedback will be noticeably detrimental to the listening quality.

Triodes and Pentodes

The old argument as to whether triodes or pentodes are superior as output tubes is another best settled by making listening tests, rather than accepting at face value the statements of those who would have you believe that there is any difference.

It was proved long ago by those who know how to build both types that there is no essential difference in the results achieved if both are designed properly. This does not mean that any triode amplifier picked at random will not sound different from any pentode amplifier picked at random. Nor would two of the same type necessarily sound alike. However, it does mean that your own ears are the safest guide to your ultimate satisfaction. Your choice, in the case of the triode versus pentrode, probably would bear no relationship to the output tubes, but, rather, would result from differences in other design factors.

The Matter of Tone Controls

Now let us consider the matter of tone controls. Two manufacturers may claim a bass boost of say 15 db. Taking these claims at their face value, you would probably assume that these controls would produce the same bass tones. Nothing could be farther from the truth. That is because the *shapes* of the curves may be different. In fact, a designer can provide less bass boost, and at a saving in cost, yet give the *impression* of more bass merely by changing the shape of the curve. Only by a proper listening test can you tell whether the bass tone control adds *fundamental* bass, or just adds bass *overtones*. The latter may give the first impression of lots of bass, but upon further listening, it will be found to have a false, unnatural quality. The bass tones produced by such controls may be pleasing to some people. But true, natural bass can be obtained only without changing the character of the bass. False quality results from emphasizing the harmonic tones in an effort to bring up the fundamental tone.

Really good tone controls are expensive. They are often sacrified for price, even in some of the highest-priced amplifiers. Occasionally this sacrifice is more the result of the engineer's lack of musical knowledge, or dependence upon performance curves rather than actual listening tests.

There are wide differences of professional opinion as to output power requirements. One engineer may insist that 10 watts are plenty for any home. Another will say that at least 25 watts are required. As an actual fact, both may be correct, depending upon the amplifier design each one has in mind. It is true that, as far as middle tones are concerned, 10 watts on a good speaker will produce a very great amount of volume for the home. Whether it will be enough for the entire system depends upon what kind of reproduction you want. If you like a boomy bass, largely harmonic in character, 10 watts are more than enough. But if you want true fundamental tones, unadorned by unnatural amounts of harmonics or overtones, then the curve shape needed can only be handled properly by output systems of greater power.[1]

Amplifier hum is a matter of no small importance. Likewise, the hiss level. In quiet rooms, hum or hiss can be very objectionable, particularly so from a highly-efficient loudspeaker. Here is a good test: Listen first to the hum and hiss with all volume controls at off but with tone controls set to provide flat response. Then, being sure nothing is plugged into the amplifier input, (in order to prevent hum pickup from external devices) turn all volume controls full on, including any pre-amplifier required for a magnetic pickup. Compare this hum, wide open so to speak, with other amplifiers under consideration. Sometimes you will find that one amplifier has less hum even with the bass boost full up than another adjusted for flat bass. How much hum can be tolerated depends upon the individual. In very high gain amplifiers designed for use with magnetic pickups, there will always be some slight hum and hiss at full gain setting, particularly with the bass boost control full up, but it should not be objectionable in comparison to the music volume. The absence of hum and hiss is some measure of the care used in design and manufacture.

Mr. Newcomb represents the new and growing school of thought which holds that, while laboratory measurements are necessary to the design engineer, the customer's final decision in selecting audio equipment should be determined by his own ears.

Volume Expanders and Scratch Suppressors

Volume expanders have been a source of much confusion to many a buyer of today's custom phonograph ampli-

[1] See the discus ion elsewhere in this issue about the fact that bass boost is often accomplished by cutting the volume in the middle and high range. Ed.

Continued on page 67

Hundreds of audiophiles have tried out the FAS system and found that it provides remarkably improved bass response. This complete review of experimental and constructional details will enable you to build your own system, or adapt the FAS idea to your present installation.

HOW TO ACHIEVE FULL BASS RESPONSE

CHARLES FOWLER

NOTHING, in recent years has stirred up so much interest among audio experimenters as the announcement last Fall of the Fowler - Allison - Sleeper audio system. Thousands of people, throughout the country, have built these systems or added them to their former equipment. Without exception, all have reported that results were extraordinary . . . "I'm getting more music from commercial pressings than I thought it possible to record" . . . "Never heard such bass" . . . "Didn't know those notes were on the record" . . . and so on, until the author's files now contain hundreds of comments and reports.

We are reviewing the FAS system in considerable detail in this issue of HIGH-FIDELITY for several reasons. First, use of the system extends the range of audio reproduction considerably beyond that with which most audio-philes are familiar. It is a radical departure from accepted practices and produces a radical improvement in the reproduction of sound. Second, it can be added inexpensively and simply to an existing system by anyone capable of handling a screwdriver and a pair of pliers. Third, the experimentally-inclined can build the FAS amplifier and, from this starting point, can test out innumerable variations of the basic system. This article contains the complete story and incorporates revisions and additions to previous material, based on further experience with the system — not only our own experience, but that of the many experimenters who have reported their results to us.

The Problem of Sound Reproduction

To understand what the FAS system does, it is necessary to go back to the beginning and consider the problem of sound reproduction. The discussion can be shortened tremendously if we make a statement which may sound rash but which is nevertheless true: good sound reproduction is relatively easy to obtain above 400 cycles. There are, we admit, problems, even in this range, but they have been satisfactorily solved. A high-quality, 12-in. cone speaker, driven by a good amplifier, will reproduce up to at least 4,000 cycles with a quality which even the most critical will find acceptable. If the amplifier is good enough, a tweeter can be added and the range extended upward to the practical limits of human hearing.

We can go on to say with a fair degree of safety (i.e. not too many readers will write in and argue the point) that we can lower that limit of 400 cycles to 200 and still get good reproduction. Below that, however, problems galore arise and the faithfulness of audio reproduction begins to fall apart.

The individual problems of faithful sound reproduction below 200 cycles are too numerous and complex to be discussed in this article. It is possible to solve some of them, but the solution itself may present a problem. For instance, one of the problems of low frequency response is that of adequate speaker loading. The solution is obvious: load the speaker with a horn, about the size of a theatre installation. But where would such a "gadget" be put in the average living room? We would have to have a separate "horn room"!

The Importance of Bass Reproduction

Yet adequate bass sound-power output is absolutely essential to lifelike reproduction of music. If the higher frequencies, say from 5,000 to 15,000 cycles, are eliminated by means of a filter, it is unpleasant but bearable. But cut off the frequencies from 50 to 200 cycles, and the music isn't music any more. It is clothing without body. And that, incidentally, is exactly what the low frequencies do for sound: they provide the body, the solidity, and the roundness.

We can criticize one-note bass and beer-barrel boom all we please, but the fact that so many people demand

it, is an indication not necessarily that they have tin ears, but that anything is better than no bass at all.

Yet that has been the best that could be provided — reasonably. Without using huge enclosures, and large amounts of money for expensive equipment, it has been impossible to reproduce the frequencies from 30 to 200 cycles faithfully. That last word — *faithfully* — is important. They can be reproduced or, to coin a word, facsimiled. Bass boost will create a false bass, often comprised not of fundamentals but of harmonics. Or at very loud volume levels, speaker cone excursion will become great enough so that sound (not just flutter) comes out.

Quality of Reproduction and Volume Level

The matter of volume level is extremely important. It is possible to get bass response at very loud levels, but that is unpleasant and, for many of us, impossible because of neighbors, the wife, or even the plaster! To achieve a fair amount of bass response, demonstration setups are often run at high levels of sound output. However, when the level is turned down, the bass drops out. In part, this characteristic of conventional equipment accounts for the popularity of compensated volume controls: they boost the bass, and sometimes the treble, as the volume level is reduced.[1]

The Advantages of the FAS System

The FAS system is primarily a method of improving the reproduction of the frequencies from 20 to 350 cycles. It is the remarkable degree to which this improvement has been accomplished which has won such wide acclaim for the system. For the first time, it makes possible unbelievable bass response, down to 25 cycles, with equipment which can be fitted into a small living room and also, fitted into a small pocketbook. It operates equally well at high *or low* volume levels.

People who have heard this radically different system of audio reproduction say that it brings out bass notes in phonograph records that they never knew existed before. It is even more startling on wide range FM or television broadcasts.

To cite a specific example: there is a passage in the Saint Saens *Symphony No. 3 in C Minor*[2] when the organ notes drop down softly to a point where you would expect to hear nothing more. With conventional loudspeaker systems, there is a moment of silence or, at best, speaker fluttering. With the FAS Air-coupler, the full magnificence of the 32-cycle note rolls out with a vibration of the air which can be felt as well as heard. Even when the overall volume is turned down to a soft whisper, the *sound* is still there.

The FAS system was demonstrated last year at the Audio Fair. Thousands of people heard it under the worst possible circumstances: a small hotel room, solid masonry floors and walls, always jammed with humanity. Yet one after another heard it and said, "Why, I didn't know those notes were on the record."

We are entirely sincere when we say that listening to full bass reproduction over the FAS system is something almost impossible to describe. As the system is used more and more, the importance of full bass to the enjoyment of music is soon realized, and the inadequacy of various substitutes becomes apparent.

Some Suggestions About the FAS System

We are going to take the time and space in this article to present the original amplifier, developed specifically for the FAS speaker system, and to discuss the original equipment used. The reason for this? Like everything else in the audio reproduction field, the FAS system can be refined and improved. It was developed almost entirely on a "try it and see" basis, because everyone with whom we discussed the original design said, "It won't work in a thousand years!" Unless the steps leading to its development are thoroughly understood, the individual seeing the system on paper for the first time is almost sure to say, "It won't work!" To which our answer is, "Try it and see — but to be sure you duplicate our results, you should duplicate our equipment. Then go ahead and experiment with different arrangements and different equipment." Therefore, we shall describe the original and complete system first, and then offer suggestions for adaptation of the system to existing installations.

The FAS Amplifier Circuit

Before describing the amplifier which was used in the development of the FAS system, one point should be made clear: this amplifier is by no means the only one which can be used with the system. However, any amplifier which is to be employed must meet the standards of high-fidelity performance exhibited by the FAS amplifier. Furthermore, its bass response must be flat down to 20 cycles, because the FAS speaker system will accentuate faults as well as good points. The adaptation of other amplifiers to the system will be discussed later.

The FAS amplifier was designed to meet the requirements mentioned earlier. That is, the amplifier itself is capable of delivering essentially flat response from 20 cycles to 20 kc., and this flat characteristic is maintained by the output transformer at any level up to its full power rating.

With such performance, hum which would be inaudible in a conventional system could become objectionable. Therefore, any amplifier to be used in an FAS installation must have extremely low hum content.

A circuit diagram of the FAS amplifier is given in Fig. 1. The circuit is simple, straightforward, and conservative. Only three stages are used, with a complete feedback loop. A parts list giving exact values for circuit components is included later in this article.

[1] These controls also compensate for a characteristic of human hearing; see the article in this issue on preamplifiers and control units, p. 18.
[2] Columbia 78 album MM-747, or LP record ML4120.

Two inputs are provided, one flat for a reluctance pickup or tuner, and the other equalized for a crystal pickup. A switched input was used, although it would not be necessary in an installation utilizing a single input, since the signal sources could be switched at some other point. If such were the case, the volume control, R3, could also be replaced by a fixed resistance from grid to ground.

It will also be noted that the input which accommodates a reluctance pickup or tuner is labeled "Tuner or reluctance preamplifier". The output of a reluctance pickup being a low-level output, preamplification is necessary to drive the amplifier at an efficient level. No preamplifier was built into the chassis, on the theory fed to the amplifier. This can be obtained by the use of a voltage divider network across an ordinary 110-volt, 60-cycle source. With this voltage being fed to the amplifier, R7 is adjusted until equal voltages appear at the control grids of the two 6L6's.

The push-pull 6L6 output stage provides high power sensitivity and adequate peak power with low distortion. Operated Class A, a pair of 6L6's deliver 18.5 watts output at 2% distortion. The efficiency of the FAS speaker system is such that 5 watts produce ample sound power for any home requirements. Hence it is very unlikely that this maximum distortion figure would ever be reached. With the negative feedback provided, the distortion under

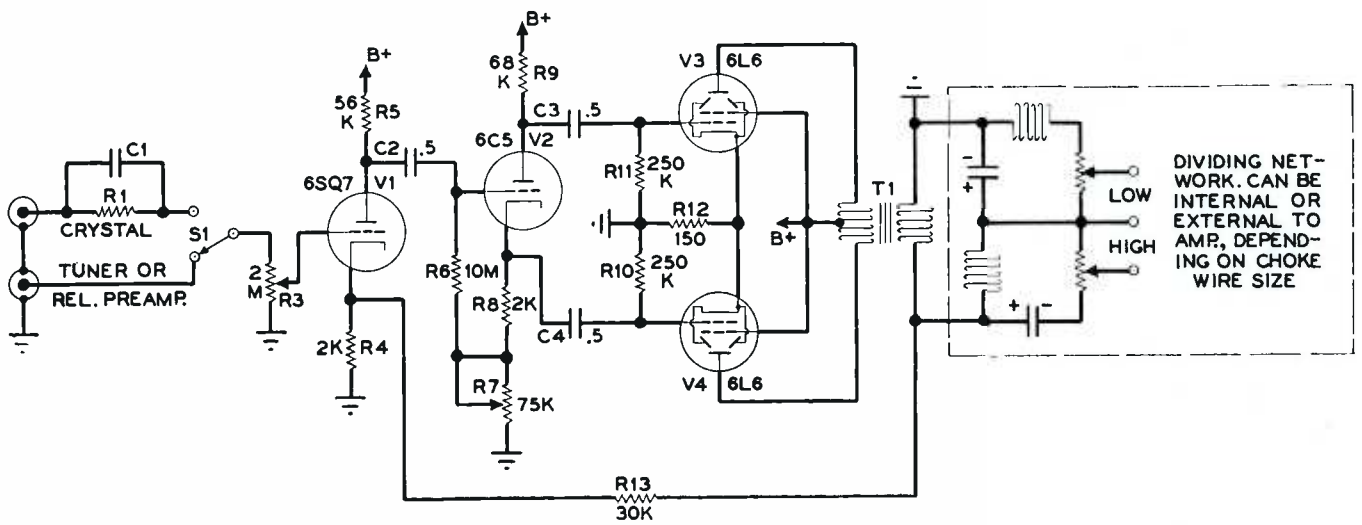


Fig. 1. Complete circuit of FAS amplifier, showing switched input. Dividing network shown is for two-speaker system.

that it is advisable to use the particular unit recommended by the manufacturer of the pickup. Furthermore, this input plug is to be used to accommodate a tuner, which will have its own volume control. Hence a separate preamplifier simplifies the wiring.

The 6SQ7 input stage has ample gain for a crystal pickup. The network made up of R1 and C1 is used to equalize for the characteristics inherent in crystals which causes their response to drop off at both high and low ends. The optimum values for R1 and C1 vary with each type of crystal. Representative values are: R1, 1 megohm and C1, 150 mmf. However, it is highly advisable to adhere to the crystal manufacturer's recommendations concerning these values.

The 6C5 stage performs two functions: amplification and phase-splitting. Phase-splitting is necessary to equalize the drive to the 6L6's. This particular design of the phase-splitter circuit causes very little of the phase shift often encountered in some other circuits. This characteristic makes the amplifier highly stable.

A variable resistance, R7, will be noted in the cathode circuit of the 6C5. Its purpose is to adjust the total resistance in the cathode circuit, so as to equalize the output of the 6C5 stage to each of the two 6L6's. The method for adjusting this resistance to its proper value is as follows: A small AC voltage (about .5 volts) must be normal operating conditions will probably not exceed .5%.

The excellent stability of the amplifier would allow a direct connection from the output transformer secondary to the 6SQ7 cathode, to achieve negative feedback, without producing oscillations. However, this is both unnecessary and impractical and the feedback achieved by the use of the 30,000 ohm resistor, R13, was found to be adequate.

Crossover Network Arrangement

Crossover or dividing networks are necessary in systems where two or more speakers are to be employed for better response. Essentially, they are devices for feeding high-frequency output to one speaker and low-frequency output to another. This is done to take advantage of the best response characteristics of each speaker. For instance, in the FAS system, the speaker which is incorporated in the Air-coupler is designed to improve bass response. Since its performance in the higher ranges is not satisfactory, a second speaker is employed to handle these frequencies. The crossover network feeds the lower frequencies into the Air-coupler system and the highs into a separate speaker. If three speakers are used the crossover network must be altered to provide three outputs instead of the two shown in Fig. 1. Further ramifications of the

crossover networks for use with other amplifiers and speakers will be considered later in this article. One point, however, which merits some attention concerns the choice between internal and external networks.

The original crossover network employed chokes wound with No. 26 enameled copper wire. This made the choke dimensions small enough so that the entire network could be installed within the chassis. However, the resistance of the relatively fine wire decreased the efficiency of the network somewhat. Better performance was obtained from an external network employing chokes of No. 16 wire. If space is available, it is recommended that the latter type be used.

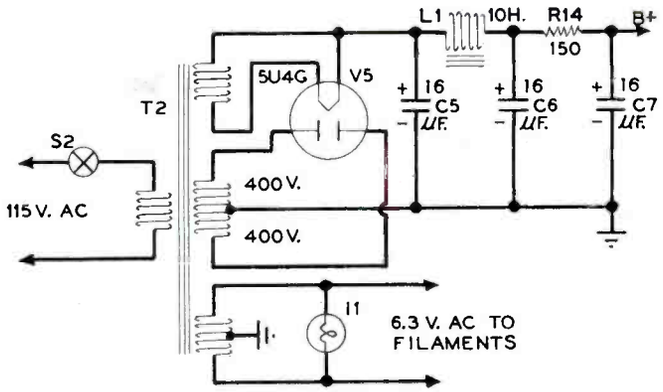


Fig. 2. Power supply uses double-pi filter, to reduce hum.

Power Supply Has Low Hum Level

With the extended low-frequency response of the FAS system, the power supply must be filtered heavily to insure that hum will not be introduced. Fig. 2 shows the schematic diagram. Since no decoupling networks are employed in the amplifier, a double-pi filter is necessary.

It will be seen that the filament winding is center-tapped. With the center-tap grounded and usual precautions taken concerning parts layout, hum output is inaudible at full volume setting.

Parts Required for the Amplifier

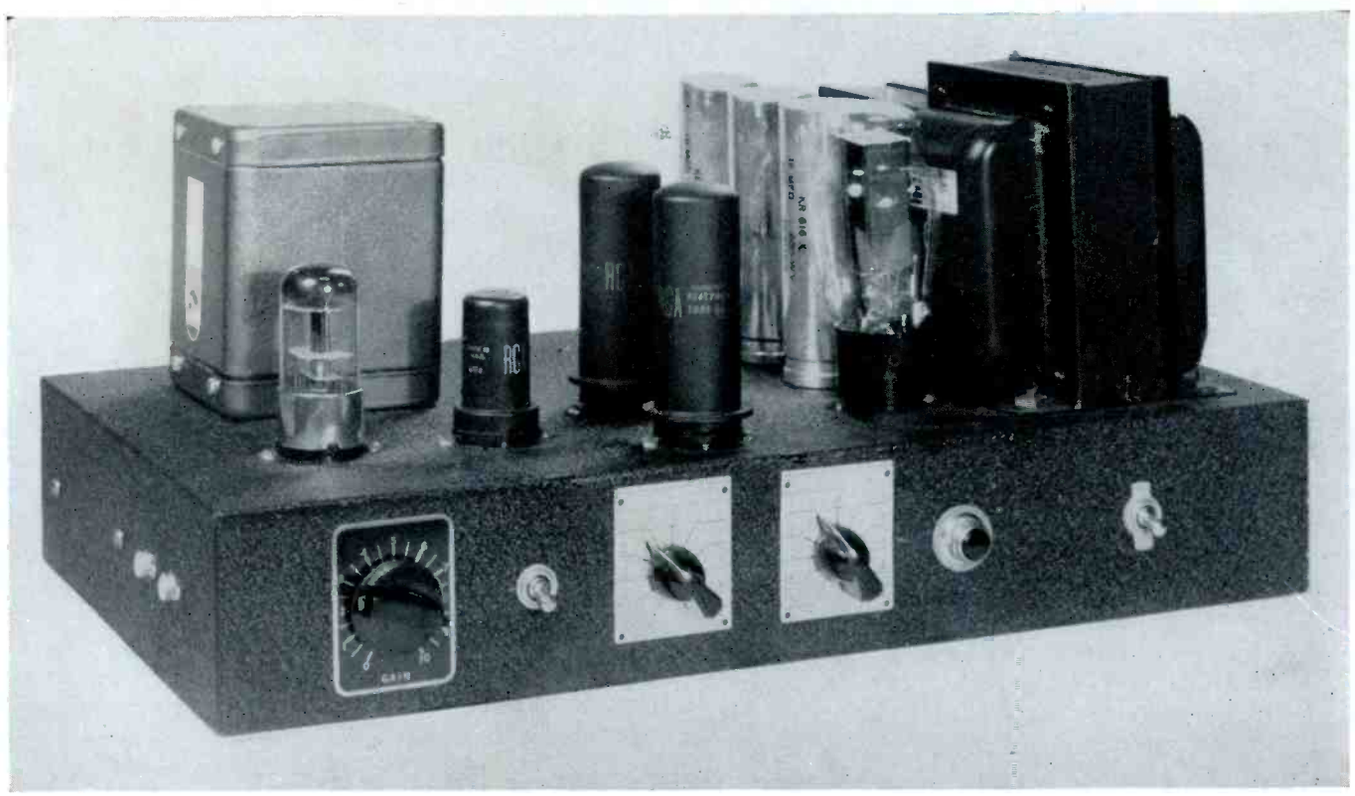
Following is a list of parts used in the amplifier and power supply. It is possible to substitute parts of equivalent quality without sacrifice of performance. Particular attention should be paid to the selection of an output transformer, since it is this component which determines the power characteristic.

PARTS LIST

Resistances:

R3	2-megohm potentiometer, ½ watt
R4	2,000 ohms, ½ watt
R5	56,000 ohms, 1 watt
R6	10 megohms, ½ watt
R7	75,000-ohm potentiometer, 1 watt
R8	2,000 ohms, ½ watt
R9	68,000 ohms, 1 watt
R10	250,000 ohms, ½ watt
R11	250,000 ohms, ½ watt
R12	150 ohms, 10 watts
R13	30,000 ohms, ½ watt

Fig. 3. The FAS amplifier. If a large chassis cannot be used, power supply should be mounted as a separate unit.



R14 150 ohms, 25 watts
(R3 can be a fixed resistor if the volume is to be controlled externally)

Capacitances:

C2, C3, C4 .5 mfd., 400 volts, paper
C5, C6, C7 16 mfd., 600 volts, electrolytic

Tubes:

V1	6SQ7	V3, V4	6L6
V2	6C5	V5	5U4G

Transformers:

T1 Output transformer, Peerless S-230-Q
T2 Power transformer, Peerless R-560-A
Power supply choke, Peerless C-455-A

Miscellaneous:

Parmetal chassis 17 x 10 x 3 ins.
Single pole — single throw toggle switch
Single pole — double throw toggle switch
2 phono input jacks
Pilot light assembly
Knobs and dial plates
AC cord and plug
5 octal tube sockets
3 terminal strips

Notes on Construction and Wiring

The parts layout for the FAS amplifier can be seen in Figs. 3 and 4. A chassis 17 by 10 by 3 ins. is recommended to accommodate all components comfortably. If space is not available for a large amplifier chassis, it is advisable to construct the power supply on a separate chassis in order to avoid hum pickup.

As can be seen in Fig. 3, the 6SQ7 tube is at the left of the chassis, close to the two input jacks on the left side. The 6C5 is next on the right, followed by the two 6L6's. Directly behind the 6SQ7 is the putput transformer.

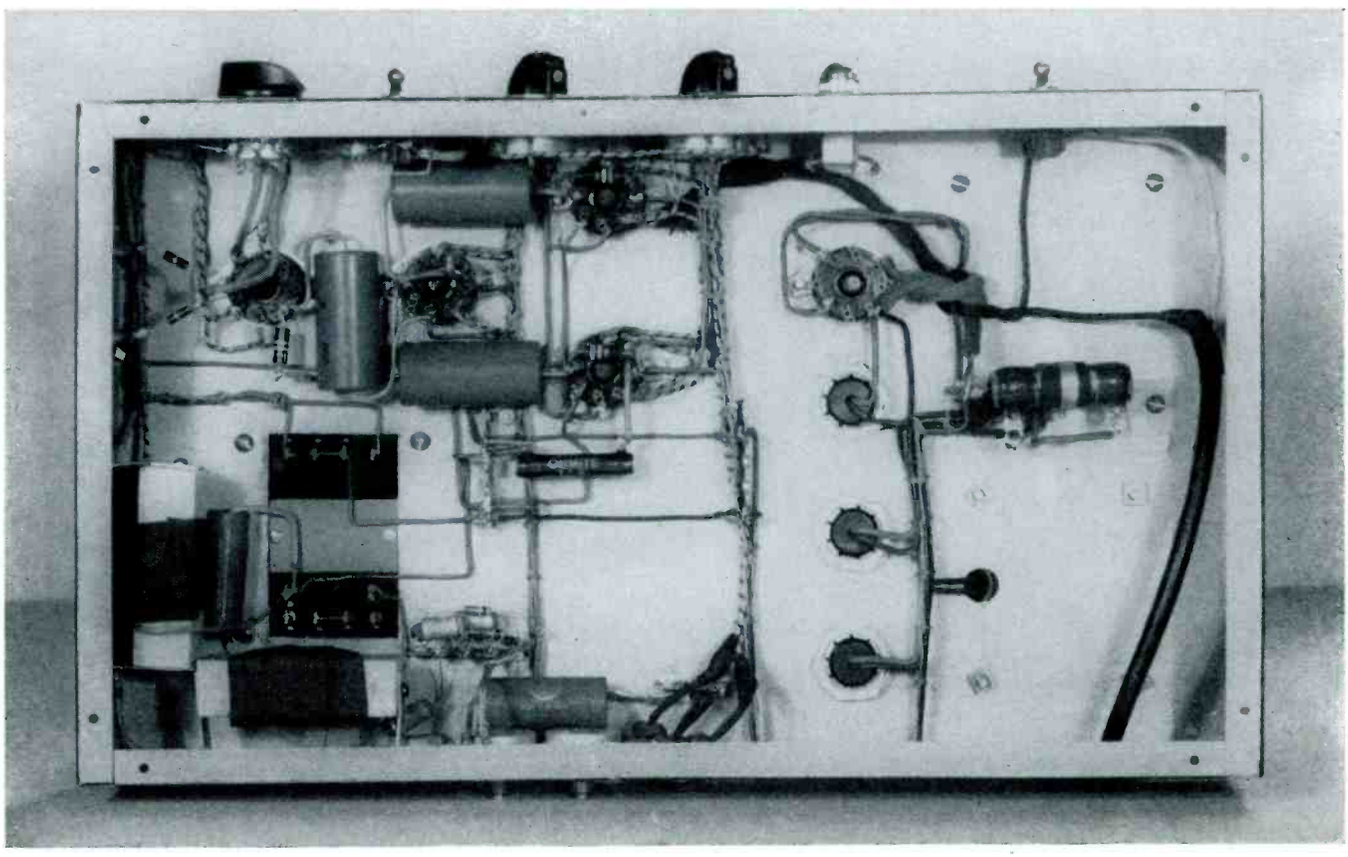
Components of the power supply are at the right, Fig. 3. The power transformer and filter choke are at the extreme right-hand end of the chassis, as far away from the input stage as possible. The choke is just visible above the 5U4G rectifier. Three filter capacitors are aligned in back of the rectifier.

Controls on the front panel from left to right are the gain control, input switch, bass and treble level controls, pilot light, and the AC on-off switch. The level-control potentiometers are components of the crossover network as shown in Fig. 1. Their resistance values depend on speaker impedances, as will be explained in the section on the FAS speaker system. When an external network is used, these controls will be external also, and can be used as operating controls or as fixed balancing adjustments.

The filter resistor, R14, is mounted on a terminal strip, Fig. 4, which also provides tie points for the other power supply components. Two other terminal strips, located below and to the right and left of the lower 6L6 tube, carry the ground and B+ buses. All ground connections should, of course, be made to the ground bus, which is joined to the chassis at one point only.

Two potentiometers can be seen on the back panel just to the right of a crossover network choke. One of these

Fig. 4. Ample working room is provided under the chassis. Note, in upper right, the extremely short AC leads from power transformer.



is R7, Fig. 1. As was mentioned previously, its purpose is to adjust the total resistance in the cathode circuit of the 6C5 phase splitter, so as to equalize the drive to the 6L6's. The other potentiometer and the components on the terminal strip above it were used in developmental work on the amplifier, and should be disregarded.

Use of Standard Amplifiers

The use of the FAS amplifier design is recommended because it was worked out specifically for the crossover network and speaker system. However, several of the standard high-fidelity amplifiers have been tried with the FAS speaker system and modified networks. In A-B tests, the difference in audio performance was found to be a matter of personal and somewhat uncertain preference. Accordingly, in the course of this discussion, data will be given on crossover networks suitable for use with several of the standard amplifiers.

THE FAS SPEAKER SYSTEM

Basically, the FAS uses three speakers with crossover networks designed to operate at 350 and 1,200 cycles. A 12-in. speaker is included in the Air-coupler to carry the low frequencies, essentially those below 350 cycles. For the intermediate frequencies, i.e., those between 350 and 1,200 cycles, approximately, another 12-in. speaker is employed in a small cabinet. Frequencies above 1,200 cycles are fed by the crossover network into a tweeter. Each of these speakers is a faithful reproducer in the range in which it is used.

As regards placement of these speakers, it has been found that the optimum listening pleasure for many people is obtained by locating the three speakers in such a way that they are 5 to 10 ft. apart. In practice, this means putting the intermediate and treble range speakers along one end of the room. The or Air-coupler, can be located wherever it can be concealed to best advantage.

This brings up the question of mounting the intermediate speaker and the tweeter in the same cabinet, or combining the two in a coaxial type of speaker. The question actually resolves into a matter of personal opinion, separation and combination each having its own advantages and disadvantages. On orchestral music, the use of speakers spaced substantially apart gives a decided stereophonic effect. There is the same feeling of placement as in a concert hall. On the other hand, it may be found that when speech is being reproduced, separation of the speakers can become undesirable due to the unnatural multiple-source effect. This results from the fact that the intermediate speaker carries the volume of the speech while the tweeter provides the brilliance and intelligibility.

It appears that some moderation must be exercised when separating the speakers, if optimum results are to be obtained. Just what is meant by optimum results? The answer to this query is the crux of the entire situation. Each individual has his own opinion as to what "sounds good". If the system pleases the listener when using a coaxial speaker (which, for the intermediate and high ranges, is a technically good idea), then, optimum results have been achieved, and this combination should be used. The principle that the best criterion is personal taste applies in all cases when judging an audio system.

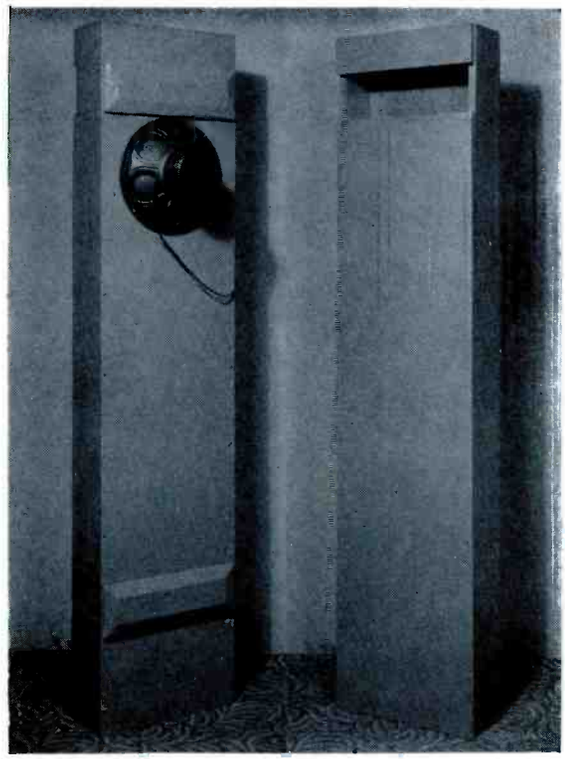


Fig. 5. Two views of the FAS Air-coupler, showing its construction. Model shown is the 6-ft. version, made of 1-in. pine, with 12-in. speaker attached. An extra brace across the back of cabinet and two across the front are usually required.

Air-coupler Construction

Fig. 5 shows two views of the Air-coupler and the mounting of the speaker, with dimensions being given in Fig. 6. Before proceeding to a discussion of the size and construction of the Air-coupler, it should be stated that the actual theory of performance has been left to the engineers who are in a better position to make concrete statements. The facts to be presented here are based on experimentation which was conducted for the purpose of improving present audio reproduction. Although no experimenter is ever completely satisfied with his results, it is believed that an important stride has been taken here towards that ideal. However, when matters involving the theoretical aspects of the situation arise, the author is inclined to tread warily to avoid misstatement or misconception!

For example, there may be certain optimum dimensions for the Air-coupler, but it appears that they are not too critical. Frequency test records indicate that there is no *predominant* resonant frequency down to 30 cycles.

Also, it should be noted that the vibration of the wood itself should be minimized. As Fig. 5 shows, there are two heavy braces screwed across the back to stiffen it. If the Air-coupler is set down lengthwise on the floor, it

should be fastened down with angle-irons or weighted on the top with a load of 50 to 75 lbs. The performance falls off if the Air-coupler stands freely on end.

No. 2 pine, ⅞-in. thick or ¾-in. plywood should be used for constructing the Air-coupler. In the former case, the width requires the use of two boards joined together. The joints must be glued, preferably with a spline for extra reinforcement. All other joints should be glued and secured with screws.

How to Conceal the Air-coupler

Since the Air-coupler can be planned for concealment in various ways, the speaker system has the advantage of being most inconspicuous, a feature which earns the approval of those who object to the use of large enclosures in their living rooms. In fact, in a private home, the Air-coupler can be moved out of the living room entirely, without any loss of tone quality. The method is very simple. It is only necessary to enclose a space 6 ft. long between two floor joists. These beams are usually spaced 16 ins. between centers giving about 14½ ins. clearance.

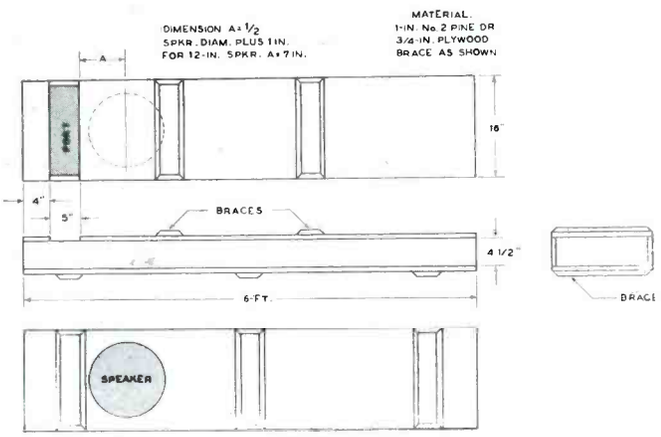


Fig. 6. Diagram showing the dimensions of the Air-coupler, and the location of the speaker hole and sound port.

An opening for the port must be cut in the floor, corresponding in size and relative location to that shown in Fig. 6. The opening can then be covered with a standard register grille. Also, a piece of light cloth should be secured under the grille to keep dust from settling on the speaker cone since, in this arrangement, the cone will be facing upward.

Where this can be done, it is recommended highly because low-frequency vibrations set up by the speaker are transmitted to the floor. This gives an amazing realism to organ and orchestra music, and maintains the bass response in proper relation to the middle and upper register, even when the volume is turned down.

However, if cutting a hole in a hardwood floor sounds impractical, many other less drastic measures may be employed. As has been mentioned before, the coupler can be placed on its 6-in. side, if it is well weighted or anchored. This opens up a myriad of possibilities for concealment. A bookcase will generally accommodate such an installation, either on one of the shelves or on top of the bookcase itself. It must always be remembered, however, that in whatever position the Air-coupler is installed, it must be well braced and anchored.

Middle-Range Speaker and Tweeter

The middle-range speaker in the original design was the same type as that used in the Air-coupler. It was mounted in a closed cabinet 24 ins. high, 18 ins. wide, and 12 ins. deep, and lined with 1-in. Celotex except on the front. These dimensions are purely arbitrary. Middle-range baffling is not critical, since the crossover point is 350 cycles. The tweeter should be enclosed in a small case, just big enough to contain the metal horn.

The Method of Speaker Phasing

An important requirement for satisfactory performance in the minds of the most critical listeners is the phasing of the speakers. If the speakers are not phased properly, it is true that cancellation will occur in the region of the crossover points, where two speakers are fed comparable amounts of power at the same frequency. Listening tests, however, do not entirely support this contention, phasing the speakers lending only slight improvement to performance.

Phasing can be accomplished easily after the speakers have been mounted in their cabinets. A frequency test record or an audio signal generator is required. The high and middle-range speaker cabinets are placed as close together as possible, in the same plane, and pointed in the same direction. Then a steady tone, at about the high crossover frequency, is supplied to the amplifier. By trying various combinations of connections to one speaker, one combination will be found which gives the greatest tone output. The speakers are then in phase.

The Air-coupler is then placed so that the port is close to the middle-range speaker, and a tone at about the low crossover frequency is fed to the amplifier. The Air-coupler speaker connections which give the louder combined output are determined. All three speakers are then in phase. The polarity of these connections should be noted and marked permanently, so that they can be reconnected properly.

In conjunction with the speaker system previously described, the equipment shown in Fig. 7 was used for the demonstration at the AES convention. At the left is the amplifier which was discussed earlier. Mounted on the record-player cabinet are a three-speed turntable and two pickup arms, one equipped with a crystal and the other with a reluctance cartridge. The crystal was used for 78 RPM records, and reluctance cartridge for 45's and LP's. This arrangement was used in order to demonstrate both types of pickups and all three types of records.

A Pickering preamplifier unit was mounted directly under the arm equipped with the reluctance cartridge, as can be seen in Fig. 8. This arrangement was one of convenience rather than optimum location. It was found that locating the preamplifier under the pickup arm caused a slight amount of hum to be introduced. Therefore,

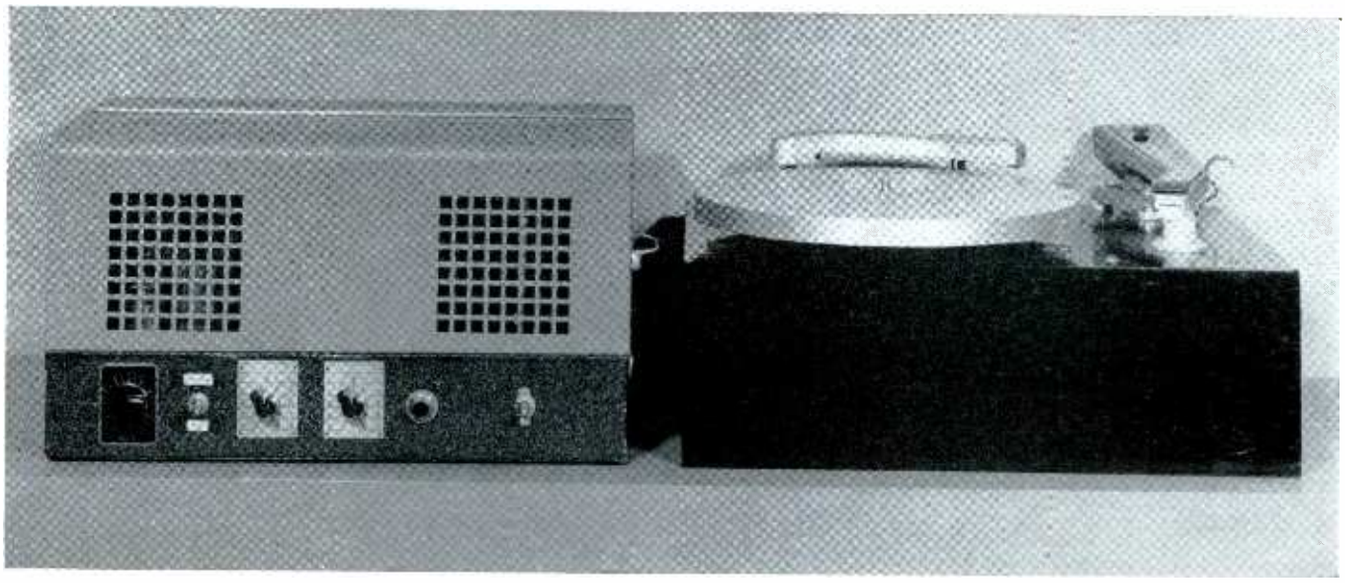


Fig. 7. The FAS amplifier and a 3-speed turntable, with crystal pickup for 78's and a reluctance pickup for 45's and LP records.

separation of these elements is more desirable. Two power switches were used: one for the preamplifier and one for the turntable.

Fine performance was obtained from both pickups. The crystal cartridge, which had a frequency response good to about 7 kc. without equalization, was further equalized by the use of a parallel RC combination of 100,000 ohms and 100 mmf., as recommended by the manufacturer. The low-frequency response of the reluctance cartridge when used in conjunction with the preamplifier was excellent also, transmitting organ pedal notes faithfully from record to amplifier.

It should be emphasized that a good turntable is required with the FAS system, because the slightest rumble or wow is immediately apparent. Care should also be taken to assure that the turntable is perfectly level.

FM and TV Tuners

Performance of the system when used with an FM or TV tuner is as good or better than when used with records. This is particularly true when live programs are being transmitted "wide open". An interesting discovery that will probably be made by the listener is that a good deal of hum is present in the transmissions of some broadcast stations.

THE CROSSOVER NETWORK

Since crossover networks are essential for satisfactory operation of the FAS speaker system, it might be well at this point to review the characteristics of typical networks. In order to simplify our discussion, we shall speak in terms of crossover networks having only two outputs — one for high frequencies and one for lows — and two speakers. As a matter of fact, when the original work was being done on the FAS system, such a two-speaker system was employed. However, it was soon found that the addition of a tweeter improved the brilliance of the sound output. A triple-speaker system, with a three-way crossover network, provided truly full-range reproduction. Such a system is employed in the present FAS system using a high crossover frequency of 1,200 cycles in addition to the 350-cycle low crossover point. The 1,200 cycle point was recommended by the manufacturer of the tweeter. A schematic diagram of the system is shown in Fig. 11. Again let it be stressed that the material presented here on crossover networks refers to two-speaker systems, but all statements apply equally well to three-way networks.

As has been mentioned previously, the purpose of a simple crossover network is to divide the output from an amplifier into two frequency bands. Frequencies above a certain reference, called the crossover frequency, are routed to one network output; frequencies below the crossover point are directed to a separate output. The low frequencies are then fed to a large speaker, which is best suited for bass reproduction. Higher frequencies

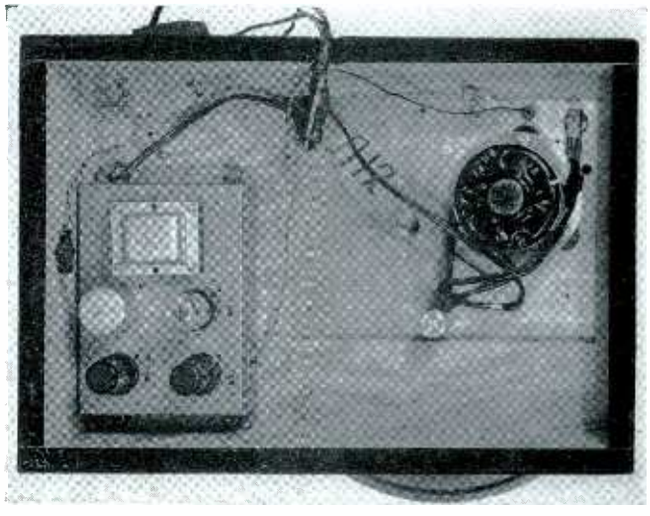


Fig. 8. A preamplifier for the reluctance cartridge can be mounted under the turntable base, making a compact unit.

are usually supplied to a small cone speaker or a tweeter horn, which reproduces highs well but cannot handle lows efficiently. Better reproduction of both high and low frequencies is obtained in this way, because each speaker is operated within its most efficient range. Also, tendencies toward intermodulation and high-frequency breakup are reduced.

Crossover network component values are determined by three factors: the system impedance, the crossover frequency desired, and the network configuration (series or

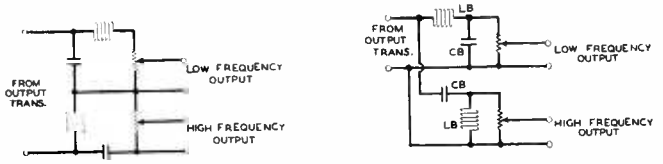


Fig. 9. Crossover networks: series, left, and parallel, right.

parallel). The system impedance refers to the impedance matching between output transformer and speaker. In this respect the crossover network acts in a manner similar to an impedance transformer. When the network is adjusted for any given input impedance, each output is of the same impedance as the input. Thus, if the speaker to be used with the crossover network is of 8-ohm impedance, the network should be designed for an 8-ohm impedance and connected to the 8-ohm tap on the output transformer.

The network configuration can be either series or parallel as shown in Fig. 9. The advantages of each are better shown by use of some specific figures such as are presented in the tables below. Representative values for both series and parallel networks, for crossover frequencies of 350 and 1,200 cycles, and system impedances of 8 and 16 ohms, are given:[3]

For system impedance of 8 ohms:

Crossover Freq.	Capacitance microfarads		Inductance millihenries	
	Series	Parallel	Series	Parallel
350	80	40	2.56	5.12
1200	24	12	0.74	1.48

For system impedance of 16 ohms:

Crossover Freq.	Capacitance microfarads		Inductance millihenries	
	Series	Parallel	Series	Parallel
350	40	20	5.12	10.24
1200	12	6	1.48	2.96

Performance-wise, there is little or no difference between the series and parallel circuits. However, one may offer constructional advantages over the other. An examination of the tables above reveals that the capacity required for the parallel network is always exactly half that needed for the series type. On the other hand, twice the inductance is required. The following factors should be considered when deciding which configuration to use:

1. Type of capacitors used: If it is planned to use paper or oil-filled capacitors, the parallel network will be considerably less expensive. But it is easier to wind chokes for the series type, and they are not so large physically. Therefore, a series network may be more satisfactory when electrolytic capacitors are employed.

2. Size of wire: Instructions for winding chokes of two wire sizes will be given below. If large wire such as No. 16 is used, there is very little resistive loss in any choke size. But if the coils are wound with small wire such as No. 26 the performance of a series network will be much better than that of an equivalent parallel type, because of the smaller resistive losses incurred.

[3] For complete data covering any crossover frequency from 100 to 3,000 cycles, see RADIO COMMUNICATION, December, 1950.

Data on Winding the Chokes

The basic coil form is shown in Fig. 10. A wooden dowel is cut to the required length, and two discs of masonite or other stiff material are attached with brass screws to hold the windings in place. Coil form dimensions are given below for both wire sizes:

	DIMENSIONS, INCHES		
	A	B	C
No. 26	½	1¾	1
No. 16	1	3	1¼

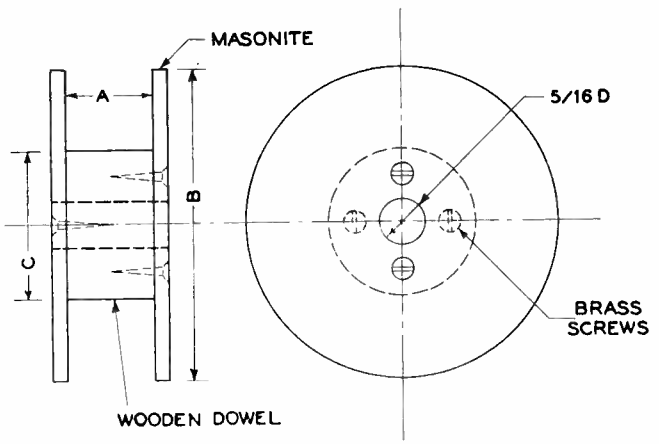


Fig. 10. Coil form for winding crossover network inductances.

Dimensions A and C are both critical. Dowels of the correct diameter can be purchased at most any hardware store. They should be cut precisely to the length given in the table above, because the length of the dowel determines the number of wire turns per layer. There should be 29 turns per layer of No. 26 wire, and 19 turns per layer of No. 16 wire. Total number of turns required for each choke follow:

	L_1, L_2	L_3, L_4
No. 26 wire	310	170
No. 16 wire	268	163

The center hole in the coil form, Fig. 10, is for the insertion of a ¼-in. bolt, which is secured by a nut. The end of the bolt is then inserted in a hand-drill chuck, and the coil can be wound quickly and easily. The bolt must be removed after the coil is wound.

Care must be taken that the enamel insulation is not scratched in the process of winding, with the resultant danger of short-circuiting a layer of the coil.

Ideally, the chokes should be mounted on a wooden

base or in a wooden box, and adjacent coils should be at right angles to each other and separated at least 6 ins.

Use of the Level Controls

Fig. 9 shows the crossover networks provided with speaker level controls. As can be seen, potentiometers are simply connected across both outputs, and the speakers fed from the movable contact arms. The resistance of these potentiometers should be as close as possible to 1.5 times that of the network impedance. Level controls on each output terminal will greatly improve the versatility of the system.

These controls serve two purposes. They can be used to adjust for differences in speaker efficiencies, which is their primary function. Another very important function is that of matching speaker impedances. For instance, it may be found necessary to use one 8-ohm speaker in a 4-ohm system, or a 15-ohm tweeter in an 8-ohm system. A mismatch which might otherwise be noticeable as power loss can be reduced to insignificance by the use of a speaker level control, set at the proper position. The control for the speaker which has the incorrect impedance should be set to give the best possible sound output. Then the other or controls should be adjusted for correct relative volume.

There are two distinct schools of thought on the use of these controls. One camp holds that they should be used as operating controls, so that they can be adjusted to suit the particular musical selection. Certainly, some unusual effects can be achieved by their manipulation, especially when the individual speakers are well separated.

However, the writer is inclined to hold the opposite

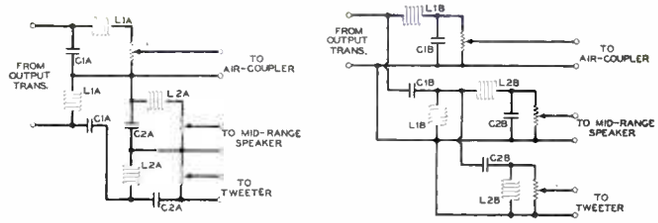


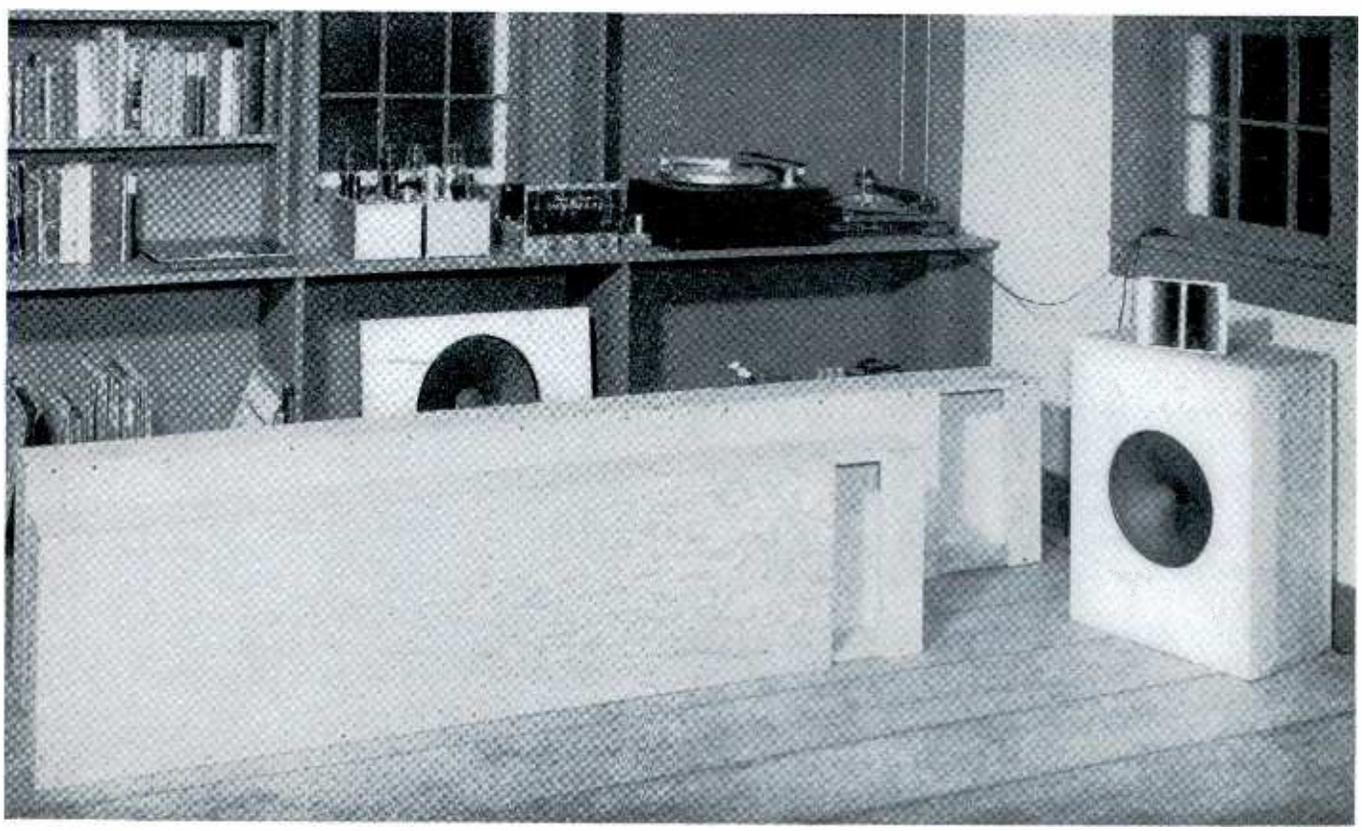
Fig. 11. Three-way crossover networks used in FAS system. Three level controls provide maximum adjustment.

view. There are enough operating controls in the usual amplifier as it is. Besides, nearly the same effects can be obtained with the FAS speaker system by operation of bass and treble controls, if such are provided, and in a more satisfactory way. It has been our experience that the level controls, once set for optimum balance, should be tucked away inside a speaker cabinet or, alternately, mounted on the back of a cabinet.

Complete Speaker System

In order to construct a complete FAS speaker system adapted for use with other amplifiers, a 3-way crossover network is required. Networks of both series and parallel configuration are shown in Fig. 11. It can be seen that each is composed of a basic low-frequency network, as in Fig. 9, to which a high-frequency crossover network of similar configuration has been added at the high output. Thus, the low output of the high-frequency network contains frequencies between the low and high crossover points.

Fig. 12. Temporary arrangement used during experiments with 15-in. speakers shows both 6-ft. and 8-ft. Air-couplers.

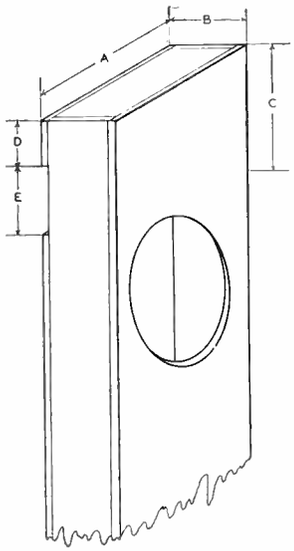


Computation of component values is carried out as follows:

1. Taking into account the factors outlined previously, the circuit configuration and low crossover frequency is determined. Then the required values for L1A and C1A, or L1B and C1B, are determined from the tables or other sources[4], for the amplifier output impedance.

2. Using the same impedance and configuration, values of L2A and C2A, or L2B and C2B, are obtained for the high crossover frequency. This can be anywhere from 600 to 3,000 cycles, depending on the recommended frequency for the tweeter employed.

3. Level controls are all of the same value, approximately 1.5 times the system impedance. These should be



DIMENSIONS FOR 6-FT AND 8-FT AIR-COUPLERS USING 12 AND 15-IN SPEAKERS

12-IN. SPEAKER	A	B	C	D	E
6-FT COUPLER	14 ½	4 ½	9 ¾	3 ¼	5
8-FT COUPLER	14 ½	4 ½	9	2 ½	5 ¾
15-IN. SPEAKER:					
6-FT. COUPLER	15 ½	5	10 ½	3 ¼	6½
8-FT. COUPLER	15½	5	11	5	7

ALL DIMENSIONS ARE INSIDE MEASUREMENTS

Fig. 13. Air-coupler dimensions for 12-in. and 15-in. speakers.

capable of handling about ¾ the maximum power of the amplifier. For general home use, a rating of 4 watts is usually sufficient for these components.

Adding to Present Equipment

Either of the circuits of Fig. 9 is all that is needed to add an Air-coupler to an existing system. The present speaker system should be connected to the high output of the crossover network, and the Air-coupler to the low output. The present speaker system should be used in its entirety, without alteration, on the high end. This is because the Air-coupler is not a replacement for the usual bass speaker, but a means to extend the lower range smoothly from the point where the conventional bass speaker begins to falter. A tweeter cannot handle the full range above the Air-coupler crossover point. Therefore, the existing speaker must be retained in order to cover the middle range.

FURTHER EXPERIMENTATION

Before proceeding to a discussion of the various experiments which have been carried on since the development of the original FAS system, let us sound a note of caution. If you want to put an FAS system into operation with certainty as to the results you will obtain, we advise you to adhere strictly to the specifications which have been outlined thus far. However, if you want to experiment with the system and to take part in its development, this account of the further experimentation which has been carried on will provide definite direction to your work.

The FAS system as described above was developed to its high point of perfection using 12-in. speakers. It has created unprecedented acclaim among audio enthusiasts, but with the praise came questions. Predominant among all the inquiries received were two questions which became a challenge to all concerned: 1) how can I use my 15-in. speaker to best advantage in the Air-coupler, and 2) what happens if I use a longer Air-coupler?

Equipment Used

It would be well at this point to enumerate the various pieces of equipment which were used in these tests. Let it be understood that any equipment equivalent in quality and nature can be used. The mention of specific models of equipment is meant only to indicate the nature of the apparatus employed. It also indicates the number variables which can influence any custom installation of an FAS system, and these variables all interact to affect the final result.

The photograph, Fig. 12, shows the 6- and 8-ft. Air-couplers laid side by side to indicate their relative size. The Altec 600-B on the 6-ft. Air-coupler is matched with the GE in the small cabinet. The University tweeter carries the extreme highs. The 15-in. Jensen woofer is on the 8-ft. Air-coupler; note the 7-in. port on this coupler. Behind the couplers is the Jensen coaxial speaker, matching its 16-ohm counterpart on the Air-coupler. On the shelf is the McIntosh amplifier, a Browning tuner, and two turntables. The Presto turntable on the left is equipped with a Gray viscous-damped arm and a Pickering cartridge; the Webster changer at the right has GE reluctance cartridges for 78-and 33-RPM records.

The 8-ft. Air-coupler

An indication of what would happen when a 15-in. speaker was attached to a 6-ft. coupler, was readily available from the comments of audio enthusiasts who had tried it. The result of using such an arrangement was a series of high resonant peaks. With this advance information, the FAS group decided to start in directly with an 8-ft. Air-coupler.

In the first experiment, the Altec 600-B speaker, a 12-in. model, was located in the same relationship to the port as on the smaller coupler. This means that the top edge of the speaker hole was 1½ ins. below the port opening. The inside dimensions of the coupler were 94½ ins. long by 15½ ins. wide by 5 ins. from front to back. The port was located 3¾ ins. below the top of the coupler, and was 5 ins. wide. Material of construction was ¾-in. plywood. No braces were used since it was desirable in these experiments to make resonances as pronounced as possible.

Continued on page 74

[4] See "The FAS Audio System", Part 3, RADIO COMMUNICATION, December, 1950.

RECORDS for your CHILD

Of the thousands of children's records now available, many are constructive; others are just records. Beatrice Landeck, author of the book "Songs to Grow On" and nationally known for her articles on music for children, here offers specific suggestions to help you in your selection.

BEATRICE LANDECK

A LIBRARY of phonograph records for children has one obvious advantage over radio and television: the choice of what the child hears can be regulated by the parent. Such a collection not only provides first rate entertainment but has educational and cultural value as well.

There are no absolute standards for judging the suitability of a record. The important factor is how it fits a particular child's temperament, intellectual comprehension, and interests. A good library includes a wide variety of records ranging in content from subjects of immediate interest to those that broaden the child's horizon. The accumulation of odd gifts chosen haphazardly to give fleeting diversion only clutters a collection and is to be avoided.

Children themselves cannot be expected to make a prudent choice of records when they are not aware of the final objective. As the child develops taste and discrimination through guided experience, he will enjoy choosing his own records, but, until that time, it is better that the parent select the records, with the knowledge of what he wants them to achieve.

The following recordings chosen from last year's output are highly recommended. They are listed in an order roughly graded according to age, and all are 10-in. 78 rpm unless otherwise stated.

SONGS

Outstanding in this category are the American folksongs which have a strong appeal for all ages from the youngest to the oldest. Children learn these songs easily and sing them on their own not only as the record spins but at other times also.

CHILDREN'S RECORD GUILD
- *Mary Doodle.* Sung by Susan Reed. 2 to 5 years. 1014
- *I Wish I Were.* Music by Mohaupt. 2 to 5 yrs. 1006
- *Skittery Skattery.* Gene Lowell Chorus. 5 to 8 yrs. 1005
- *Grandfather's Farm.* Gene Lowell Chorus. 5 to 8 yrs. 5004
- *Ship Ahoy!* Told by Alan Hewitt. 5 to 8 yrs. 5003

YOUNG PEOPLE'S RECORDS
- *Mary Martin Sings for Children.* Pre-School.
- *More Playtime Songs.* Sung by Charity Bailey. Elementary.
- *Singing in the Kitchen.* Sung by Charity Bailey. Elementary.
- *A Capital Ship.* Sung by Tom Glazer. Elementary.
- *Sing Along.* Sung by Mardi Bryant. Elementary.
- *Another Sing Along.* Sung by George Rasely. Elementary.

COLUMBIA
- *Mother Goose Songs.* Sung by Burl Ives. 2 10-in. MSV 67
- *Animal Fair.* Sung by Burl Ives. 2 10-in. MSV 59

DECCA
- *Children's Corner.* Sung by Frank Luther. 2 10-in. CVS 14
- *Get Along, Little Dogies.* Sung by Frank Luther. 2 10-in. CVS 18.

CAPITOL
- *Cowboy Songs and Stories.* Sung and told by Tex Ritter. 2 sets of 2 10-in. DBS 133 and DBS 134

CONTINENTAL JUNIOR
- *The Big Rock Candy Mountain and others* J 59
- *Whoop Ti-Yi and others.* J 56
- *Clementine and others.* J 55

LIBRARY OF CONGRESS
- *Soldier Won't You Marry Me?* AAFS8
- *Negro Work Songs.* AAFS14
- *The Gray Goose.* AAFS15
- *Negro Children's Games, Lullabies and Ring Games.* 12-in AAFAS20

ACTIVITY RECORDS

Young children usually want to become acquainted with their environment by impersonating animate and inanimate objects through play-acting. The following records encourage such response.

CHILDREN'S RECORD GUILD
- *Little Red Wagon.* 5 to 8 yrs. 1004
- *Train to the Zoo.* 5 to 8 yrs. 1001
- *Ride 'Em Cowboy.* 5 to 8 yrs. 5001

YOUNG PEOPLE'S RECORDS
- *Little Gray Ponies.* Elementary.
- *Little Cow Girl.* Elementary.
- *Every Day We Grow.* Elementary.

RCA
- *Fun All Day Long.* Sung by Cliff Edwards. Y403
- *Fun On Old MacDonald's Farm.* Sung by Cliff Edwards. Y404
- *Cowboy Fun.* Sung by Cliff Edwards. Y405

STORIES WITH MUSIC

To set the mood and heighten the emotional content, well-arranged classical music and new scores by contemporary composers are used as background to the following stories and poems.

LITTLE GOLDEN RECORDS
- *Out of the Window* and *The Busy Elevator.* Music by Alec Wilder
- *Five Little Firemen* and Bach's *Flute Dance*

COLUMBIA
- *When We Were Very Young.* Sung by Gene Kelly. 2 10-in MS 42
- *The Eager Piano.* 2 10-in. MS 43

DECCA
- *Winnie the Pooh* and *Christopher Robin Songs.* Sung by Frank Luther. 1 12-in. CV 109

CHILDREN'S RECORD GUILD
- Prokofieff: *Cinderella* (as done by Sadler's Wells Ballet) 2 10-in.
- *On Lemmer Lemmer Street* 5006

YOUNG PEOPLE'S RECORDS
- *Rocket to the Moon.* Music by Raymond Scott. Elementary.
- *Little Hawk, the Indian Boy.* Music by Herbert Haufrecht.
- *Robin Hood.* Music by Haufrecht. 2 10-in.
- *Emperor's New Clothes.* Music by Douglas Moore. 2 10-in.

WILLIDA RECORDS CO.
- Stravinsky: *Petrouchka.* (Condensed form) KL12
- Prokofieff: *Peter and the Wolf.* (Condensed form) KL6
- *Johnny Appleseed.* KL9

VOX PRODUCTIONS, INC. 3 10-in.
- Music Master Series: Mozart, Beethoven, Schubert, Mendelssohn, Chopin, Schumann, Tchaikovsky, and Grieg

OTHER INTERESTING ITEMS

DECCA 2 10-in. CVS 19
- *Little Orley: His adventures with the Barn Dance, the Poison Ivy, the Moon, and the Pancake, told by Uncle Lumpy.* These inimitable, imaginative tales are in folk style — refreshing and amusing.

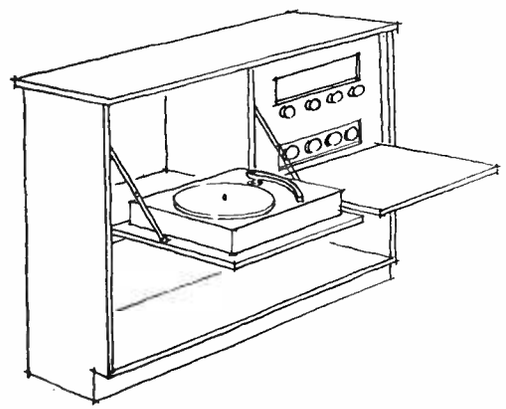
Continued on page 76

Here's a practical and original solution to the problem of fitting a 16-in. turntable into an 8-in. shelf. The article is excerpted from a new book, Make Music Live, which is soon to be published.

BOOKSHELF INSTALLATION

IRVING GREENE

Fig. 1 This method of mounting a record-player or transcription turntable can be adapted to bookshelves or to a custom console such as the one illustrated below.



ALMOST all high fidelity enthusiasts encounter the problem of sufficient cabinet depth when building a home music system. There is usually adequate space for the radio tuner, amplifier and speaker. The record player, however, presents a very serious problem because it requires more depth than is usually available in existing furniture or bookcases. Consequently, many phonophiles must resort to placing their record player on top of a table or bookcase. While this arrangement may seem functional at the time, it is far from artistic and furthermore, is unsound from a practical standpoint, because it exposes the delicate mechanism of the phonograph to dust and accidental damage. Some other method of installation must be devised.

Regardless of the shape, size or form of the existing furniture, there is generally sufficient height and width, but rarely sufficient depth, for proper installation. Record changers such as the Webster-Chicago 356 and 106 series require a minimum dimension of 15 ins. front to back, while the Garrard RC/80 series requires 13¼ ins. Since the maximum depth of bookcases or similar shelf arrangements is approximately 11½ ins., even the smallest record changer will not fit into them under normal mounting conditions. The serious music lover who wishes to use a transcription pickup arm and turntable faces an even greater problem, because the bare minimum for this type of installation varies from 16½ ins. to 24 ins.

The problem of space limitation is not a hopeless one and can be solved easily by the average home craftsman capable of doing some cabinet work. The materials required are readily obtainable. No special tools are needed either for the woodwork or for the installation. Those who wish to have the work done by an expert will find the information presented here sufficient to guide the local cabinetmaker.

As illustrated in Figs. 1 and 2, a record player can be mounted in a bookcase section less than 12 ins. in depth if the assembly is mounted so that it swings to vertical when the door is closed. This provides a simple and practical solution to the depth problem. None of the changers previously mentioned requires more than 10 ins. from the top of the spindle to the bottom

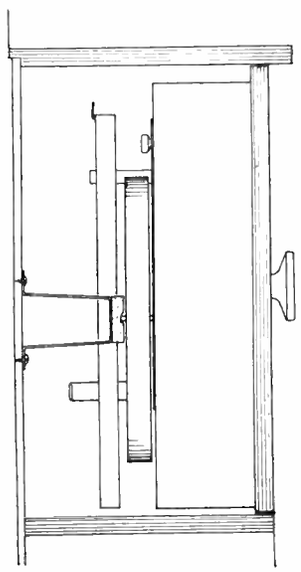


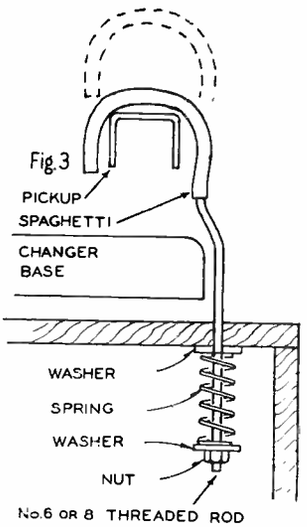
Fig. 2. In closed position, record-player stands vertically. Arm and turntable are held in position by U and S-brackets.

of the motor, and this is the dimension which becomes depth when the changer is tilted into the vertical position.

However, before starting on such a project, there are several factors to be considered. These are dictated by the characteristics of each type of transcription arm, turntable, or changer mechanism.

The first problem is that of holding the pickup arm in place when the unit is tipped to the vertical position. A freely moving arm will swing and may damage the stylus. Whether or not the arm is a part of the changer mechanism or transcription player has little bearing on the problem, but restricting the action of the arm when the entire assembly is lifted for storage is very important.

A survey of the various arms used in record playing systems shows that the Pickering Model 190, the Astatic Model 400, and the arm of the Garrard RC/80 Record Changer lock when in the rest position. The Pickering is held in place by a magnetic strip on the arm which holds fast to the bar rest. The Astatic is held in place by means of a knurled screw which fits into a grooved arm rest, and the Garrard arm is automatically locked in the rest position. The arm of the Markel Playmaster Changer does not require support as it remains in a stationary position when placed on its side. Consequently, these changers present no problem of arm action when swung into the vertical position. The arm of the Webster-Chicago changers, and the Audak, Livingston, Clarkstan and General Electric transcription arms, require a retaining clip, Fig. 3, which can be easily constructed from a length of threaded brass rod (6/32 or 8/32 screw stock) and some radio spaghetti. The rod stock can be fabricated into almost any shape that may be required to fit the pickup arm. The exact dimensions and shape of the retaining clip will be determined by the particular arm for which it is designed.



Another problem encountered in vertical mounting is support of the turntable. The current Webster-Chicago series[1] are made with a retaining pin which holds the turntable in place when the unit is on its side. This is also true of the Markel Playmaster Models 74 and 75. The turntables manufactured by Alliance and General Industries, are supplied with a C-clip which secures the turntable to the assembly. Such units do not require any additional support.

The older Webster-Chicago changers are mounted on rubber washers fitted into cone-shaped springs which are secured in circular wells routed into the wood base. The changer then floats freely to cushion the record when it drops. One method of securing the Webster changer assembly, Fig. 4A, is to substitute Webster-Chicago part No. MH-59, which is normally used for portable units. A more satisfactory method is shown in Fig. 4B. The S-clamps may be purchased from a local hardware dealer or can be fabricated in the home workshop from strip brass. The inside is lined with felt which is glued to the clamp with fabric-to-metal cement. This type of clamp permits the changer to float and yet secures the changer mechanism when lifted and folded inside the cabinet. If Webster 355 or 357 series is used, this type of clamp is unnecessary as the changer is supplied with a metal base.

[1] See instructions in following paragraphs for spring-mounted Websters.

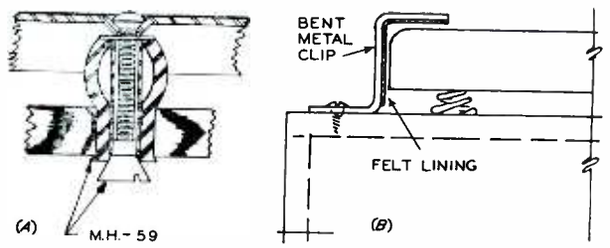


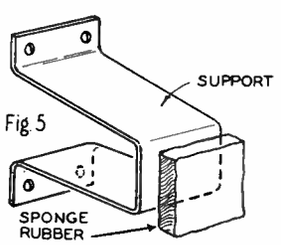
Fig. 4A shows a standard mounting screw for portable record changers. Fig. 4B is a suggested alternative.

The Garrard changer, although mounted like the Webster to float on springs, is secured to the base by feed-through screws, which are also used to level the changer when mounting. Consequently, this changer does not require any precautions to prevent it from dropping back or moving out of position.

The Rek-O-Kut, Presto, and Garrard units have heavy turntables which may fall out when the assembly is tilted for storage. As shown in Fig. 5, a cushioned support can be made from strip brass and foam rubber. It can be easily bent into proper shape and size in a vise, or a standard U-bracket of the proper size can be purchased in a local hardware store. The foam rubber cushion cemented to the end of the support will prevent damage to the turntable. The method of installation is shown in Fig. 2.

Almost all manual turntable assemblies are secured to the base by wood screws and do not float on springs. Consequently, there is no danger that the unit will move out of position or fall back when the assembly is folded back into the vertical position for storage.

The base necessary for mounting the record-playing equipment can be constructed from ¾-in. lumber core plywood, faced with a veneer to harmonize with existing furniture in the room. To make such a base, first cut out the motor board or top to agree with the template furnished by the manufacturer of the equipment. Cut the sides to size, butting or mitering the corners, and fasten together with screws. Finish the base as desired, and when dry, mount the record equipment as previously described. Fasten the entire assembly to the drop leaf door by means of four 2½-in. angle brackets placed at each side of base.



SELECTING A SPEAKER

WILLIAM H. THOMAS

IF YOU are planning to buy a loudspeaker, the chances are that you are already familiar with the performance of speakers built into audio or television receivers, and that you are dissatisfied with what has been the generally-accepted quality of reproduction from factory-built cabinet models. In that case, you have something in common with the great and increasing number of people who are coming to realize that "store sets" fall far short of reproducing original speech and music. And you are probably seeking the realism which can be obtained from well-chosen components, assembled into a high-fidelity installation.

The Experience of Critical Listening

It is the purpose of this article to discuss the role of the loudspeaker in custom installations, its particular function in high-fidelity reproduction, and the design features which must be considered in selecting a speaker, or combination of speakers, that will most nearly meet your particular requirements.

The contrast between the audio quality of factory-built sets and high-fidelity installations is so great that it is important, before selecting a wide-range speaker, to take ample time to become acquainted with the difference in tone quality. At first, you may not be ready to accept the change. Then, after you have become accustomed to realistic reproduction, you will wonder how you ever put up with the tone of conventional radios and phonographs. And you will begin to understand why the great, new demand has grown during the last four years for audio quality which virtually recreates the original programs, instead of merely simulating them.

Basic Types of Loudspeakers

The choice of a particular type of speaker should be determined to a considerable degree by the specific equipment used with it. However, it is not the purpose of this article to discuss the various elements of a complete audio installation, although certain general recommendations will be made.

The first decision to be made when buying a loudspeaker is the selection of a type that will satisfy your requirements as to location, available space, the enclosure, and the price. And remember that a speaker and its enclosure cannot be considered separately, since the performance of the former is affected to a considerable extent by the design of the latter.

There are three basic types of speakers or speaker systems from which to choose:

1. The single, wide-range cone-type, mounted in a reflex enclosure or on an infinite baffle, such as the wall of a room.

2. The dual speaker system, comprised of cone-type speaker as a woofer, and a small diaphragm-type speaker as a tweeter. These are used in conjunction with an electrical filter or crossover-network that feeds the lower frequencies to the large speaker, and the higher frequencies to the small speaker.

3. The built-in installation where a combination of speakers is fabricated completely as a unit in a single enclosure, or built into the actual structure of a room.

The single-cone speaker should be chosen if the associated equipment is not of the highest quality. The divided network system reproduces the extremely high and extremely low notes faithfully, and that is where distortion is most serious in associated equipment of mediocre quality. It requires a really good amplifier, pickup, or radio tuner to do justice to a divided network system. The single speaker is less expensive, and can provide very satisfactory reproduction when it is used properly.

Thus the divided network speaker system should be chosen only when the best possible results are demanded, and when all other components are of equally high quality, and are designed to work together. This point is emphasized because so many people have had the experience of having the performance of a fine amplifier spoiled by an inadequate speaker, or of buying a high-quality speaker that emphasizes the distortion contributed by a poor amplifier!

Notes on the Design of Loudspeakers

A discussion of the technical features of speaker design and performance immediately enters a field that is wide open to controversy. In lieu of technical support for the statements to be made, the writer wishes to explain that the opinions expressed are drawn from accepted general practices of those who are experienced in this field.

There is a tendency to rate speakers according to cone size. The size of the cone is important, it is true, but it is secondary to the quality of reproduction. That is, a good 8-in. speaker can deliver far better audio quality than a mediocre, 15-in. type.

Again, in a divided network system, the components must all be of the highest quality; they must be accurately matched and balanced in respect to one another, and the enclosure must be designed correctly. If all these conditions are not met, it is very possible that a single, high quality speaker will provide better response.

There are several characteristics of speaker design and

performance which can serve as a guide in selecting loudspeakers although, unfortunately, it is not easy to check them in a dealer's demonstration room.

Loudspeaker Efficiency

One figure of merit widely applied to loudspeakers is given by the formula $(BL)^2/R_{vc}$, where BL is the magnetic force in the gap (between magnet and voice coil) times the length of wire on the voice coil, and R_{vc} is the DC resistance of the voice coil winding.

It would be possible to measure BL by connecting a dry cell, rheostat, and milliammeter in series with the voice coil, putting a weight on the cone, and observing the current required to lift the cone to its initial position. The writer is not recommending such a procedure to prospective purchasers of loudspeakers, however, as it would not be conducive to cordial relations with audio equipment dealers!

Some idea of the relative BL factor, or efficiency, of two speakers can be obtained by instantaneously switching the same program source from one to the other, and noting the difference in volume level. Of course, the results of such a test are influenced by the sound-distribution angle of each speaker, and the acoustics of the room. However, any really great difference in efficiency is readily noticeable. With exceptions noted later, the more efficient speaker is to be preferred.

A voice coil of large diameter is superior to a small one. For instance, there are speakers available with voice coils ranging from 1 to 4 ins. in diameter.

The best cone is the one that is stiff enough to reproduce low, fundamental frequencies, light enough in weight so that the mass is kept sufficiently low for the reproduction of high frequencies, and designed to break up evenly in the middle range. Finally, the cone should have a free air resonance of 40 cycles or below.

Unless you have the advice of an expert, or want to experiment on your own, it is not advisable to buy a low frequency speaker of one make, a tweeter of another, and a network from a third source. Proper balancing, achieved by coordinated design, are of the utmost importance. The components of most high-quality systems supplied in assembled or kit form are properly balanced and matched.

Amplifier Power Requirements

The amount of amplifier output power required by a speaker for realistic reproduction is of great importance. According to Massa[1], the optimum reverberation time for a 1,000-cycle note in a room of 2,000 to 10,000 cubic feet is very close to 1 second. Massa also states that peak sound pressures of 100 dynes per square centimeter are required to produce realistic musical reproduction. A sound power of 0.8 acoustic watts is required to produce sound pressure of 100 dynes per square centimeter in a room of 3,000 cubic feet, having the optimum reverberation time of 1 second. The power required is, of course, proportional to the volume, so that a room of 1,500 cubic feet would require half as much power.

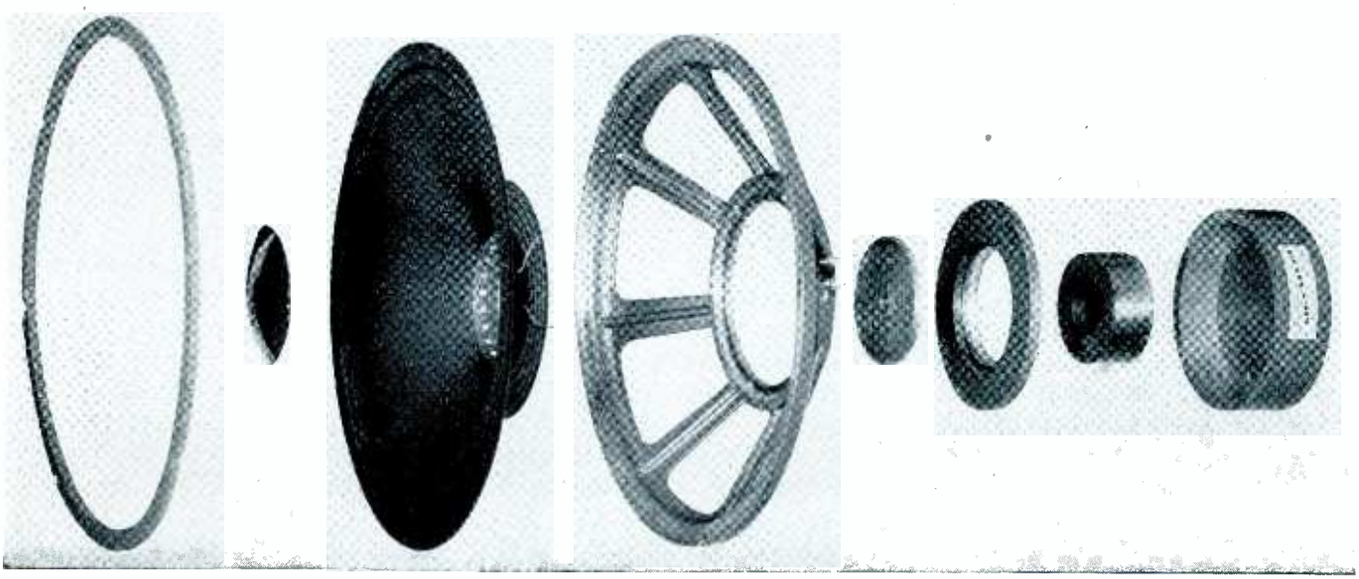
For peaks of 0.8 acoustic watts, an average power of 0.2 to 0.4 acoustic watts is necessary.

It can be shown that if you want to achieve flat response or, let us say, response flat within plus or minus 1½ db, from the mid-range value down to 40 cycles, and you want to do this with a 15-in. speaker mounted on an infinite baffle, the speaker must have an efficiency of approximately 1% in relation to its radiated acoustic power. That means 20 to 40 clean electrical watts average power input to reach the required sound pressure in a room of 3,000 cubic feet.

Most ordinary speakers designed for infinite baffle service and installed therein do not satisfy the plus or minus 1½ db requirement for flatness or response down to

[1] *Acoustic Design Charts* by Frank Massa.

An exploded view of the components of a loudspeaker. Design factors which influence fidelity of reproduction are discussed in the text.



40 cycles, because they have efficiencies of from 4 to 6 percent and are, hence, not flat in response below 100 cycles. Also, if their free air cone resonance is high — say, 70 cycles or above — their response will have fallen off considerably, long before 40 cycles is reached. Because of their greater efficiency, these speakers would require only 4 to 16 watts to produce the required sound pressure of 100 dynes per cm^2. However, if bass boost, through use of the tone control is applied to bring up the response in low-frequency region, the power requirement increases rapidly to approximately the amount required by the 1%-efficient speaker.

It must also be remembered that the acoustic output of a flat plate or piston in an infinite baffle is the square of its velocity times the radiation resistance of the air on the piston. Fig. 1 shows the computed radiation resistance of a flat plate or piston in an infinite baffle, and Fig. 2 is the same curve calibrated for a 15-in. speaker in terms of db level rather than watts.

It can be seen from Fig. 1 that when the ratio of cone diameter to wave length is less than 0.5, the radiation resistance begins to drop off at the rate of 6 db per octave. From Fig. 2 it can be seen that for a 15-in. speaker this occurs at approximately 440 cycles.

Now to return to our piston or cone in an infinite baffle, it is evident that to maintain a constant acoustic output below 440 cps for a 15-in. cone, the velocity of the cone must increase inversely with frequency. This means that

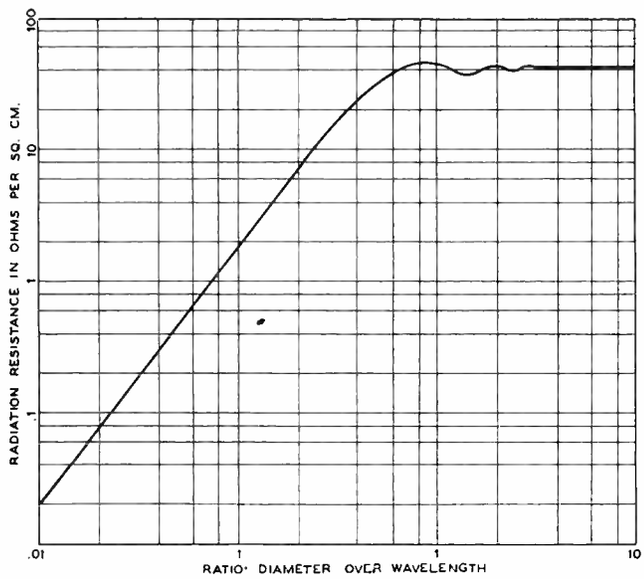


Fig. 1. Computed radiation resistance of a flat plate or piston.

the displacement or excursion of the cone will have to increase inversely as the square of the frequency. For example, for a cone speaker to radiate one acoustic watt of power at 40 cycles in an infinite baffle, the cone must move almost ¾ of an inch, peak to peak. This amount of excursion cannot be handled by most speakers and even the finest available will show considerable distortion long before this point is reached.

On the other hand, a high efficiency direct radiator, possessing a large electro-magnetic coupling coefficient or BL factor, has a diaphragm whose velocity is independent

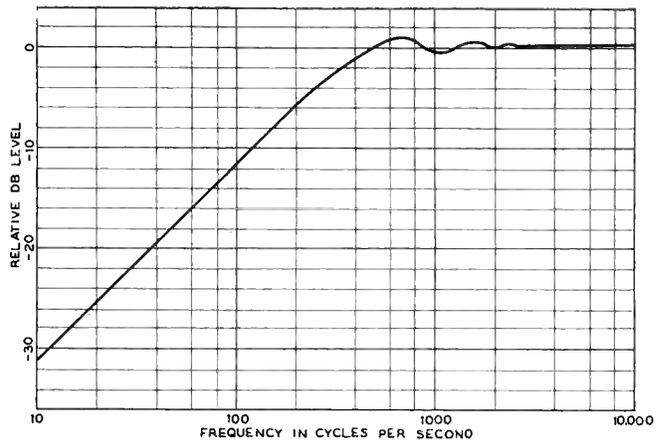


Fig. 2. Drop in radiation resistance, in db, for a 15-in. speaker.

of frequency for a constant applied voltage to the driving coil. The sound output of such a speaker will then, of course, drop off 6 db per octave below the critical point of 440 cycles for a 15-in. speaker[2]. But the response from this highly-efficient radiator, when installed in a properly designed reflex enclosure, will hold up relatively flat down to 40 cycles. Now this diaphragm has only increased its displacement inversely in proportion to frequency instead of inversely as the square of the frequency as is the case with the infinite baffle. The total peak-to-peak displacement then for the efficient unit for the same condition of one acoustic watt radiated is only 1/16 of an inch approximately. This amount of displacement is entirely reasonable and can be accomplished by most high-quality speakers without distortion.

Several speakers of this type are available with efficiencies of the order of 15%. These speakers, in accordance with our previously stated requirements, will then need power inputs from the amplifier of only 2 to 4 watts to reach required peak power levels in the room.

Our original assumptions were, of course, based on quiet surroundings, a relatively small room, minimum acceptable power, and average musical programs. If the scene changed instead to a small party in a larger room and a symphony orchestra requiring a high peak volume level, the power requirement might well tax a full 20-watt amplifier even with the efficient speaker in a reflex enclosure. It is obvious what would happen to the infinite baffle unit that originally required 20 to 40 watts.

As to the type and design of the proper enclosure for the speaker of your choice, the two should be considered inseparable, and the manufacturer's recommendation should be obtained and followed closely.

True high fidelity reproduction is certainly an accomplished fact and is being enjoyed by an ever increasing group of music lovers and professionals throughout the country. It is still necessary, however, to consider the purchase of such equipment with more thought and study than is required when purchasing the average radio. Ample time should be given to selecting the correct speaker, in its recommended enclosure, to match the amplifier and the requirements of room acoustics.

[2] Throughout this discussion, 15-in. speakers have been referred to, since the chart of Fig. 2 is drawn up for such speakers. The principles, however, hold for speakers of different diameters, only the critical values being different.

You can improve TV audio with this

VIEWER'S AMPLIFIER

MELVIN SPRINKLE

TO THOSE accustomed to listening to records or FM radio programs over a wide-range, high-fidelity audio system, the sound performance of most commercial television receivers is a bitter disappointment, made all the worse because of the knowledge that many TV transmissions start out as some of the very best, wide frequency range material on the air today.

Much of the reason for the poor audio performance of average TV receivers lies in the commercial aspects of manufacturing and selling these receivers. The dealers — and the public — want bigger picture tubes. For the dealer, they are tremendously effective as point-of-sale persuasion. For the public, they are often taken to indicate superior quality.

For the manufacturer, the cost of the video part of a TV receiver is many times that of the audio part, and it cannot be reduced without seriously affecting picture quality. The economies are often made on the audio section of the receiver. For instance: prior to last November, when the excise tax applied only to audio components, it amounted to about $1.50 for most TV models. That meant that the audio section, complete with speaker, was valued at $15 in the manufacturer's selling price! Not much in the way of audio realism can be expected for $15.

Some information has been published on improving the audio reproduction from TV sets, but this has been limited to data on changing the output transformer, usually to a larger replacement type, and perhaps introducing a little inverse feedback.

These measures do improve the quality, but only to a very limited extent. A real job calls for a high-quality output transformer, a push-pull power stage, inverse feedback circuit, an adequate power supply, and a good loudspeaker. TV cabinets haven't that much space to spare.

Design of the Viewer's Amplifier

The units shown in Figs. 1 and 2 are the result of the writer's determination to get the full value of television entertainment that can be obtained from a moderately-priced table model, by making a small additional investment. The added enjoyment is not debatable. In fact, a demonstration of the improvement is so impressive that this unit, which has been called the Viewer's Amplifier, offers a source of considerable extra business to custom set-builders and servicemen.

Essentially, this design is intended to combine, in minimum physical size, frequency response flat within 1 db from 30 to 15,000 cycles, and undistorted power over a wide frequency range. The latter specification is a new concept to high-fidelity enthusiasts who have been concerned primarily with frequency-response curves. Fig. 4 presents the frequency response and power curves of the Viewer's Amplifier, with intermodulation plotted against power in Fig. 5.

Any good output transformer should show reasonably flat frequency response, but the power curve is actually of far greater significance. The measurement of intermodulation, which so plainly reveals the operating defects of amplifiers, emphasizes the importance of the power curve.

A plot of frequency response shows the degree to which a signal is attenuated at various frequencies as it passes through the transformer; *i.e.*, it is a measure of gain or loss.

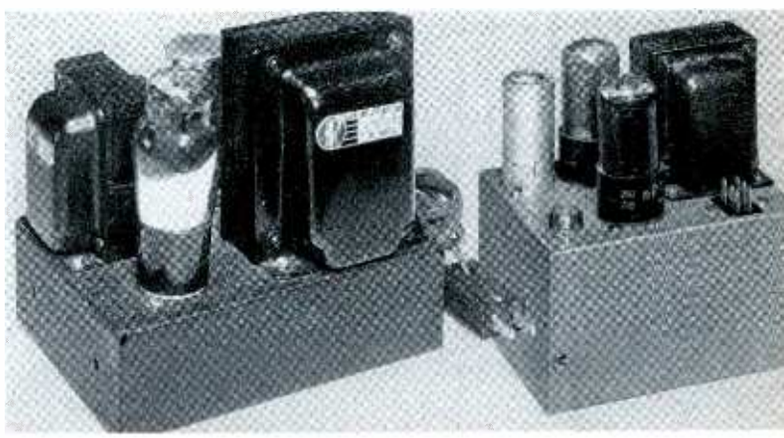


Fig. 1. Amplifier and power units are on separate chassis.

On a power curve, the zero line represents the full, rated output level of the tubes. The curve shows the maximum power of which the transformer is capable without attenuating or distorting the wave-form. Thus it shows the maximum useful power at any frequency.

Because this factor was given special consideration in the design of the Viewer's Amplifier, a few words of additional explanation are in order:

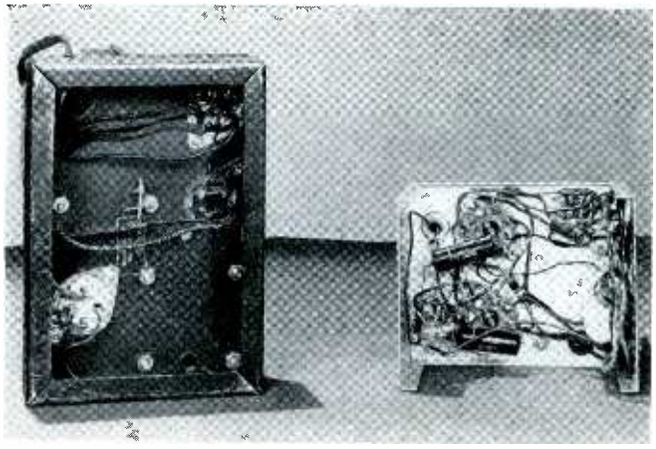


Fig. 2. Wiring of power supply and amplifier is very simple.

The power curve of a transformer in general follows the frequency response curve, but droops much more at the frequency extremes. At the low frequencies, the exciting current increases, particularly when power is drawn from the transformer. When the exciting current component of the primary current attains a magnitude comparable to the load component, the distortion inherent in the exciting current causes the secondary voltage to become distorted, and terminates the useful power delivery of the transformer. In poor transformers, this effect occurs long before levels are attained that might be expected from the frequency response curve alone. At the high frequencies, magnetic leakage and shunt capacity cause the power to fall short. In the Peerless S-508A transformer specified for this amplifier, the power is not more than 3 db down at 30 and 15,000 cycles.

The intermodulation curve was made with Altec-Lansing equipment. It is a very rigorous test since frequencies of 40 and 2,000 cycles were used. Usually, in the case of an inexpensive output transformer, frequencies of 100 and 2,000 cycles are used. It must be pointed out that while the IM curve shows larger numbers than harmonic measurements for the same degree of distortion, the apparently large numbers do not indicate excessive distortion. At the usual living room loudness level, where the power used is about 0.5 watt, distortion in this amplifier is practically non-existent, and it remains at inaudible values in the 10-db safety zone to handle the peaks in speech and music.

As Fig. 3 shows, the voltage amplifier and phase-inversion functions are combined in a single tube. The use of a 12AT7 miniature double triode has made it possible to keep the overall dimensions of the amplifier to $5\frac{5}{8}$ by 4 by 5 ins. The tube selected has high transconductance, and puts out plenty of drive voltage, with some real gain.

The first section is a conventional amplifier stage, using self bias, and is direct-coupled to the phase inverter. The phase inverter is of the cathodyne or split-load type, having equal load resistors in the plate and cathode circuits. This type of circuit has several advantages, among which are almost perfect balance over wide frequency range, independence of changes in performance with tube replacement, and inverse feedback action. In addition, it lends itself readily to direct coupling from the preceding stage. The high cathode resistance in the phase inverter would produce an abnormally high bias, but this is offset by positive voltage from the preceding plate, so that both stages operate properly. As a matter of fact, the direct-coupled circuit is almost automatic in its adjustment for optimum operation. There is the additional dividend in that the direct coupling extends operation to DC frequencies, and eliminates a coupling capacitor which, unless it is of generous size, can cause low-frequency attenuation and phase shift.

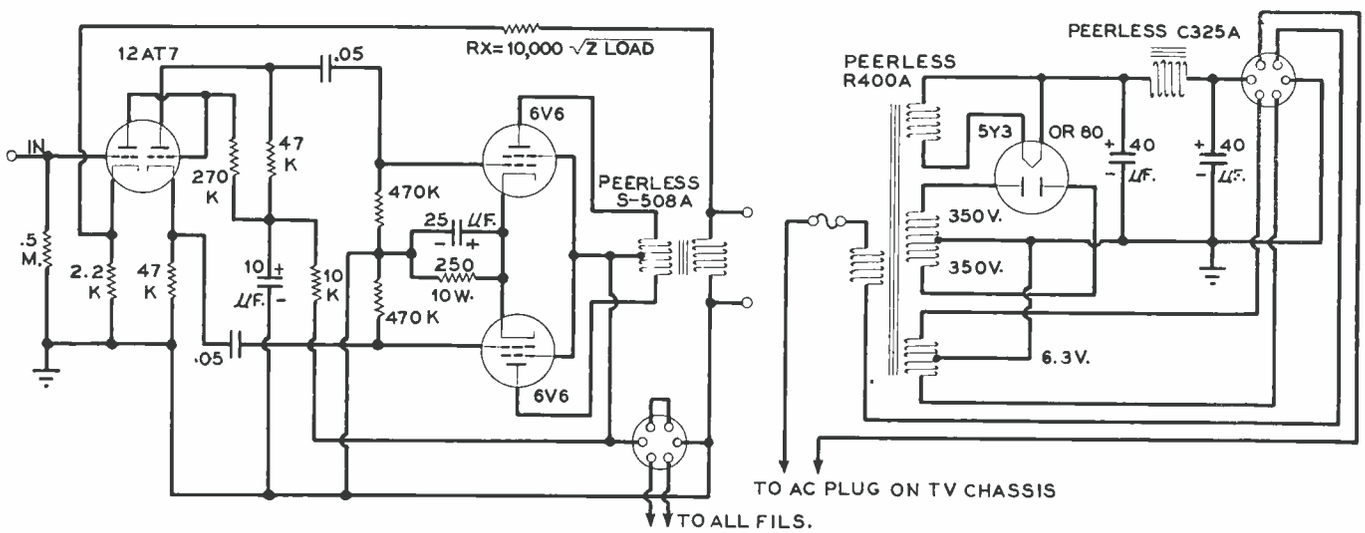


Fig. 3. Simplicity of design characterizes the schematic of this amplifier. Note feedback loop, and also filtering of power supply.

The whole power amplifier chassis has only two coupling capacitors in it, one to each of the 6V6 grids from the plate and cathode of the phase inverter. Thus the low-frequency response of the amplifier is very fine, as will be seen from the performance data. Because of the few tubes, small output transformer and circuit used, the entire amplifier is mounted on a steel chassis which measures 3 by 4 by 5 ins. There is plenty of room inside for accessi-

Continued on page 76

RECORDS IN REVIEW

JOHN F. INDCOX

Editor's note: When we suggested to John Indcox that he review recent record releases for HIGH-FIDELITY, he put a blunt and important question to us: "What do you want, 25 words each on 250 records, or 250 words each on 25 records?" That is, of course, the $64 question. The final decision will be left to our readers . . . your suggestions and comments are sincerely requested. For this first review section, we asked Mr. Indcox, who is a record collector, music lover, and audio-phile of long standing, to discuss at length the most interesting of the hundreds of records released during the past few months.

GABRIEL FAURE: *Songs*
Ninon Ballin, Soprano. Maurice Faure, Piano. Vox PTL 1730.

Eight fine French songs of that greatly unappreciated master of the art song, Gabriel Faure, are now available on this Vox LP, sung by the noted French soprano Ninon Vallin. Covering a span of twenty years, 1880 to 1900, this collection includes *Le Secret*, *Soir*, *Aurore*, *En Sourdine*, *La Parfum Imperissable*, *Nell*, *Au Cimitiere* and *Les Roses d'Ispahan*. From the fragility of *Nell* to the quiet passion of *En Sourdine*, each reflects the composer's ability to establish and sustain a mood, in a deceptively simple manner, but which asks deep appreciation and great interpretive powers from the singer.

Ninon Vallin, long admired for her work in these Faure songs, makes a most welcome reappearance in the domestic catalog. Her voice, one of typically Gallic timbre, still retains enough of its former beauty to produce a knowing and sensitive performance. Her careful phrasing and diction, her sense of style, the skillful and delicate way she colors her voice are all very much in evidence.

Originally recorded for Pathe, in France, the transference to LP has been satisfactorily accomplished, although the last band on side 2 is marred by much surface noise. Maurice Faure at the piano accompanies acceptably.

BRAHMS: *Vier Erneste Gesang Op. 121*
SCHUMANN: *Frauenliebe Und Leben Op. 42*
Kathleen Ferrier, Contralto. John Newmark, Piano. London 12-in. LLP 271

A lovely and most satisfying vocal recording. Miss Ferrier's admirers should keep the cash registers jingling for quite a while.

The *Vier Erneste Gesand* of Brahms were a product of the difficult year of 1896. While still mourning the loss of his friends Hans von Bulow and Elizabeth von Herzogeberg, and his sister Elise, the illness of his dear friend Clara Schumann was also causing him the greatest anxiety. On May 20, 1896, Clara Schumann died, and on his return from her funeral Brahms sent a copy of these songs to her daughter Eugenia Schumann saying, "You will not be able to play them, but I beg you to lay them aside and regard them as a death offering to the memory of your dear mother." Brahms was to survive her only by eleven months. Is it possible that he had some perception of the short time left in which to leave to the world his philosophy of life? Surely nothing could be more appropriate than the texts he chose, nor the source of them: the Bible. Three come from Ecclesiastes . . . the last from St. Paul's First Epistle to the Corinthians.

Miss Ferrier's voicing of the work is thrilling for the nobility of feeling, the coloration of her tones, her beautiful diction and attention to detail. Her phrasing is superb. It might be thought that the tessitura of some of these songs would cause her some trouble, as it has others before her, but she meets every vocal challenge with apparent ease.

Schumann's *Frauenliebe und Leben* dates from the year 1840, in the course of which he composed also the *Liederkreis* and *Myrthen* cycles, and over a hundred songs. The texts used are by Adalbert von Chamisso, and in themselves tend to be somewhat maudlin, depicting the joy and sorrow of a woman's love. The songs are remarkable for the musical setting with which Schumann has endowed them, and his extraordinary gift for the understanding of such a woman's feelings. It seems more than likely that his own much-hindered marriage to Clara, with its emotional stresses, had considerable to do with his success here.

It would seem to me that Miss Ferrier has less success with this cycle than with the Brahms . . . for reasons that I am unable to state, from just one hearing of the recording. Her sumptuous tones, careful phrasing and musical integrity are here in plenty, but I seem to feel a constraint, a holding back of her inner feeling. Additional listening may dispel this reaction. On both sides John Newmark supplies accompaniments which are adequate but no more. All in all I would consider these definitive versions of both works.

Traubel (Columbia ML 2072) gives Ferrier close competition on the Brahms, though her voice is too heavy and operatic for my liking. She has the advantage of excellent piano support from Bos, who was the pianist when these songs were first publicly presented. The magnificent Kipnes set (Victor DM 522), made in 1936 is, unfortunately, no longer available.

The Schumann, a stumbling block for many singers in the past, is available now in recordings by Anderson and Uta Graf. The old Lehmann set, with Bruno Walter at the piano — none too satisfactory in any case, both because of Lehmann's limited vocal capacity and breathy tones and Walter's uninspired accompaniments — has been cut out. The release of the Elizabeth Schumann recording, made in England in 1947 for HMV, is dubious, but in any case it is to be doubted that she would be able, at this stage of her career, to match Ferrier.

SCHOENBERG: *Ode to Napoleon*
Villers Quartet., Rene Liebowitz, cond. Jacques Monad, Piano. Ellen Adler, Recitor. Dial 12-in. LP 3.

This recording should bring much pleasure to devotees of Schonberg, but will prove tough going for those not completely conversant with his specialised and profound idiom, the *sprechgesang*, invented and previously used by him in his *Pierrot Lunaire*. Written in 1942, Schonberg has used a poem of Byron's as his text, seeing in its contents an analogy to the fall of one dictator (Napoleon) in the expected collapse of another (Hitler). The result is a powerful, satiric and deeply felt score, in which the fusion of the text and music is extraordinarily skillful. The use of a narrator for the *sprechgesang*, a device where the words are rhymically treated and voiced, though not sung, gives the work an almost macabre mood.

Surmounting the amazing difficulties of the score, Rene Liebowitz gives a penetrating, clear and beautifully shaded performance. One that has remarkable balance and drive. The bite and snarl of the string tone has been wonderfully captured, pointing up the accompanying mood of the Byron ode. Ellen Adler, though her voice lacks resonance, and in consequence there are moments where she is almost buried under the orchestral tone.

The recording, as such, is extremely good, Surfaces are excellent and quiet.

SHUBERT: *Quartet for Flute, Guitar, Voila and Violoncello in G Major.*
K. F. Mess, flute. Arthur Faiss, guitar. Heinz Kirchner, viola. Sigfried Barchet, violoncello. Period 12-in. LP. SPLP 518.

When originally written in 1814, this was neither a quartet nor was it by Schubert, but a Serenade for flute, guitar and viola by the Bohemian composer Wezeslaus Metyegka, for whom Schubert is said to have had some admiration. Schubert, whose interest in unusual combinations for small works is well known,

added an original 'cello part. Thus, when the work was first published in 1926, the manuscript having only been discovered in 1918, it appeared as a Schubert composition.

It is a light, graceful work of no particular depth, and owes a good deal to the folklore music of Bohemia and Austria, though the fourth movement, marked "alla zingharese — in the gypsy style," is restrained and somewhat formal. Fine stuff for informal chamber music sessions, for which occasions Schubert probably had this in mind. The soloists give an excellent reading of the score, which is splendidly recorded, with unusually quiet surfaces.

However, it seems somewhat unethical to release this as a work of Schubert. As well attribute *Turandot* to Alfano, or *A Night on Bare Mountain* to Rimsky-Korsakoff, because of the addition to, or revision of, the Puccini and Moussorgsky scores.

BERG: *Chamber Concerto for Violin, Piano and Thirteen Wind Instruments.*
Paris Chamber Orch., Rene Liebowitz, cond. Jacques Monod, Piano. Roland Charney, Violin. Dial 12-in. LLP 9.

To *Wozzeck* and the *Lyric Suite*, Alban Berg's accepted masterpieces, may now be added this beautiful *Chamber Concerto*, a product of 1925, dedicated to his master and good friend Arnold Schonberg. It would be presumptous to add anything to the letter, reprinted on the back of the record sleeve, which Berg wrote to Schonberg offering the work as a birthday gift, and which includes an interesting and lucid explanation of its form, purpose and organization.

The *Chamber Concerto* consists of:

1. Theme scherzino can variationi
2. Adagio
3. Rondo ritmica con intraduzione

The beauty of its form, the expressiveness of the music and the economy of means used to obtain the desired result are nothing short of astounding. A grand work to break down the anti-atonalist listener, for this is as listenable a score as one can think of in this field.

Much care has been expended by Liebowitz and his group on the recording of this technically difficult work. They play it with affection, care and the necessary brio. There is some blasting in the fortes, particularly in the middle of side 1, while the piano at times lacks definition — overpedalling? Otherwise the recording is good, and surface noise at a very low level.

The enterprising Dial Label, whose catalog is devoted to contemporary classics, is to be thanked and applauded for releasing this work . . . a joy indeed.

KODALY: *Sonata for Unaccompanied 'Cello. Opus 8.*
Janos Starker, Violoncello. Period 12-in. LP. SPLP 510.

The idea of a sonata for unaccompanied 'cello may sound rather dull to you. If so, here is a recording to change that viewpoint. A work of the eminent Hungarian composer, Kodaly, at the age of 33, this is exciting rhythmic music which exploits the use of the instrument to the full . . . and then some.

As is to be expected, most of the material here is of traditional Hungarian folk music derivation, but used in an extraordinarily modern manner. By widening the range of the instrument, the performer is able to produce, either with bow, hands or fingers, some truly remarkable tonal effects. As mandolin, guitar, and violin follow one another, there are times when one wonders how many hands Starker has at his disposal. Even the horn and Transylvanian bag pipe are here, plus some unusual percussive sounds.

Starker gives a stunning performance of a technically difficult score, for which it is apparent he has great affection. His tone in the middle register seems a little thin at times, but this is a minor criticism. The recording is excellent, though it is unfortunate that a break comes in the middle of the second movement.

MESSIAEN: *Vision de L'Amen*
Yvonne Lorod, 1st Piano. Olivier Messiaen, 2nd Piano. Dial 12-in. LP 8

Having heard Messiaen's *L'Acension* at Tangelwood in 1949, under Koussevitsky's direction, I was struck by the sincerity and vitality of that work. The Columbia LP under Stokowski, while not matching the Boston performance, confirmed my impression, and I looked forward to this release with interest. However, I must confess to being extremely disappointed, for this, despite its sonorities, its romantic mysticism and impressionistic coloring, is a series of inflated trivialities, to my ear. It does nothing to enhance the composer's reputation as one of the foremost modern French composers.

The recording, as such, is quite good, though the balance between the pianos might be better. The second piano would seem to be too close to the microphone. The composer and his co-artist deliver a well integrated performance, and lavish more affection on the score than I find in it. As on all Dial recordings that I have listened to, the surface noise is practically non-existent.

TCHAIKOVSKY: *Piano Concerto No. 1 in B Flat Minor Op. 23*
Clifford Curzon, piano. The New Symphony Orch., George Szell, cond. London 12-in. LLP 276

Ten years ago, if radio listening were any criterion, this would certainly have been thought to be *the* concerto. While its popularity may have waned a little since those days, it still remains one of the best loved of all works in this field. Having regard to its numerous performances, both on records and in the concert halls, it is nothing short of amazing that Nicholas Rubenstein, to whom it had been dedicated, declared it unplayable. Tchaikovsky rededicated it to Hans von Bulow, the German conductor and pianist who had done much to establish the composer's music in Germany. Von Bulow, about to embark on an American tour, was full of praise for it, and gave it its world premiere in Boston on October 25, 1875, where it was enthusiastically received. Some years later, after Rubenstein's death, some changes were made in the work by the composer and incorporated in the edition of 1889.

The collaboration of Curzon and Szell, begun with the recent issue of the Beethoven *Emperor*, is continued here with felicitous results. There is a happy understanding of each other's role in this work, which makes for excellent balance between soloists and orchestra. Curzon plays the *Concerto* with a grasp of its content and a knowledge of its problems that makes for a compellingly satisfying performance. The bravura portions are dispatched with skill, with some beautifully controlled octave work and the second movement is graced with lovely phrasing and eloquence. Szell provides well adjusted and rhythmically fine support.

The overall recording is excellent, though the brass tone, especially at the beginning of side 1, is edgy and has slight blasting. My copy also has more surface noise than is usual even for London.

There are now five LP recordings of this work, including the recently re-issued Victor Heifetz—Toscanini, of which I am not an admirer. The others are Hansen—Mengelberg, Levant—Ormandy and Rubenstein—Mitropoulos. The Mengelberg on Capitol is a pressing from Telefunken. It was made before the war, and is remarkable for the excellence of its recorded sound and for Mengelberg's powerful orchestral reading. In my opinion the Curzon—Szell recording is the finest now on records.

RODGERS: *Pal Joey*
Vivienne Segal. Harold Lang, etc. Lehman Engel, cond. Columbia 12-in. ML 54364

The Rodgers and Hart musical, produced in 1940, starring Vivienne Segal and Gene Kelly remains a landmark in the history of American musical comedy. Based on the stories of John O'Hara, and originally written for the *New Yorker*, with a show-business heel and his loves as leading characters, it boasted of what was probably the most adult and realistic book ever to grace a musical play. Even so, Hart's sophisticated lyrics, Roger's tricky score and a fine production by George Abbott could not make it a smash hit. It was undoubtedly in advance of its time, and might fare better today, when audiences are more ready to accept such a departure from the accepted.

Rodger's score, while hardly one of his major efforts, still contains enough good things to have carried over the years: Witness "Bewitched" and "I Could Write a Book." The impact of "That Terrific Rainbow" is lost, for it needs the visual appeal of the tawdry night club setting and the weary show ladies which it had in the show. The remainder of the score, full of off-beat rhythms, comes off well. Fortunately, Miss Segal has been induced to sing "Bewitched" again, as well as "Take Him, etc." She's a lady who knows her way around the inuendos of Hart's words, and makes "Bewitched" the droll ballad it originally was . . . rather than the sugary affair modern vocalists have made of it. Harold Lang, while no Gene Kelly, does a good job with his numbers, and the rest of the cast is acceptable.

A lively, well paced and atmospheric performance, under Lehman Engel's direction, adds a good deal to the enjoyment of the recording, which is one of Columbia's better efforts in this field.

It's good to have a pal like Joey back again.

STRAVINSKY: *Renard*
Solists and Orch. under the direction of Robert Craft. Dial 12-in. LP 10.

Renard, an opera-ballet by Stravinsky, had its premiere at the Paris Opera in the 1922 season of the Diaghilev Ballet Russe. With decor and costumes by Larionov, choreography by Nijinska, and Nikitina as Le Renard, it followed the production there of the same composer's opera *Mavra*, and like that work met with little success. Diaghilev re-staged it in 1929 at Covent Garden with new choreography by Serge Lifar,

Continued on page 72

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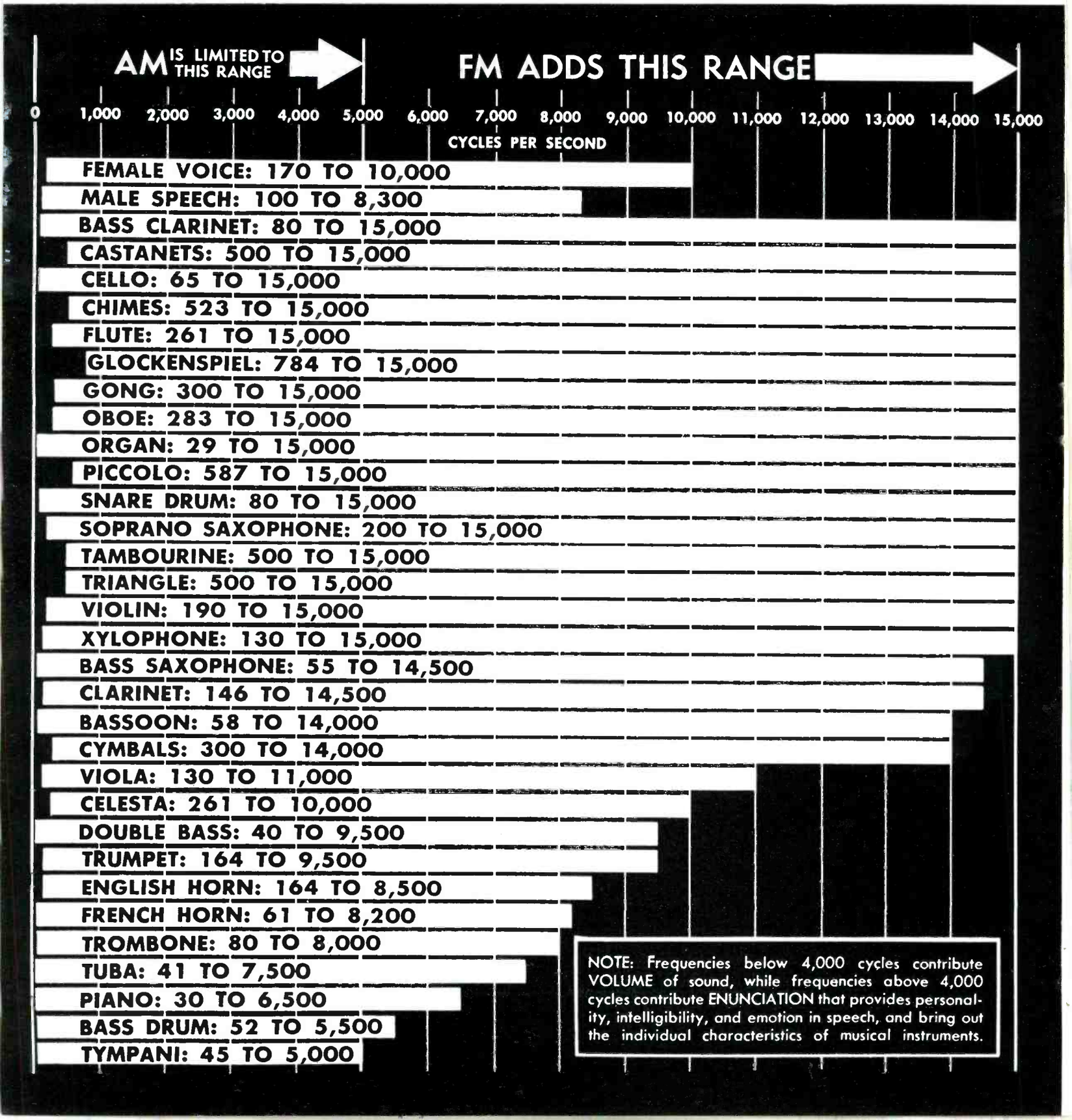
Although this chart was drawn up primarily to dramatize the wider frequency range which can be transmitted by FM broadcast stations, it also demonstrates the approximate difference between 1931 and 1951 phonograph records, and between commercial radio-phonograph combinations (basically designed for AM reception) and custom installations. The frequencies between 5,000 and 15,000 cycles are the ones which supply brilliance and definition to individual sounds and instruments. Their importance to realism in sound reproduction is one of the reasons why concert stations prefer FM as a transmitting medium.



MUSIC ON THE AIR

Continued from page 17

some commercials cause to an increasingly large number of people, and so restricts his program material that it borders on the erudite and, further, limits commercials to the dignified, that broadcaster will have a hard job persuading advertisers a) that his listeners comprise a market for their products, and b) that low-pressure advertising will sell the products to these listeners. Yet it can be done, and is being done. For instance, WXHR in Cambridge, Mass., adheres firmly to this commercial policy: 1) No singing commercials of any kind. 2) No long-winded redundant advertising copy. 3) Commercial spots are inserted where they naturally fit, within the continuity of the music. 4) The station will not accept any advertising which promotes a product it considers not of reasonably good quality. 5) Commercial copy is kept to a minimum, containing pertinent facts, delivered by the announcer in a quiet, dignified manner. 6) The station sells programs only, half-hours and hours, and does not have any so-called participating programs, in which spots are read between every short selection. 7) Music is never faded or interrupted in any manner to insert a commercial message.

In his report, John Thornton, General Manager of WXHR, goes on to say: "I hope our policy does not appear snobbish. We know our audience has a violent distaste for the average commercial copy on most radio stations. However, the rigid policy above has been followed to the letter by our advertisers and, because our audience has a great appreciation for this kind of advertising, the results have been amazingly lucrative for the sponsors. We are simply trying to present good music as it would be heard on a concert stage. We consider our station to be a guest in the listener's home, and so we try to observe the rules of good behavior."

But how does a station which imposes such restrictions on its advertisers, obtain adequate revenue? For many of them, it is indeed a problem, and they may be forced to modify their regulations in order to attract advertisers, thus becoming as vociferously commercial as any other station. However, the more courageous pioneers in this field have clung tenaciously to their original ideals, and the results have been surprising. Advertisers who have substituted for their high-pressure methods the use of dignified presentations have found that it can be a profitable practice, because the listeners really appreciate such advertising, and on their next shopping trips may seek out the product involved. Other stations, however, have not yet been able to convince enough advertisers of the merits of this dignified approach. Some depend in part upon voluntary financial support from their listeners. The story of WQQW in Washington is an interesting example of appreciation expressed by listeners. Its manager wanted proof of audience interest. When he threatened to drop the classical music programs, 5,000 letters of protest flooded in. For further proof, he asked for contributions of 50¢ to support a particular program. He received $1,300 — enough to pay for it for months!

Other stations are operated on a purely sustaining basis, strictly as a public service, and these stations carry no advertising at all. Such stations as WEFM Chicago, owned and operated by Zenith, and Major Armstrong's famous KE2XCC at Alpine, N. J., are examples.

The Selection of Program Material

The program material offered by the music station is, of course, the backbone of its efforts to please the audience. The skill — or lack of it — which its staff demonstrates in the selection of this material determines in a large measure the success or failure of such a station. The recognition of this fact has led many of these broadcasters to employ specialists to handle this work. WEFM, for instance, maintains a staff of college graduates, all holding degrees in music, whose job it is to choose the musical selections which will be broadcast. However, such a staff cannot rely solely on its own judgment. Therefore, most music stations encourage suggestions from their listeners.

WQXR periodically calls for suggestions from a voluntary Advisory Committee comprised of about 4,500 families who have agreed to answer specific questions about the station and its programs from time to time. To encourage audience participation still further, WQXR maintains a record information service which in 1950 answered over 6,500 inquiries concerning records.

A delicate balance must be maintained among the various types of music to be played, and the proportion of each is best determined by listener reaction. For instance, WEFM has found over a period of years that it must devote about 85% of its time to the broadcast of symphonic repertory — symphonies, concerti, chamber music, operas, etc.—allowing only the remaining 15% for lighter music. This increased emphasis on the heavier works is a direct result of listener demands. Undoubtedly, audience participation in formulating program policies is much greater in the case of the music station than in the case of a network station. The interest of the audience is stimulated in many cases by program guides, published by the station, which include not only schedules of programs to be heard, but other items as well which might be of interest to listeners, such as notes on musical scores, and reports on the activities of musical organizations.

Why the Preference for FM?

All concert stations broadcast on FM. Only a few transmit simultaneously on FM and AM. Why this preference for FM? Frankly, because FM is better for *any* type of program, but its advantages are particularly noticeable on orchestral material. The outstanding features of FM are: wide frequency range, no fading, no static, no background noise, and no interference. If you live close to an AM station, (and by close, we mean within 5 to 10 miles from a powerful station) you may not experience fading or interference, but static is a bad problem during electrical storms, and background noise is always present. Far more important to the music lover and audio-phile is

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FM's advantage of wide frequency range. Because of problems of adjacent-channel interference, the standard AM station transmits approximately a 5,000-cycle range, whereas an FM station does not face this problem and can broadcast in a range which will include all audible frequencies. Also, the dynamic range is customarily compressed for AM transmission. The added brilliance of FM is most apparent in the case of wide-range music programs — such as live music or LP records. The difference between AM and FM broadcasting is almost the same as that between a 1931 phonograph record and a 1951 LP. The increased frequency and dynamic range is about the same; the freedom from needle scratch and record noise corresponds to FM's elimination of background noise and static. And for those living any distance away from the transmitter, the difference is even more marked. It is literally true that in Great Barrington, Mass. — 90 airline miles from New York City — we cannot count on hearing *any* program on AM. Interference and fading are *that* bad!

The Broadcasting Operation

Because concert stations rely largely on records and recordings for the source of their programs, their studio and station facilities are more specialized than those of the typical AM station. The photographs on the preceding pages illustrate some of the features. We have included illustrations not only of concert stations but also of some of the very interesting educational FM stations whose programs are becoming more and more worthwhile.

The theatre-like auditorium, designed to accommodate an immense and hilarious audience, is omitted in favor of a small, acoustically-correct studio for live programs such as chamber music concerts and soloists. Great attention is given to record-playing equipment. (Sometimes too much attention! Engineers occasionally get out of hand and add so much noise suppressing, equalizing, and range-expanding equipment that the same record sounds better played over home equipment!) Most concert stations broadcast records "flat to the racks"; some add noise suppressors to quiet their older and more rare discs. Generally speaking, station managers are audio-philes and are as interested in providing you with maximum realism as you are in receiving it.

How You Can Help

This discussion of the advantages of FM is not news to readers of HIGH-FIDELITY, nor probably are the details about the concert stations. They have been reviewed to bring out some of the problems in economics which confront FM station owners in the highly competitive broadcasting business. Obviously, they cannot continue their present FM service or meet the expenses of improved programming without revenue from sponsors. To sell time in competition with AM and TV stations they must have evidence of listenership. And when they sell time, the sponsors must have evidence of responsive audiences.

Thus they welcome letters from you to show how many people are listening to FM and where they live; they need your comments and suggestions on programming, and your support of advertised products and services.

Another important point: managers of FM-AM stations are very much inclined to discount their FM audiences. One reason is that listener surveys are generally made only in the immediate area around the station. Thus they do not include FM listeners who are outside the AM coverage area and who must depend on FM reception. Consequently, an audience survey may show a larger percentage of AM listeners because it does not cover those who listen only to FM.

Now, with several hundred TV stations in prospect, it is obvious that all the present 2,300 AM and 665 FM stations cannot continue. Eventually, audio broadcasting must be all one system or the other. If, regardless of program *content*, you get better *reception* on FM than on AM, the managers of your FM and FM-AM stations need to know about it, and it is in your own best interest to tell them.

AUDIO AMPLIFIER

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fiers. It is for the user to decide whether or not the cost is warranted. Again, there is no better way than by a thorough listening test.

Volume expanders were first developed many years ago when the recorded dynamic range was far less than it is today, and when the linear dynamic range of the loudspeakers then in general use was also quite limited in comparison with the greatly extended dynamic range of the superb loudspeakers now available. To determine the need for an expander, you have only to recall how frequently you would like to *reduce* the volume of the loudest passages in many of today's superior recordings, when the volume level of the softest passages is great enough to enjoy. An expander would increase still further the volume of the louder passages. The very considerable cost of an expander will go a long way toward improving other important phases of an amplifier design, not to mention increased costs of upkeep inherent in the more complex circuits and their greater possibilities for distortion.

Automatic scratch suppressors[2] are not always appraised correctly. Only by listening can you tell whether you are more bothered by the changing levels of scratch, as a result of the automatic control, than by the scratch itself when the level is controlled manually. In the latter case, you can save money and possible service expense by buying the simpler, manually-adjusted cutoff and rolloff filters which have been highly developed in recent years.

Special Features

Remote or chair side controls are another source of divergent opinions. Such a feature, while seeming to be desirable, may sacrifice much in good engineering practice, resulting in greater hum and hiss, loss of response, and a great deal of added cost per unit of performance, not to mention added sources of trouble. To furnish such a feature, the manufacturer must charge

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[2] See also article in this issue on control units.

INSPIRATION

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frequencies are dissipated to a large extent because of the cabinet's thin walls and inadequate size. The high frequencies, which tend to travel straight out from the speaker, are also partially lost because of the speaker's location a foot or so from the floor. Several so-called super-deluxe radio-phonographs have appeared, equipped with quite good tuners, pickups, amplifiers and speakers. However, in many of these in which the choice of speaker location need not have been restricted by cost or cabinet limitation, this very important component was given its usual spot — at the bottom of the heap.

To those having even a fair amount of musical perception, the difference between the usual speaker in a console, and a properly built-in speaker, of equal size and characteristics, is at once apparent. A complete wide-range system is startling in its illusion of presence. To reach such nearness to perfection, both a large speaker and a large enclosure are necessary. It is impossible to deliver to the average room any usable amount of true, deep bass power with a small diaphragm and a small enclosure.

Furthermore, just as the range of any human voice or a single musical instrument is limited to a very few octaves, so is the range of a good loudspeaker. Therefore, in really fine high-fidelity installations, two sound producing units are used, one high frequency and one low frequency. Usually, these are combined and called a duplex speaker, each unit of which is fed its proper range of frequencies through a crossover network.

Flexibility

In addition to superior audio reproduction, a custom installation offers complete flexibility. Any amount of equipment can be installed anywhere, all at once or a little at a time, and the system can be improved or added to as finances and fancy dictate.

Consider the point of adding equipment: with the advent of LP records, thousands of large, handsome(?) radio-

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INSPIRATION

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phonograph consoles were *dis*-graced by the addition of an LP player or adapter placed on its top, on a card table alongside, or squeezed in somewhere else. The only alternative was the purchase of a new combination console at a cost of several hundred dollars. On the other hand, with a built-in job, it was simply a matter of removing the old 78-rpm changer and dropping in a new, multi-speed unit.

Similarly, each unit in the system can be changed and improved or modernized without marring the attractiveness of the whole. A duplex or coaxial speaker can be substituted for a simpler unit; an FM-AM tuner can replace the older, AM-only chassis. A television tuner can be added for much less than the cost of a separate table model, and full benefit realized from the existing high-fidelity amplifier-speaker system.

Because the components of a built-in system can be put almost anywhere, valuable space can be saved. Closets, bookshelves, and storage walls make admirable locations for the radio equipment. None takes up any floor space. Nor is there any problem of rearranging furniture, or even of matching furniture styles. This is truly important in many homes. Where, for example, could a big Chippendale radio-phonograph-television console be placed in some of the rooms illustrated in this article? The custom installation, on the other hand, blends unobtrusively with the furnishings and style of the house.

Planning the Installation

A detailed description of the planning and installation of a complete system will be given in a forthcoming article, but before closing this discussion it would be well to sound one or two warnings.

First, the final arrangement should be planned at the very beginning. Every reasonable possibility in the way of equipment should be considered and space allowed for it.

Second, adequate ventilation is very important and often neglected. With

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RECORDS ON LOAN

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As in the case of the records on the shelves, the card catalog is divided into three sections: children's, LP's, and 78's. For every record or album a master card, Fig. 4, is made out and filed according to composer. Complete information is included on this card:

Composer
Composition
Orchestra
Conductor
Performing artists
Number of records
Size of records
Date purchased
Amount paid
Where purchased
Code number of record
Make of record

In the case of children's records, this is the only card made out and filed. For other records, the file is first divided into LP's and 78's, and each is then subdivided into a master file arranged by composer, and a cross-reference file in which the four to ten copies of the master card may be filed according to one of the subheads listed above.

The card catalog may seem to be fairly complex, since as many as twelve cards may be made out for one record. However, the slight amount of extra time required to prepare a truly complete cross-reference system is more than made up for by the ease with which patrons' requests can be interpreted ("I think the composer's name began with B, and it was a Columbia record") and the record found.

During the twelve years that the record library has been in existence, many variations of the system outlined above have been tried and found wanting in one respect or another. As every librarian knows, the only answer to veritable, if occasional, chaos is to foresee every whim on the part of the borrower. For instance, at first it was thought sufficient to keep track of albums as units, without bothering to indicate the number of records in the album. A few experiences trying to untangle the album which came back with more records than it started

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RECORDS ON LOAN

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out with put an end to *that* shortcut! And even today, with the heavy circulation of single record folders for LP records, it is astonishing to discover how many people can walk in proudly on the last day of their loan period with the folder under their arms . . . and the record still back home on the player!

In addition to the record and music loan service, the Library has a soundproof listening booth, with both standard and LP turntables, which is kept surprisingly busy, and certainly provides many of the lighter moments in the day's work. In the main section of the Library, the vast majority of the patrons come to sit and study, sit and read, or, once in a while, sit and snooze. In the listening booth area, anything can happen. There are the thinkers who support their heads in their hands, as if in agony over the music. There are floor sitters, the floor squatters, the striders, who pace back and forth like caged lions, and finally, the ballet dancer. He appeared just a few weeks ago and, with the possible exception of a brown paper bag under his arm, looked just like everyone else. After carefully selecting two or three records, he disappeared into the listening booth and dropped to the floor. He was classified as a floor squatter and dropped from thought until there was a burst of music as the door of the booth opened and he pirouetted around the room, unmindful of his surroundings, and complete with ballet shoes!

Yes, music hath its charms . . . and if the experience of our Library in Pittsfield can be taken as an indication, it is charming an ever-growing section of the population.

TRADER'S MARKETPLACE

Here's the place to buy, swap, or sell audio equipment. Rates are only 20c a word (including address) or $20 an inch, and your advertisement will reach 20,000 to 40,000 audiophiles. Remittance must accompany copy and insertion instructions.

LLEWELLYN Amplifier. New, unique, 3-tube 40-watt triode feedbackless amplifier using standard parts. Hum-free, ultra-low distortion, easily built. Full constructional data, prints, parts lists, layout $5.00. Data special high gain equalized 4-stage preamplifier accommodating every cartridge $3.00. Both $7.00. No COD's. Llewellyn Keim, 825 Fifth Avenue, New York 21, N. Y.

RECORDS IN REVIEW

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and a double cast of acrobats and dancers, but it achieved no more success then than had the earlier production. It was to be one of the last ballets Diaghilev saw before his death in Venice later that year.

Using an orchestra, with cymbalum — a dulcimer-like instrument he had first encountered in Geneva and whose unique tonalities he wished to exploit — Stravinsky has based the work on a Russian folk tale. His directions state: *Renard* is to be played by buffoons, acrobats and dancers, preferably on a trestle stage with the orchestra placed behind . . . the voices, two tenors and two basses, are placed in the orchestra." From which it may be assumed that an outdoor presentation of this work would be the ideal setting. Listening to the odd little march that introduces his mimes, one can appreciate the atmosphere of the open air carnival or fair which it typifies.

The whimsical tale of disruption in the barnyard is amusingly conveyed by the use of the soloists against an orchestral background of strongly percussive music, which is mainly abstract in form.

The orchestra and soloists, under the knowing direction of Robert Craft, a Stravinsky protege, give a performance full of humor and drollery. A few vocal inadequacies are present, but these are not too noticeable. An excellent recording job . . . very quiet surfaces. This work has not been recorded previously.

Some miscellaneous shorter works of the composer appear on the reverse side, including the odd arrangement he made of *The Song of the Volga Boatman*. Also the *Berceuse du Chat*, which I find somewhat trivial.

SCHUMANN - GLAZOUNOV: *Carnaval* ROSSINI-RESPIGHI: *La Boutique Fantasque*

The Royal Philharmonic Orch., Efrem Kurtz, cond. Columbia 12-in. ML 54367

Although the orchestration of the 21 piano pieces of Schumann, known as *Carnaval*, are usually attributed to Glazounov, it is generally agreed that both Liadov and Tcherepnin had some hand in it, and possibly Rimsky-Korsakov. Originally commissioned by Diaghilev for a ball at St. Petersburg, it made its first appearance in the repertory of his Ballet Russe in 1910 at Paris. With decors and costumes by Bakst, choreography by Fokine and Lopokova, and Massine dancing Columbine and Harlequin respectively, it was an instantaneous success, and remains today one of the most popular of all ballets.

La Boutique Fantasque, a ballet set to assorted piano pieces of Rossini, arranged and orchestrated by Respighi, had its premiere at the Coliseum in London in 1919. Diaghilev, having quarreled with Bakst over the latter's ideas for the decor of this ballet, turned to the French painter, Derain. This proved a fortunate choice for Derain's curtain, costumes and decors admirably complemented and fused with the music and choreography . . . and were responsible for much of the success the ballet enjoyed. The aging Enrico Cecchetti appeared as the toy shop proprietor, Massine and Lopokova were the Can Can dancers.

To place these two works on one LP record was a happy choice on the part of Columbia, and to hand the conducting chores to Kurtz, a wise one. He has a way with this sort of thing, as his background and previous recording efforts testify. The Schumann work flows well if somewhat ponderously in spots, and I would say he has greater success with the more expansive moments than in the quieter, reflective moods of Eusebius, Chopin and Pierrot. Remembering that this is played as ballet music it would be trivial to complain of some of the tempi adopted. The Respighi, a joyous effervescent score, receives a better organized performance. From its tarantella through the Can Can to the galop, everything moves merrily along.

Both sides are excellent examples of the fine sound Columbia has been producing on LP recently, though I find occasional wiriness in the violin tone. This may possibly be an English characteristic, since the same fault is apparent in some London recordings. In the Chopin episode in *Carnaval*, the flute seems badly placed microphone-wise . . . making for rather unbalanced result. Surface noise seems rather high . . . a fault I have noted in some of the latest Columbia releases.

The excellent performances of both these works, made for HMV about twelve years ago by Goossens and the London Philharmonic, and issued here as Victor DM 415 (*La Boutique Fantasque*) and Victor DM 513 (*Carnaval*), are unfortunately no longer in the catalog.

BARTOK: *Suite from the Miraculous Mandarin*

New Symphony Orch. Tibor Serly, cond. Bartok Record Society 12-in. 301

Another addition to the rapidly expanding catalog of Bartok on records, and one more reason to deplore the passing of this great modernist. Much remains to be recorded and it is to be hoped that the enterprise of the Bartok Record Society in filling the void will meet with public support.

Although written in 1919, a time that Bartok once called his most radical period, the first Hungarian production only took place in 1946. The scheduled performance in 1931, in celebration of Bartok's fiftieth birthday, was banned by the censor. Written to a libretto supplied by Menyhert Lengyel, this is a bubbling, seething score of barbaric and bizarre content. The oriental cast, implied in the title, is skillfully suggested, rather than obviously displayed . . . while the Hungarian element in Bartok's music is faintly in evidence. The ever-shifting mood, from the strange call of the siren, in the wood winds, to the rhythmic dervish-like dance figure of the finale for full orchestra is astonishingly portrayed. A gruesome and fiendish situation is vividly brought to life. An altogether absorbing and powerful score . . . which one would like to see in the repertoire of one of our progressive Ballet companies, for whom it would make an ideal subject.

Tibor Serly, Bartok's closest friend, leads the New Symphony Orchestra through a compelling reading of the work. Recorded in Kingsway Hall, London, noted for its acoustical properties, the richness of sound captured by the engineers compliments the work of the conductor. On my hi-fi equipment, the violin tone sounds slightly wiry, but this is not noticeable when played on a commercial machine. Quiet surfaces here add to the other joys of this record.

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BRAHMS: *Hungarian Dances*
Oklahoma City Symphony Orch., Victor Alessandro, cond. Allegro 12-in. LP 102

As far as I can determine, this is the first complete recording of the *Hungarian Dances* of Brahms. Accustomed as we are today to hear them as display pieces for violinists, or as orchestral works, it is well to remember that they originally were four-handed piano arrangements. Published in two volumes, Books 1 and 2 in 1896, Books 3 and 4 in 1880, they precipitated a storm of protests. Charges of theft and plagiarism were levelled at Brahms, despite the fact that they bore no opus number, and were published as "Arranged for Piano." Apart from one or two, which are supposed to be Brahms originals, the remainder are arrangements of tunes heard in the inns, fairs and concerts of local bands, while on a tour of Hungary with Remenyi, the violinist. They are remarkable for Brahms' assimilation of the Hungarian idiom, while still retaining a strong personal Brahmsian feeling. Through the years, they have been arranged, and in some cases overarranged, by many hands — from Dvorak to Stokowski, but as far as is known Brahms orchestrated only Nos. 1, 3 and 10.

At least an E for effort can be accorded this recording, though I am afraid the feel of the music eludes both conductor and orchestra. The playing has little verve, some sloppy string work in spots, and the exotic flavor of the music has a rather refined air. On my review copy, the the bass is rather overcut, and the tone of the orchestra slightly muddy. Surfaces are well up to the usual high Allegro standard. It is good to have the entire work on one record, even though it's a lot to take at one sitting. More to my liking is the excellent Reiner (Columbia ML 4116) recording of *Dances* Nos. 1, 5, 6, 7, 12, 13, 19, and 21. A superb control of the forces at his disposal, the more experienced Pittsburgh Symphony, brilliant recording and an inborn affection for the music on his part, all go to produce a most satisfying disk. Numerous recordings are available of individual dances, though strangely none are in the original four-handed arrangements.

OFFENBACH: *Tales of Hoffman* (Complete Opera)
The Sadler's Wells Chorus and soloists. The Royal Philharmonic Orchestra. Sir Thomas Beecham, Cond. London 3 12-in. LLP-4.

In the summer of 1876 Jacques Offenbach returned to Paris from a most successful tour of America. While there, he had been haunted by the past . . . the tunes from his old operettas *Orpheus*, *The Grand Duchess of Gerolstein* and *La Belle Helene* were being whistled and hummed everywhere, but this did not please him. He wanted to divorce himself from the operetta. He was tired of it, and so, he thought, was the public. He wanted to write an opera, something that would establish him, for all time, as a big composer. For twenty-five years he had been providing scores for more than ninety productions that had pleased the Paris of the Second Empire, and had made him the leading composer

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IMPROVED BASS

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Immediately noticeable were 1) increased ability to handle high volume levels without breakup of the sound or frequency-doubling effects, 2) a woody or boxy flavor to the sound, and 3) a very low-frequency resonant point. The sound power output on very low frequencies (below 100 cycles) was improved slightly, but the increased blur on tones between 100 and 400 cycles was annoying.

No attempt will be made here to discuss the results of each experiment. However, it might be well to point out what appears to happen when fundamental changes are made.

For instance, when the standard port was closed off, and a similar opening made at the other end of the front panel, the Air-coupler behaved much like an ordinary air column. Certain frequencies became very pronounced. There were many unbalanced resonances and harmonics. The boxiness of the sound was increased tremendously and could not be minimized materially even when a 100-cycle crossover point was used.

Experimentation with other variables led to certain principles or characteristics which were found to apply to either 15- or 12-in. speakers in 8-ft. couplers.

First, as the speaker is moved along the front panel from a position exactly opposite the port to a position at the opposite end of the coupler, the sound output is increased at very low frequencies, but a beer-barrel boom is produced. However, it must be pointed out that this is not a one-note bass! Maximum brilliance, and minimum low-frequency response, are produced when speaker and port are opposite one another.

Second, increasing either the thickness or width of the coupler does not result in any marked improvement. In the course of the original work on 12-in. speakers, it was found that keeping the width of the Air-coupler within 2 or 3 ins. of the speaker size, i.e. 14½ ins. inside for a 12-in. unit, was optimum. Therefore, for the 15-in. speaker, an inside dimension of 15½ ins. wide was used. Similarly, the thickness of the coupler reached optimum at 4½ ins. inside for 12-in. speakers. For the 15-in. unit, couplers whose inside dimensions were 5 and 9 ins., respectively, were used for comparison purposes. The tests confirmed earlier beliefs: increasing the thickness extends bass response slightly but, for equal levels of sound-power output, a greater driving power is required. If the coupler is made too thin, extreme lows begin to drop out.

Third, and this phenomenon is familiar to all who have worked with vented enclosures, the port opening on the coupler can be adjusted for optimum balance between speaker and air resonances. To give an example from an outside authority, Briggs reports[5] that cone and air resonances for a 12-in. speaker dropped from 42 and 68 cycles, respectively, with a 9- by 9-in. port, to 33 and 66 cycles with a 9- by 2-in. port. The speaker for Briggs' tests had an open-baffle resonance at 65 cycles. To tune the port, cut the piece "D", Fig. 14, larger than necessary; then slide it back and forth until optimum results are obtained.

The fourth characteristic concerns the crossover point. With the Altec or GE 12-in. speaker on a 6-ft. Air-coupler, a crossover of 350 cycles was found to give best results. The use of a lower point on FAS installations is somewhat a matter of personal listening preference, but the characteristics of the system play an important role in determining this point. If the middle-range speaker is highly efficient at low frequencies, the listener may want to reduce the crossover point to 250 cycles.

Using 15-in. speakers on either 6- or 8-ft. Air-couplers, plus the Jensen coaxial speaker for the middle and high range, the FAS group found that a 200-cycle crossover point was preferable, especially on the 8-ft. coupler. A crossover of 100 cycles was also tested but it was found that the bass response in the 75- to 150-cycle range was weak. Below 75 cycles, the coupler came into action and produced undue emphasis on the extreme lows.

Conclusions

With the four principles established above for 15-in. speakers and 8-ft. couplers, optimum performance of the FAS system can be obtained under a wide variety of conditions. The specifications which were found to be best under the specific conditions of the experiments are given in Fig. 13. To simplify the drawing, only the top half of the Air-coupler is shown. The audio-phile may want to modify these to suit his own equipment. It should also be emphasized that no braces were used on the Air-couplers in these experiments. Resonances arising from the wood construction will be reduced if three or four braces are used on the back panel. Two or more, unequally spaced on the front panel, should be tried if needed.

The major advantage of an 8-ft. Air-coupler is its ability to handle greater volume levels. This advantage is particularly apparent when especially designed woofers are used. Such woofers are to be preferred to wide range units, and are almost essential for 8-ft. units operated at high volume levels. The longer Air-coupler extends the low frequency range slightly, but except in special applications, this is hardly necessary since 30 cycles are well within the range of the standard 6-ft. coupler and 12-in. speaker.

The 8-ft. coupler with a 12-in. speaker provides approximately the same advantages over the standard 6-ft. size, namely, greater volume-handling ability. But, at normal levels for home listening, sound-power output is better with a 6-ft. coupler.

When comparing the two sizes of speakers on 6-ft. couplers, it is found that, when a 15-in. speaker is used, the sound-power output in the 50- to 100-cycle range is improved at medium and high volume levels, but that there is no appreciable difference in sound-power output at low levels. However, this conclusion should be interpreted with care, since 12- and 15-in. speakers differ considerably in efficiency.

G. A. Briggs, Wharfedale Wireless Works, Sound Reproduction.

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of the French operetta. Tuneful, satiric and witty, they undoubtedly were, but Offenbach wanted to do something that would last.

He turned to the works of E. T. A. Hoffman. There had been produced at the Odeon in 1851, a dramatic version of *Les Contes Fantastiques d'Hoffman* by Barbier and Carre, in which Offenbach had seen the basis for an-opera. He now decided to write such an opera. Immediately he ran into difficulties, for Meilhac and Halevy, his old collaborators, to whom he appealed for a new libretto, politely refused. They had transferred their talents to his competitor, Lecocq — the Meyerbeer of the Renaissance, as Offenbach called him. It was then he discovered that Hector Salomon, the chorus master of the Opera, had almost completed a score for an opera on the same subject. With a magnanimity unusual in musical circles of the time, Salomon withdraw his work, leaving the field free to Offenbach. At this moment, however, The Lyrique, with whom he had been arranging an early production, went into bankruptcy. A less determined composer would have thrown up the sponge, but not Offenbach, who now saw his fate inextricably linked with the work.

At a concert on May 18, 1879, Carvalho, director of the Opera Comique, heard portions of the score, and was enthusiastic enough to accept it for production, without, as was usual in those days, specifying any date. In May 1880, Offenbach wrote Carvalho "Make haste and produce my opera . . . I have not much time left, and my only wish is to see the first performance." In June the cast was selected and the work was to be the first new production of the winter season. Would Offenbach live to see it? During this time he had also written *Maitre Peronille*, additional music for his old opera, *Les Bringands*, *Madame Favart*, *La Marocaine* and *La Fille du Tambour-Major*. Small wonder that his health, never very robust, broke down under such a schedule.

Delays over scenery, costumes and decor occurred. Knowing his impatience to see the work, friends took him to hear some rehearsals. He even played the score through for the benefit of the artists. But on the afternoon of October 4, 1880, while looking over the piano arrangement, he was seized by an attack of suffocation, and about three-thirty the following morning died. Time had run out on Jacques Offenbach.

The premiere finally took place at the Opera Comique on February 10, 1881.

This complete recording of the opera, sung in English, is primarily a triumph for Beecham and the orchestra. This is a score that all too often receives only a routine performance from conductors . . . but not Beecham, who expends as much affection on it as he might were it a Mozart symphony. Distinguished for clarity of detail, beauty of phrasing, sumptuousness of tone and elegance of orchestral playing, it reminds one, as did his work at the Met in the early forties, that as a conductor of French Opera he has few peers. Vocally, the honours are carried off by the men. Rounseville, as Hoffman, is a fine tenor, with style and excellent tones, who knows how to use his voice effectively. I am more impressed by Bruce Dargavel, a baritone of resonance and range, whose characterizations of Lindorf, Coppelius, Dapetutto and Dr. Miracle are superbly realized vocally. Since these four parts are usually assigned to four

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VIEWER'S AMPLIFIER

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bility and service should it be required. All resistors for the first tube are installed immediately below the tube on a Vector socket.

Power Supply Unit

The power supply was installed on a separate chassis because 1) two-chassis construction lends itself readily to more compact installations since the chassis can be placed side by side, end to end, or stacked, 2) hum and noise are reduced, 3) construction is simplified, and 4) there is no trouble from excessive heating. The power supply chassis measures 2 by 5 by 7 ins. There is plenty of room, but no waste space. The power transformer is a Peerless R-400A, the filter choke is a Peerless C-325A, and the filter capacitor, a double 40-mfd. Sprague type EL. The brute-force filter gives dependable, hum-free power. Hum level in the complete amplifier is 90.2 db below full output or −49 dbm. On a practical basis, there is no hum audible in the speaker at 6 ins. with an open grid.

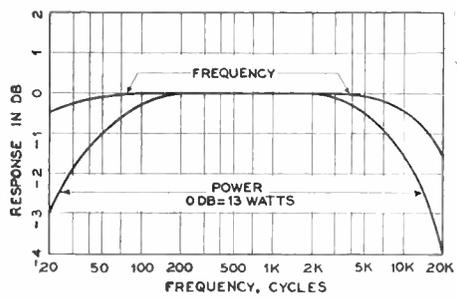


Fig. 4. Response and power curves.

A 6-conductor cable is used to feed power from the power supply to the main amplifier chassis. Four of the wires carry plate and heater power, the center tap of the heater winding being grounded. The two remaining wires carry the 115-volt AC line up to the amplifier and back. This procedure was adopted to prevent turning the power supply on unless the interconnecting cable is in place. A 6-pin Amphenol plug and socket are mounted on the power supply but, because of space limitations, a 6-pin Jones plug and socket are used on the amplifier. The connector is mounted on the amplifier chassis, and the socket on the power supply so there are no hot plugs. An AC line switch is not needed because provision is made on the TV chassis to turn the amplifier on simultaneously with the TV power switch.

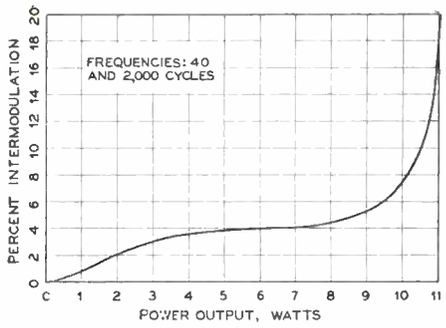


Fig. 5. Intermodulation vs. power.

As for connecting this amplifier to a particular set, the reader must be on his own to a great extent, because of the many different TV models in use today. The amplifier and associated power supply described in this article is an entirely self-contained unit and, as such, can completely replace the audio amplifier circuit in most TV circuits. An understanding of the circuits involved in any particular set is essential if such replacement is to be successful. In most cases, the output of the sound discriminator stage can be fed into the Viewer's Amplifier across a volume control. It is often possible to use the volume control on the TV set itself.

CHILDREN'S RECORDS

Continued from page 53

BELDA TALKING KOMICS An interesting innovation including a comic book with text illustrating the record.

Lonesome Octopus
Chirpy Cricket
Grumpy Shark

RECORD READERS

Readers include pages of text with colored illustrations for the child to follow as he listens.

PHONO-BOOKS Especially recommended

"*What*" *Stories* (What Makes Rain?, etc.)
"*How*" *Stories* (How did we Learn to Count?, etc.)
"*Why*" *Stories* (Why are Bees so Busy?, etc.)
"*Who*" *Stories* (Who was Aesop?, Who was Daniel Boone?, etc.)
"*Where*" *Stories* (Where do Birds go in Winter?, etc.)

RCA VICTOR

Uncle Wiggly. Told by Paul Wing. 2 10-in. Y415

MGM

Tom and Jerry at the Circus. 2 10-in. 51A

AUDIO AMPLIFIER

Continued from page 41

more for an equivalent product, or reduce costs in other ways not so apparent to the customer. In the long run, the simpler products are to be preferred for both lower upkeep and better performance per dollar of cost.

Remote controls do have an advantage in installations where the amplifier is immediately adjacent to the speaker or is in some inaccessible location. In such a case, you might prefer to adjust the controls from your normal listening position, because you can judge the effect more accurately than when you are standing right at the speaker.

Every designer, during the course of the design of his product, is confronted with numerous choices to be made between design principles and cost. Thus, the designer who goes overboard in one special direction may quickly find himself seriously penalized in the balance of his design. That may apply to some point-of-sale feature that seems impressive when a salesman tells you about it, but which proves to be of no consequence after you have used the amplifier for a few days.

The best design is not necessarily the one that excells in one feature but rather one that has intelligently distributed costs throughot the design. There is little point, other than advertising advantages, to increasing performance in one respect if, in so doing, other factors must be sacrificed.

Read what you will regarding performance, but do not let it interfere with satisfying your own ears. That's the beauty of custom installations. You can achieve the results you are looking for without regard to the preferences of others. By no other means can so much real, personal satisfaction be achieved. Listen to the engineers and the salesmen, but make your final choice of an amplifier by listening to comparative performance tests.

EDITORIAL

Continued from page 9

the experts, but we certainly will do our best to dig up any information you want on equipment, components, manufacturers' addresses, books, and other things within reason. If we haven't the answer at hand, we can probably hunt up the particular specialist who knows.

If your question is simple enough to answer in a few lines on a postcard, there will be no charge. If you're going to make it necessary for us to write you a letter, send 25c for each question. Since we don't like to draw diagrams, we will probably refer you to a book that will give you the circuit for what you want. And if you hit us with the $64 question, enclose a remittance accordingly!!

We'll do our very best to get an answer off to you within 3 days, but be lenient with us 1) when an issue of HIGH-FIDELITY is just about to go to press and 2) during July and August, when we spend a fair share of our time at Tanglewood listening to the Berkshire Festival. At all other times, answers to your problems have top priority.

RECORDS IN REVIEW

Continued from page 75

different artists in the opera house, this is no mean feat.

Dorothy Bond as Olympia hardly seems to have the technique necessary for the role, her Doll Song lacking brilliance, while Margherita Grandi can no longer produce the sound she was once capable of. Her tones are edgy and the voice wavery. Ann Ayars seems well suited as Antonia, though some of her attacks are rather tentative. The voice itself is pleasant, and her singing in the third act duo is excellent.

The notice enclosed in this album advises that phonograph controls should be stepped up for best results, the recording having been processed from the film sound track. At ordinary levels, the sound is very boxy and tubby, with a considerable loss of highs on average phonograph equipment. However, when played at relatively high volume levels on wide-range equipment, the sound was superb. A startling comparison to make. Try it and see.

As noted before, the opera is sung in English, the acceptable libretto being by D. Arundell . . . however no text is supplied, instead a superfluous photographic brochure of scenes from the film comes with the album.

The complete recording in French issued by Columbia last year, containing as it does Cluyten's lack-lustre reading, Jobin's forcing, Doria's dull Doll Song, fails to measure up to this superb job.

REPERTORY

Continued from page 28

FULL MODERN ORCHESTRA

R. STRAUSS: *Also Sprach Zarathustra* (London LLP-232). Not perfect, but a bold, skillful manifestation of the orchestral intricacies of the greatest tone-colorist.

WAGNER: *Rhine-Journey* and *Death-Music from Gotterdammerung*. (Columbia ML-4273). Exhibition of warm and seductive tone maintained throughout a rich, ominous, and tragic discourse.

In addition to the examples cited as revelatory of certain specific virtues, a number of records of other types are notable for all around excellence. Music-lovers should hear Bach's *B Minor Mass* on Westminster, and Prokofief's *Alexander Nevsky* on Columbia as examples of what can be done with choral bodies and orchestra combined. Three stage-works of different kinds have unusual merit in four editions that should be used as criterions for future work. They are *Die Fledermaus* in both the Columbia and London versions, the *Orfeo ed Euridice* of Haydn issued by the Haydn Society, and RCA-Victor's splendid *Rigoletto*.

Every month sees the production of about twenty major works previously unrecorded, plus a greater number in new and usually improved editions. We have begun the recapture of the Eighteenth Century and skirmished with the Seventeenth, while retaining the Nineteenth and Twentieth. There can be little doubt that the recorded output of the next decade will furnish us with a repository of a richly representative anthology of all kinds of music written in every musical epoch, to be drawn upon by musicians, teachers, and students, as well as by Mr. Smith and Mrs. Jones. Exactly as much of the world's great music will thus be made available in Owosso, Sapulpa, Owl's Head, and Paducah as in Vienna, New York, Paris, and London.

KLIPSCHORN

Continued from page 14

when there is dancing. Unless one has a concrete floor, even normal walking may shake the stylus out of a microgroove. Even a concrete floor transmits traffic-induced seismic disturbances with resulting rumbles. The best remedy found so far has been a 4-stud oscillating support suspended from 8 shock mounts. This has proved better than springs because of the damping (shock absorber) action of the rubber. It appears desirable to make the table suspension resonant at a point at least two octaves below the resonant frequency of the tone arm. In the case of the Gray 108B arm, the resonance frequency appears to be of the order of 20 cycles, so the table should have a natural frequency of 5 cycles or lower, two octaves lower being one-fourth the frequency.

NERVE CENTRE

Continued from page 24

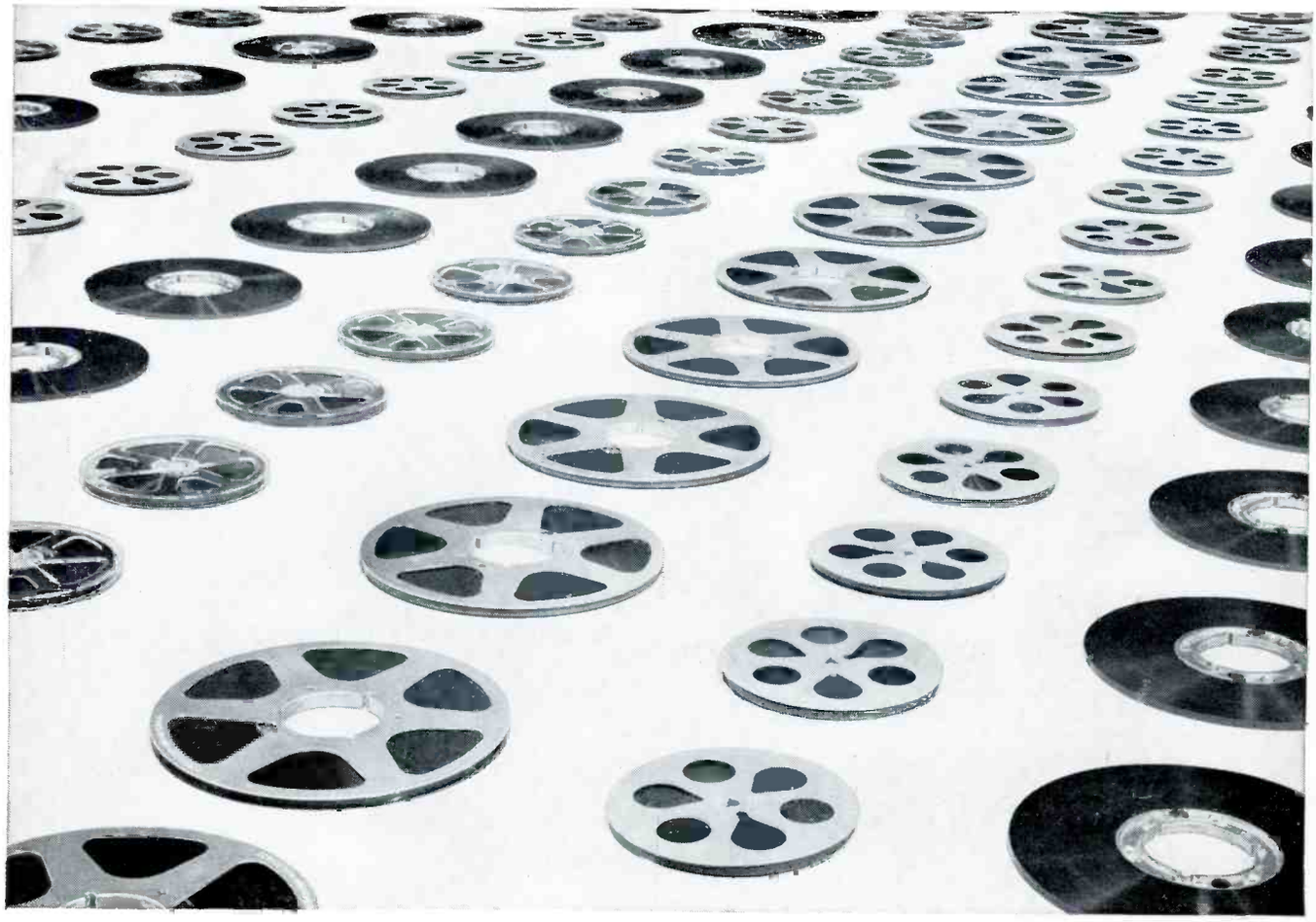
This array of equipment, all of which operates between the reproducing unit and the amplifier, comprises the nerve center of any home installation. With the exception of the volume control and an on-off switch, all of it can be eliminated. But each is designed to help recreate realism, to help bring the symphony orchestra or the soloist, out of the recording studio where the music originated and into the living room.

INSPIRATION

Continued from page 69

a custom installation, the tendency is to put all equipment in a tightly closed bookshelf or cabinet. Lack of ventilation, and the resultant excessive heat, will damage tubes, condensers, and even transformers. It is because of the importance of ventilation that the method of allowing adequate air circulation has deen detailed in the descriptions of the installations illustrated in this article. When in doubt, a thermometer in the equipment compartment will give the answer. If it gets up around 100° more air is needed!

CONSISTENT UNIFORM QUALITY



. . . reel after reel after reel!

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made by audio engineers, for audio engineers

● Yes — when you reach for a reel of Audiotape, you can be *sure* that you will have the finest recording that your equipment can produce. You *know* that the output volume will not vary more than ± ¼ db within every 1250 ft or 2500 ft reel of plastic base Audiotape. That is *guaranteed*. You *know* that these reels are entirely free from splices. That is guaranteed also. And you get an actual Esterline Angus output curve in every 5-reel package of plastic base Audiotape — giving positive visual proof of unequalled uniformity.

But, still more important, you know that you can depend on Audiotape for unequalled *over-all performance* — with maximum fidelity of reproduction and minimum surface noise and distortion.

In short, Audiotape *always* gives you the same consistent, uniform quality that has characterized Audiodiscs for more than a decade.

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and to keep up-to-date on all phases of tape and disc recording be sure to read

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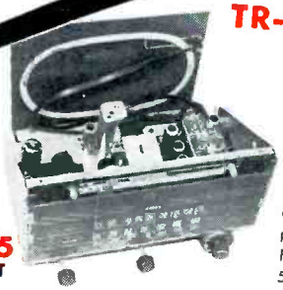
NO SKIMPING ON ESSENTIAL MATERIALS

IMMEDIATE DELIVERY AT LOWEST PRICES

TR-12A AM-FM TUNER

SEPARATE 5-TUBE TUNING UNIT, SHOCK MOUNTED, 6-GANG ALUMINUM AND COPPER TUNING CONDENSER



An outstanding 11-tube superheterodyne AM-FM tuner, self-powered for use with any good amplifier. Well-engineered circuits and top-quality parts assure high fidelity reception. FM covers 88 to 108 MC., AM covers 535 to 1720 KC. Latest FM drift-compensated design, automatic volume control, easy tuning. TR-12A is supplied complete with 2 antennas for AM and FM, all mounting hardware, panel escutcheon, template and instructions. 13½" W x 9" D x 8½" H.

79.95 NET

RCA 15" DUO-CONE SPEAKER

with full weight ALNICO V magnet

This full-size 15" RCA loudspeaker provides the listener with full depth of bass and clear natural upper register. The unique magnetic structure and Duo-Cone arrangement with two voice coils accounts for its smooth frequency response from 40 to 12,000 cycles. Power capacity is 25 watts. 16 ohm input impedance. Weighs 15 lbs. RCA 515S1.

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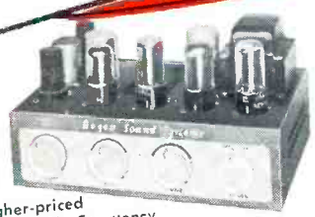
VISIT TERMINAL'S FAMOUS SOUND DEPARTMENT!

NEW! WEBSTER-CHICAGO DISKCHANGER

Automatically plays 12", 10" and 7" records — standard or LP microgroove — at 33⅓, 45 and 78 rpm. Features simplicity of operation and well-balanced tone arm designed for G.E., Pickering and Audak cartridges. Supplied with mounting hardware, pair of plug-in shells (less cartridges), 7" record hole adapters, mounting template and instructions. Base 13" x 13½"; requires 5⅛" above, 3⅛" below bose plate.

PRICES SUBJECT TO AUTHORIZED CHANGES

NEW! BOGEN DB-10 WIDE RANGE AMPLIFIER



Extremely compact, embodies features of higher-priced amplifiers. 10 watts output, distortion less than 3%. Frequency response range of 30 to 18,000 cycles, ±1 db. Dual tone controls. Phono preamplifier is correctly compensated for G.E., Pickering and Audak pickup cartridges. Inputs also for crystal pickup and radio tuner. Output impedance 4, 8 and 16 ohms. 11" W x 7" D x 6" H.

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CARTRIDGES for W-C DISKCHANGER and GARRARD RC-80

G.E. RPX-050 Reluctance triple-play dual sapphire stylus cartridge 8.20
G.E. RPX-040 Reluctance cartridge for standard groove; sapphire stylus 5.82
G.E. RPX-041 Reluctance cartridge for LP; sapphire stylus 5.82
Pickering S-120-M magnetic cartridge for standard groove, sapphire stylus 9.90
Pickering D-120-M, same as above, with diamond stylus 24.90
Pickering S-140-S, magnetic cartridge for LP microgroove, sapphire stylus. 15.00
Pickering D-140-S, same as above, with diamond stylus 36.00
Audak R-2 Polyphase magnetic turnover head, equipped with 2 sapphire styli 17.05
Audak L-6 Polyphase magnetic, precision studio turnover cartridge, 2 sapphire styli 22.93

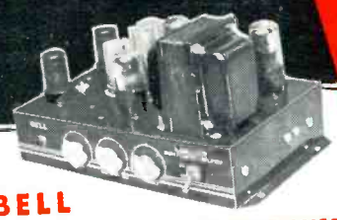
GARRARD "Triumph" RC-80 RECORD CHANGER

The Garrard RC-80 fully automotic record changer is distinguished by its watch-like construction, fastidiously machined and finished. Concert quality reproduction for all records — 33⅓, 45 and 78 rpm — regardless of diameter (7" — 10" — 12") or size of spindle hole. Shuts off automatically after last record is played. 15½" W, 13½" D; requires 5¾" clearance above, 3½" clearance below base. Supplied complete with mounting hardware, 2 plug-in shells (less cartridges) and mounting template.

39.80 NET

RC-80C—Same as above, but equipped with turnover dual crystal cartridge. **44.90**

BELL 2122 WIDE RANGE AMPLIFIER



Remarkable fidelity and quality. Four separate inputs for radio tuner, crystal pickup and two magnetic or reluctance cartridges. 10 watts, less than 3% distortion, 30 to 15,000 cycles with dual tone controls set at normal. Outputs: 4, 8 and 16 ohms. 11½" W x 7½" D x 6" H.

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All equipment furnished for operation on 105-120 volts, 60 cycles AC.

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The Western Electric 728-B results from Bell Telephone Lab's search for natural reproduction of sound. Frequency response is 60 to 10,000 cycles; 30 watts power capacity. Standard 12-inch mounting holes. Voice coil impedance is 4 ohms. Large magnet contributes to unusual overall efficiency. Weighs 17 lbs.

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