MAY, 1955

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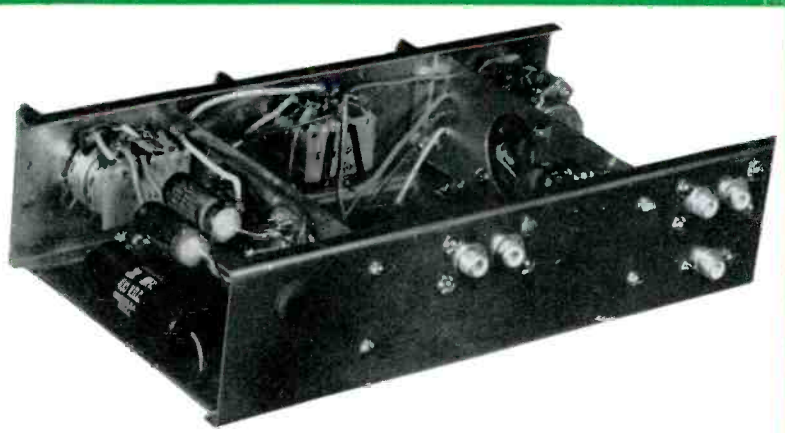
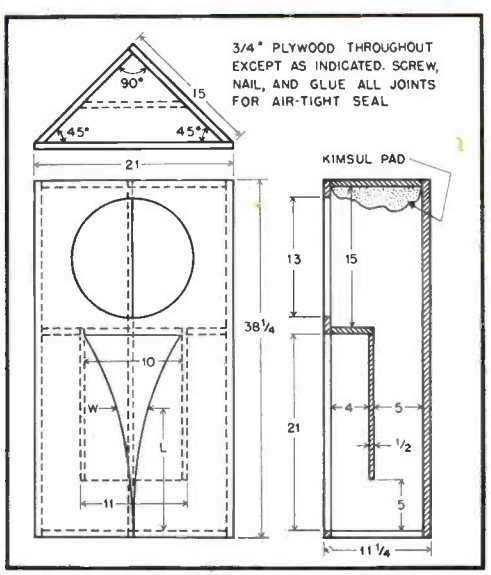
MAY 24 1955

# AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION



*Designed for modern phonograph records, and for use with tuner and tape recorder, the "Preamp with Presence" has been miniaturized, and construction is simplified by using a printed circuit panel which is available. See page 20.*




*Complete constructional data is given for a small corner enclosure using the tuned-pipe principle to enhance bass reproduction. See page 18.*

**SELECTING YOUR LOUDSPEAKER**

**A QUALITY AMPLIFIER FOR THE HOME**

**MINIATURIZED "PREAMP WITH PRESENCE"**

**ARTIFICIAL EAR FOR MEASUREMENT OF HEADSET RESPONSE**

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**AXIOM 22**
12-inch
20 watts
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**$72.95**


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**ROCKBAR CORPORATION** 215 East 37th Street, New York 16, N. Y.

MAY, 1955 VOL. 39, No. 5
Successor to RADIO, Est. 1917.

# AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION



CONTENTS



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

# AUDIO PATENTS

RICHARD H. DORF*

THE UNITED STATES is not, of course, the only country in the world that has a patent system; almost every country has one. However, we are so used to our own system—which, of course, contains the largest number of patents of all, perhaps more than all other countries lumped—that many of us are not aware of the great differences that exist between our own patent laws and those of some other countries. Almost all patent systems are based on those of the U. S., Britain, Germany, and France. Of the foreign group, the British system is most like ours (as it is in most matters of law) and the French is the most different.

### British Patents

The British system, though much like ours (or *vice versa*), has significant differences. In the first place, it is not necessary to wait until a complete application is ready before establishing a filing date in the Patent Office. It is possible to submit a "provisional specification" (in Canada and formerly when allowed in the U. S. called a *caveat*) in advance of formal submission of the application. The effective filing date then is that of the *caveat*. The formal and complete specification need not then be filed for a year, and sometimes there is a three-month extension in addition. However, the application must be approved within a year after submission. This is important, because it means that the monopoly resulting from the granted patent cannot last more than 17 years from the formal application's filing date. In the United States a patent may take years to issue. There may be as much as six months delay before the Examiner takes action, and the applicant is allowed six months to answer each action, of which there may be as many as four or five. This effectively extends coverage because there is the 17 years after granting plus the years taken in processing the application. (Although there is no legal monopoly during the processing time, either the invention is concealed during those years or competition is prevented by the fact that it would be folly for a competitor to copy it knowing he would have to stop at any time.) In Britain actions take place faster and the time allowed for reply to each is much less, so that maximum coverage is the 16 years granted after allowance plus the 1-year processing maximum.

Claims in a British Patent are relatively few. A typical well drawn U. S. Patent has as many claims as possible, graded from the broad to the narrow. British patents have only one or two broad claims followed by a few narrow ones covering minor features of the idea. The last claim is often, "A superblooper having its parts constructed and arranged substantially as hereinbefore described for the purposes specified." Just what this may mean or cover is open to a great deal of interpretation, a strange thing since court adjudication of patents in Great Britain is commonly based on a strict interpretation of the actual words of the claims.

The British Office follows U. S. philosophy in requiring that an invention be original, and it searches the prior art to determine this. However, prior use outside of Great Britain is not a bar to a patent, while in the U. S. prior use anywhere is considered anticipation and prevents allowance of claims. In Britain the inventor himself need not apply; his assignee or even the first importer may apply.

Even the granting of a British patent is not anything like final. At any time within the following three months anybody may oppose the patent by alleging a legal bar such as prior use in Great Britain. In the U. S. patent matter is kept secret until the actual granting date, after which no opposition is possible without deliberate infringement to invite the patentee to sue. With the British system those in each field can watch for the issue of patents and can have time after publication of the material to oppose it, if they wish, without a great deal of fuss and expense.

Two other British features are interesting. First, there is not a single fixed fee; there is a "tax" on every patent which is payable yearly. The second and more interesting point is this: if a patent has not been worked—actually used—within three years after it is granted, any person can apply to the Comptroller for relief from "abuse of monopoly right." After investigation, the Comptroller can order grant of a license, indorse the patent "License of Right," which means then anyone can practice the invention on terms set up by the Comptroller, or even revoke the patent entirely. This tends to make it impossible to use a patent for the purpose of suppressing an invention, as is sometimes done in the U. S.

### Patents in Germany

To be patentable in Germany an invention must not have been practiced or published anywhere in the world (unless the applicant has priority for certain reasons under the International Convention for the Protection of Industrial Property). Edibles, chemicals, and medicines cannot be patented; but a function—that is the idea of achieving a certain result without specifying the method—is patentable, contrary to U. S. and British practice. Either the inventor or his assignee can apply, and a patent is always granted to the first who applies, no interference processes existing.

A German patent application must specifically state in what respect the invention is an advance over the prior art—it must, in other words, make a comparison. This is true not only in the specification but also in the claims. Few claims characterize a German patent, one broad and one narrow often being enough.

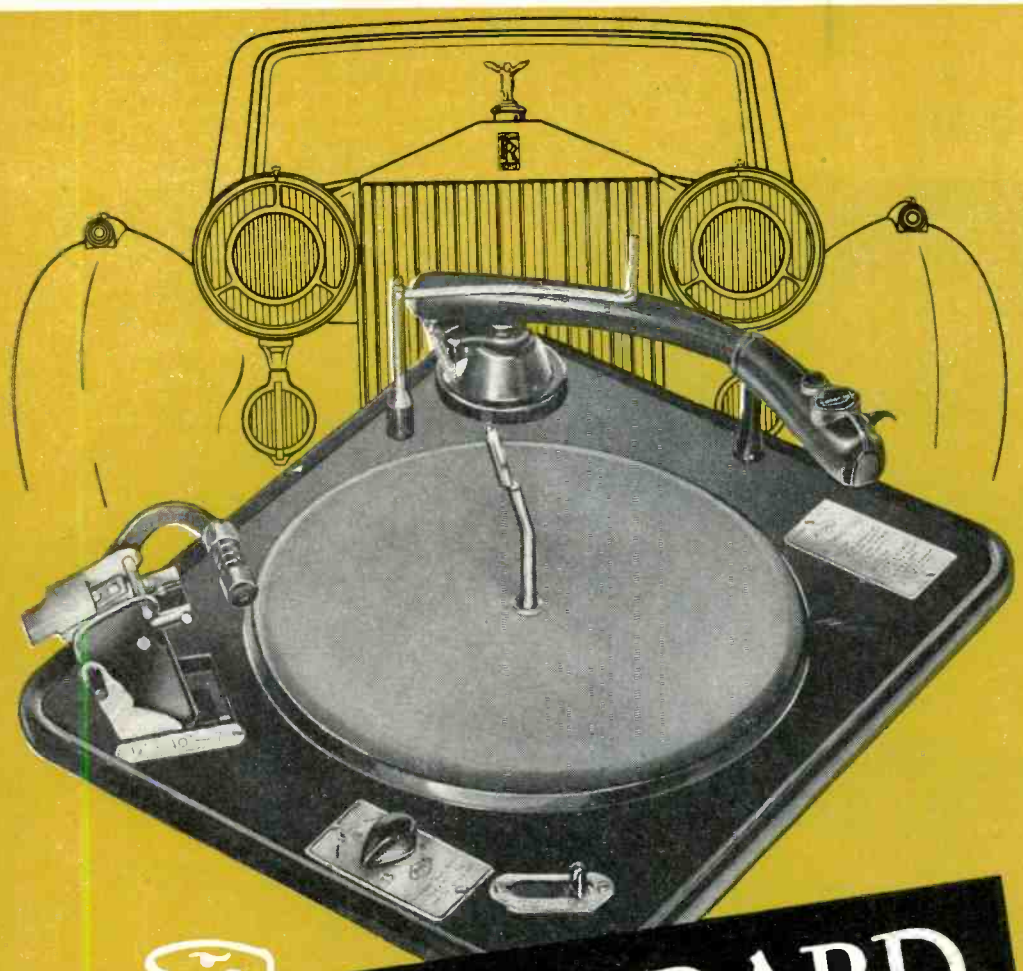
The probable reason for not bothering with a great number of claims becomes apparent when one looks at the judicial procedure in infringement actions. Unlike British and American practice, the

* *Audio Consultant, 255 W. 84th St., New York 24, N. Y.*

# Incomparable...

**Since 1935**
**the Garrard has been sold and serviced throughout the United States.**

**It is recognized every where for superior performance, ruggedness and reliability.**



**CHECK CRAFTSMANSHIP, FEATURES, PRICE AND SERVICE . . .**
and you will understand clearly why this is the world's No. 1 high-fidelity record changer.

**"RIGHTS" and "WRONGS"**
of record changer design
(important in protecting your records).

**RIGHT:**
**Garrard Precision Pusher Platform . . .** the only record changing device that insures positive, gentle handling of records with standard center holes.

**WRONG:**
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**RIGHT:**
**Garrard removable and interchangeable spindles** . . . Easily inserted; accommodate all records, all sizes, as they were made to be played; pull out instantly to facilitate removal of records from turntable.

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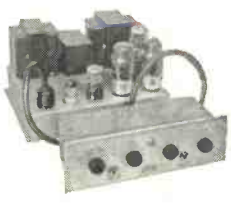

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patent coverage is not limited by the claims, which serve only to show the nature of the invention and not its limits. The court can interpret the patent broadly or narrowly as it sees fit, and it considers the prior art and evaluates the inventor's contribution in arriving at a decision. This makes things rather difficult for both patentee and others in the field. On the one hand, the patentee can sue or threaten to sue almost anyone in his field for infringement since he is not limited by his claims. On the other hand, he must use his crystal ball to determine whether the court will uphold him even in what appears to be a perfectly legitimate suit to protect his rights.

A German patent is more precarious than a British or American one after issuance. When the application is approved the specification and drawings are published, and opposition can be filed by anyone within four months. After that period the actual patent issues, but an interested party can bring an annulment suit at any time during the patent's 18-year life. Nonworking can also be penalized at any time after three years, although German patents held by American citizens are exempt from this.

### French Patents

The French patent might be expected to be radically different from the U. S. or British one, since the foundations of French law are so different. (For instance, recall that a defendant in a French court is presumed guilty and has the burden of proving his innocence, rather than the reverse which we consider essential to justice.)

A French patent is issued to anyone who asks for one and complies with a few simple technical requirements. There is no search or requirement of novelty, and the patent itself contains no claims, the final part being merely a *resumé* or summary. The question of validity is left for the courts. At an infringement trial the questions of priority and anticipation are gone into for the first time, even the scope of the patent being undefined until the court makes a finding. It is said that French courts allow themselves to be unconcealedly influenced by matters which, if considered in U. S. or British courts, would be causes for impeachment—things like the professional and business standings of the patentee and other litigants.

While one can resign himself to "doing as the Romans do," and thus figure that if one is in France, he would probably become accustomed to French patent law, it is hard to refrain from commenting that French patents hardly seem worth the paper they are printed on. Surely any such system in this country, with its tremendous volume of inventions, would wreak havoc with the entire industrial complex and would choke the courts to extinction.

### Other Patent Systems

The British patent system does not cover any territory other than the British Isles and possessions; colonies have their own systems very often, and of course the Dominions are entirely separate. Sometimes there is a system of "confirmation patents" wherein separate patents are issued but are based on those issued elsewhere. For instance, a patentee in the Union of South Africa can get a colonial patent in Basutoland based on and expiring with the South African patent.

The Canadian system, of much interest to inventors and manufacturers in the U. S., combines features of the British and Ameri-

(*Continued on page 59*)

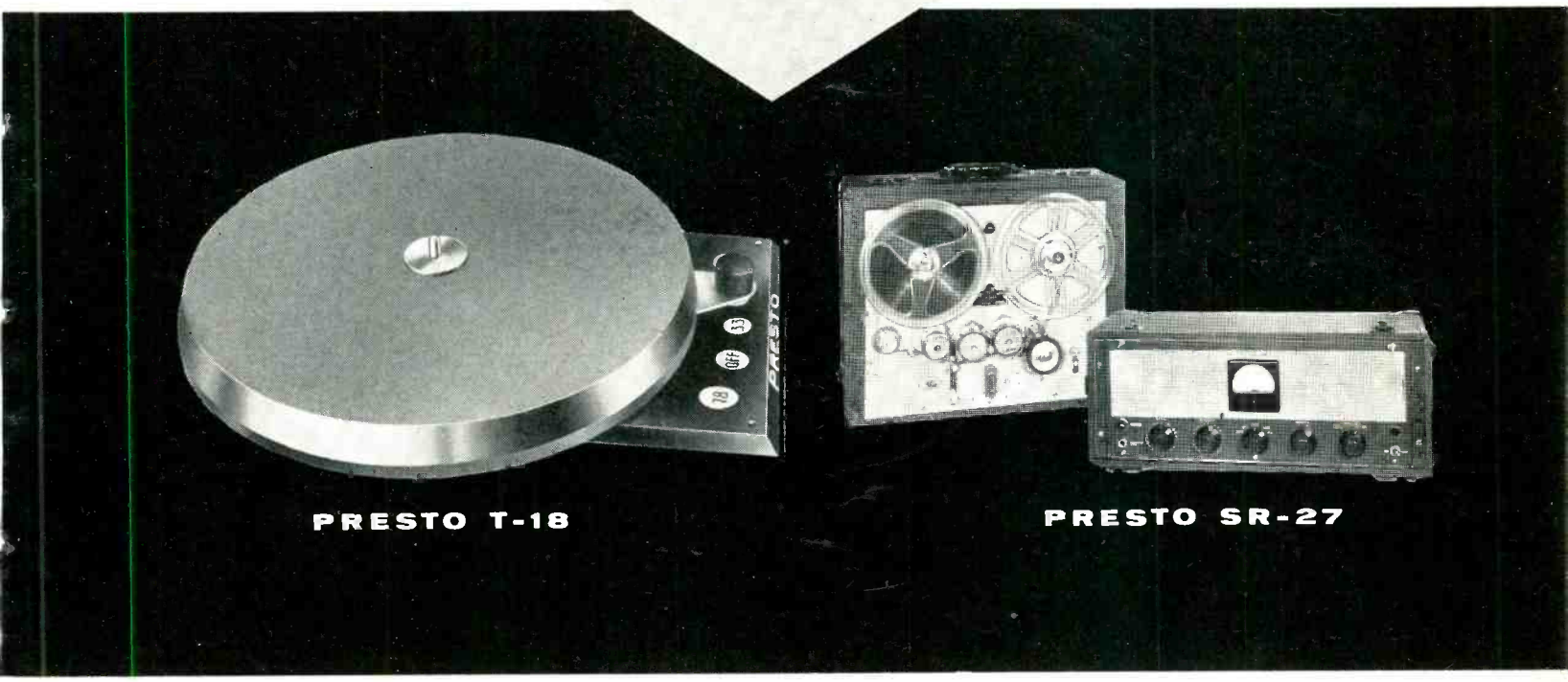
# TWO NEW PRESTO UNITS

## PRECISION THREE-SPEED TURNTABLE

# T-18

## LOW-COST PROFESSIONAL TAPE RECORDER

# SR-27

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introducing new flick shift!
one sideway motion
selects 3 speeds—33⅓, 45, 78 rpm.

The new streamlined T-18 sets the highest standards in turntable design and performance today. Most revolutionary is the exclusive 3-speed shift—with 3 idlers mounted on a single movable plate. A sideway flick of the single control lever automatically engages the proper idler. Trouble-making arms and shift cams are eliminated. Other advantages! Extra heavy weight, wide-bevel table, precision deep-well bearing, built-in adapter for 45 rpm discs, smart telephone black and brushed chrome finish. Only $53.50. Also available with hysteresis motor, $108.

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**WORLD'S LARGEST MANUFACTURER OF PRECISION RECORDING EQUIPMENT AND DISCS**

CZECH ACTORS, refugees from communism, listen to playback of weekly satirical program "Cafe de l'Europe" on tape recording machine in one of Radio Free Europe's Munich studios. Supported by contributions from American citizens, RFE now beams as many as 20 hours of home news and entertainment every day to the five key satellite countries of Czechoslovakia, Hungary, Poland, Romania and Bulgaria. Programs compete hour by hour with communist stations in such cities as Prague, Warsaw and Budapest.

BITING WIT and patriotic music featured in popular tape recorded programs like "Kohout's Cabaret" incite bitter attacks on RFE by Red officials in satellite countries. With tape, exile entertainers, clergymen, statesmen from behind Iron Curtain can address listeners in their native languages at all hours of the day.

ARMORED CAR ESCAPEES from Czechoslovakia tape record the story of their flight to freedom for Radio Free Europe listeners. Besides world news, RFE tells captive peoples the *real* news in their own countries. Coded messages to families and friends are daily part of network's schedule.

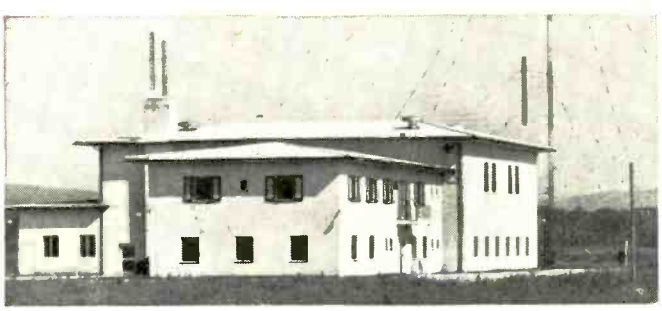
# THE RADIO NETWORK THAT BRINGS HOPE TO 50 MILLION EUROPEANS

Leaders of Iron Curtain countries are anxious to drown out Radio Free Europe because RFE is stimulating opposition to communism in key satellite countries. By exposing communist collaborators . . . answering Red propaganda . . . revealing news suppressed by Moscow, RFE gives the will to resist oppression to the captive populations of Romania, Hungary, Poland, Czechoslovakia and Bulgaria.

But the job of broadcasting the truth grows harder. The Communists are stepping up their efforts to block Radio Free Europe. So far, superior engineering know-how has kept RFE ahead of Red "jammers". But now, more and *stronger* transmitters are urgently needed. Keep the truth turned on—by contributing to Radio Free Europe. Send your "Truth Dollars" to CRUSADE FOR FREEDOM, c/o your Postmaster.


*Radio Free Europe uses "SCOTCH" Brand Magnetic Recording Tapes exclusively to assure uniform, highest quality broadcast results.*

OKLAHOMA CITY radio producer David Sureck fights daily battle with communism. Directing inspirational and service programs, adult and children's broadcasts, he exposes Red propaganda. Most RFE programs are tape recorded for round-the-clock broadcasting from transmitters in West Germany and Portugal.



29 TRANSMITTERS like this one near Mannheim, Germany help Radio Free Europe break through the Iron Curtain. By beaming all transmitters on one target for certain periods of the day, RFE makes Soviet jamming ineffective.


"SCOTCH" BRAND Magnetic Recording Tapes are used exclusively by Radio Free Europe in the U.S. and abroad. "Scotch" Brand's easy erasability and superior fidelity make it a favorite with RFE engineers.

# LETTERS

### Living with Bach

SIR:

I feel that I must comment upon Mr. Harold Lawrence's article (ABOUT MUSIC, January, 1955) with which, in the main, I entirely agree.

The "British tradition" of choral singing, by which is implied a full symphony orchestra and a choir of 500 to 1000 voices, is, I am glad to report, dying rapidly, a process accelerated by the acoustics of buildings such as the Royal Festival Hall. The same is true of the other European stronghold of oratorio, Holland.

A feature of the last five years has been a great revival of interest and improvement in frequency and standard of performance of 18th Century music all over Europe. This is borne out by the fact that in England today no less than six manufacturers are engaged entirely upon building harpsichords and allied instruments. The harpsichord, viola da gamba, and so on are now expected by audiences, in concert hall or in church, with orchestra and choir of a size small enough for correct balance. This applies not only to Bach, but to Handel, where tradition was much more firmly rooted.

The record catalogues of Germany, France, and Britain also show the trend, and as a result more people are listening to more 18th Century music in more or less its original form. Bach is coming to be enjoyed as one whose music has more fullness and original qualities than that of his contemporaries, even the ever popular Scarlatti.

I enclose three concert prospecti as examples of what can now safely be anticipated to attract capacity audiences nowadays, not of musicians in particular, but from all walks of life —particularly science or engineering graduates.

Any American in Europe cannot do better than to subscribe to "The Gramaphone," published at 49, Erdington Road, Kenton, Middlesex, England, at 1/- (14¢) per copy or 16/- ($2.24) per year, for 12 monthly copies by post. (*In England. U. S. prices undoubtedly higher.* ED.) The reviews are clear and forthright, both as to technical points and musical quality, and especially valuable as comparisons are made with all other recordings of the same work available in Europe, which are listed.

No European company has an over-riding reputation for the highest quality, but if one must rely solely on the name on the label in making a choice, D.G.G. in Germany or Decca in Britain are the safest.

JOHN RODGERS,
"The Cottage,"
132, Worrin Road,
Shenfield, Essex, England

*(The prospecti listed weekly concerts of the Orpheus Society presenting the London Harpsichord Ensemble, the Taylor Recorder Consort, the Boyd Neel Chamber Ensemble, the Robert Masters Quartet, London Piano Quartet, London String Trio, and a number of soloists. Music of Bach was presented by The Geraint Jones Singers and Orchestra, and in organ concerts by Geraint Jones.* ED.)

### Useful Information

SIR:

I have the following copies of AUDIO I would like to sell if any readers are interested:

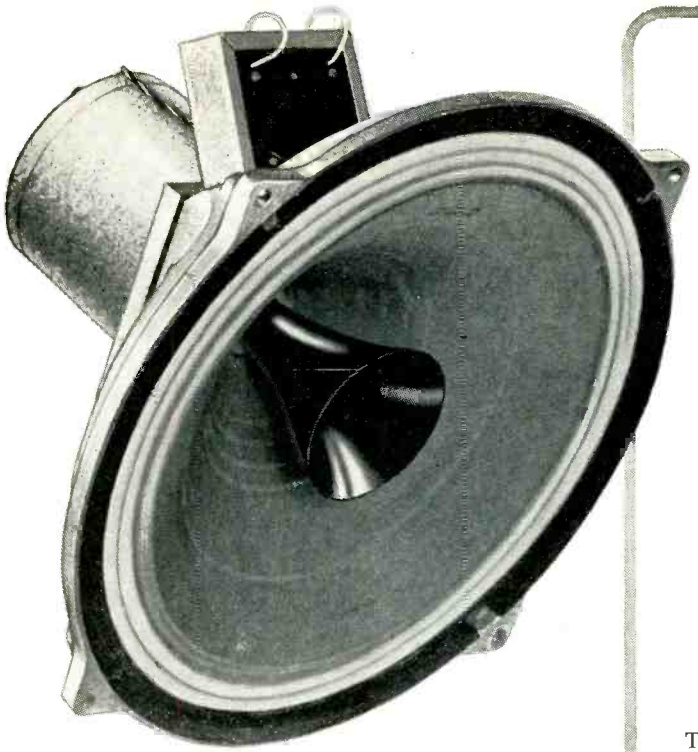
1953: May, June, July, August, September, October, December
1954: All issues except June

CARL R. SHORT,
3788 Rocky River Drive,
Cleveland 11, Ohio

### Exchange for Audio

SIR:

Could you perhaps direct me to whatever exchange houses (for tape recorders, etc.) about which you happen to know? We are seeking a used tape machine of the Concertone, Magnecorder, etc. class, in exchange for a (factory specially-checked) Pentron 9T-3C having about 10 hours use by research-oriented personnel. Reason: need for installation of multiple tracks for research use; present machine is too compact to permit this. Perfect condition of desired machine unessential as we will rebuild. I know about Audio Exchange, in Jamaica, N. Y., but



"Well worth careful consideration"
—HIGH FIDELITY TITH REPORT

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## Stand-Alone

The superb, British made Stentorian line of High Fidelity Loudspeakers provides types and sizes to fit every audio purpose. Whether you select full range coaxial speakers or extended wide range direct radiators, tweeters or woofers you'll find a Stentorian to suit you perfectly. All models feature the revolutionary patented Stentorian cambric cones and suspension; Sizes 8 inches and up feature non-resonant die-cast chassis. Stentorians are unmatched in performance, craftsmanship and value. Hear Beam Stentorians – the Sound that "stands alone" – for yourself and be convinced.

**12" Duplex** (twin concentric) **$99.50**

Response, 20 to 20,000 cps; bass resonance, 35 cps; built-in crossover; 15 watts; gross weight, 16¼ lbs. Series Alcomax magnet system; net weight, 11½ lbs.; 31,000 Gauss; two 1½" voice coils.

**12" Extended Range Direct Radiator** **$42.50**

Response, 25-14,000 cps; bass resonance, 39 cps; 15 watts; gross weight, 10 lbs.; Alcomax magnet, 5½ lbs., 14,000 Gauss; 1½" V/C.

**10" Duplex** (twin concentric) **$44.50**

Response, 30 to 16,000 cps; 10 watts; gross weight, 6½ lbs.; 3 lb. 9 oz. Alcomax series magnet system; 25,000 Gauss; two 1" V/C.

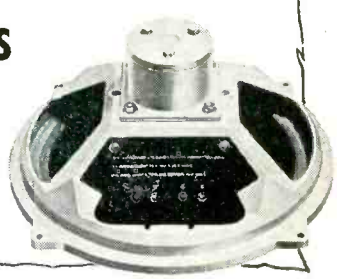
## New 3 way variable impedance DIRECT RADIATORS

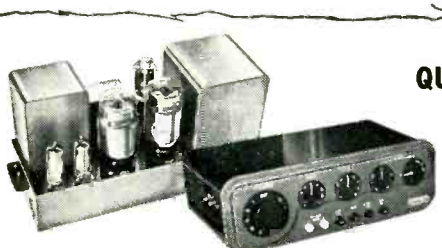
4 - 8 - 15 Ohms

**You select the perfect impedance match for your system!**

| | |
|---|---|
| **HF 1012 U-10"** | **$15.95** |
| **HF 912 U-9"** | **12.55** |
| **HF 812 U-8"** | **11.95** |

Extended Range Response, 30 to 14,000 cps; bass resonance, 35 cps. 10 watts. These models also available with 15 ohms V/C only. All have 12,000 Gauss, 2 lb. 1 oz. Alcomax Magnets.





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AMPLIFIERS

- Response, 10-60,000 cps; 0.5 db
- 20-20,000 cps level at full 15 watts
- Total Distortian, at 700 cps, less than 0.1%
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—*Audio Equipment Report*

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| Quad II Amplifier | $130.00 |
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The Beam QUAD is a truly superior audio instrument, providing uncompromising quality *plus* unparalleled flexibility of control. Its scarcely traceable distortion is inaudible at any volume. Add high efficiency harmonic filtering, push-button equalization and channel selection, plug-in pickup matching, balanced feedback throughout, 13 section output transformer, superb British craftsmanship, and the most functional styling in high fidelity today – and you can see why QUAD is the recognized world leader in high quality audio reproduction. Hear it at your earliest opportunity.

*Send for literature and detailed specifications on the Beam Products described above, and on Stentorian Speakers from 5" to 12" sizes, 5 and 15 watt pressure horn tweeters, matching crossovers, the Stentorian 18" woofer and Beam enclosures.*

**BEAM INSTRUMENTS CORPORATION**
350 Fifth Avenue, New York, N. Y.

(*Continued from page 8*)

would like to know of other sources. Unfortunately, exchange services do not make themselves well known.

DR. CHARLES D. RAY,
Medical College of Georgia,
Augusta, Ga.

(*This ought to do it!* ED.)

### Color Organ Data?

SIR:

I would like to solicit the aid of your readers in pursuing the continued development of a device described as a Color Organ. I currently have one of these devices constructed generally in accordance with a schematic diagram published in *Radio Electronics* of October, 1948.

Looking further into this audio visual field, I have been able to secure reprints of three earlier articles as background information. These are: *Electronics*, Jan. 1941; *Popular Science Monthly*, Apr. 1936; *Proc. I.R.E.*, Aug. 1931.

I would like to know if there has been any further experimentation in this field using a more modern circuit than the one which uses '71A tubes, which are fairly short lived. If so, are these circuits available or are they held by patentees.

The effect of this visual supplement to the audio experience is, to me, a pleasant one, and would like to improve my installation. I would appreciate hearing from any of your AUDIO's readers who have information on this subject.

W. O. STONE, JR.,
Fairmount Road, R. D. No. 5,
Alliance, Ohio.

### Record Dealer's Viewpoint

SIR:

. . . I have one little complaint to make about a comment made by Mr. Canby in the April issue. He mentioned that record dealers still get a whopping 40 per cent of the selling price of the now reduced LP records.

First of all, 40 per cent is not a "whopping" amount of discount for a retail operation, and secondly, it is now 38 per cent, and the return privilege (which was 5 per cent) has now been cut out on all LP records. Even though more records are now being sold, the total profit is less since the amount taken in on each record is so much less. I might add that the losses due to stocking slow moving records and from damage done to records by customers make the retail record business a very difficult one in which to make money.

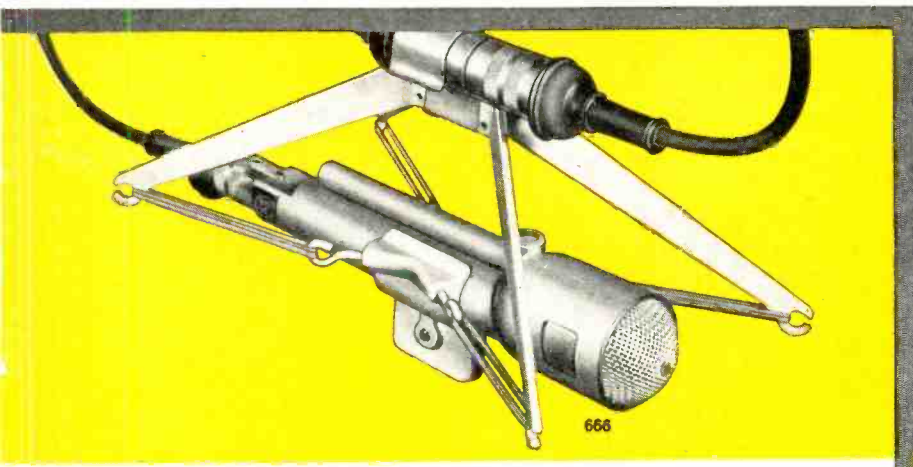
The retail dealer also has to provide listening facilities for not only his own customers, but also for these who buy records through the mail. I am in favor of the new price structure because it has helped cut down on the mail order purchases.

One other thing Mr. Canby failed to mention is that when the new prices were announced we dealers had to begin selling all our old stock of LP records at the new prices at once. We had absolutely no advance notice of the price reductions. When a stock of LP's is up into the many thousands of dollars like ours was, the loss you take isn't "hay." I just want to make it clear that the record dealers and distributors took the rap just as much as the manufacturers did. One other thing—the whole idea was the manufacturers' and not the dealers'.

WILLIAM J. POLLOCK, JR.
The Music Box,
P. O. Box 225,
Oak Ridge, Tenn.

# RESPONSE, RUGGEDNESS and VERSATILITY

## Engineers and Management both want

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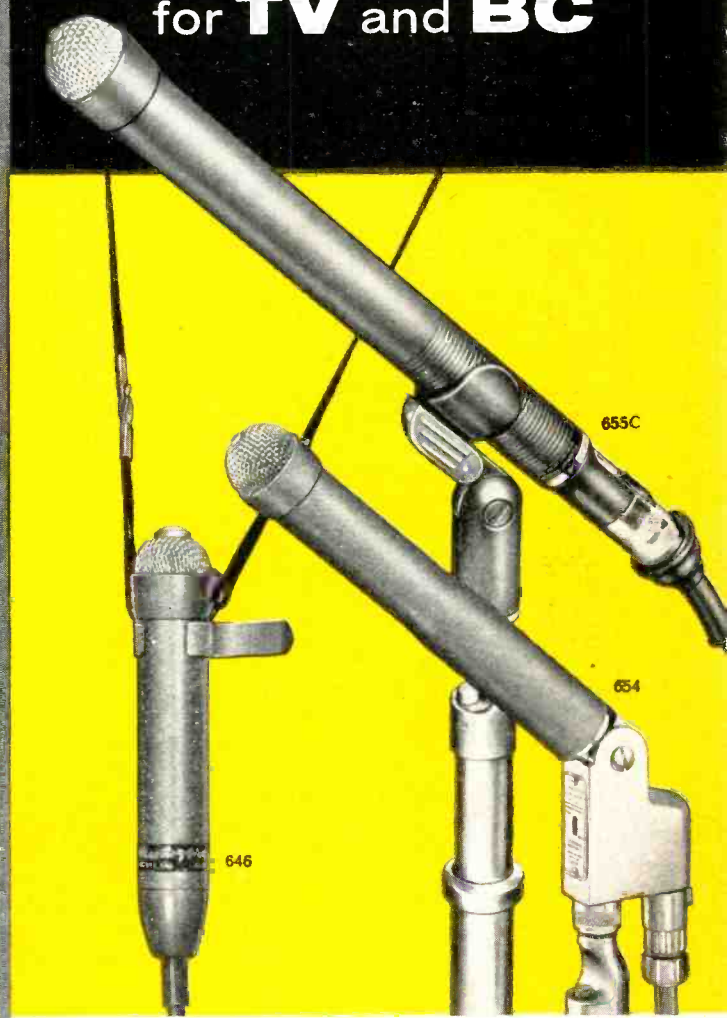


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# EDITOR'S REPORT

## TORONTO AUDIO SHOW

ALTHOUGH SOMEWHAT LATE in the month to be reported so soon, the Audio Show held in Toronto on April 27, 28, 29, and 30 was of sufficient interest to warrant mention. In spite of the rigors of Customs, considerable equipment was exhibited from the U. S., in addition to some manufactured in Canada and much from Great Britain. Canada is not really a foreign country to most U. S. citizens, since the customs are not too dissimilar to our own. But it did seem a bit strange to walk through the exhibit rooms and see so much equipment that was not entirely familiar. But of that, more later.

As to the show itself, it followed the general style of U. S. Audio Fairs—being held in hotel rooms to permit hearing as well as seeing the equipment on display. Tried here for the first time was the idea of charging a small admission fee—50¢—which caused some consternation among the exhibitors the first afternoon—probably because the opening game of the baseball season took place the same day, and undoubtedly drained some of the potential customers away from the Show. However, the first evening semed more normal for an audio show, and the remaining days fulfilled the exhibitors' expectations.

Emory Justus deserves considerable credit for his work in promoting the Canadian Audio Shows—this being his second, since the first was held in Montreal early in February. Starting any such operation is always fraught with much hard work, the need to see hundreds of people, arranging for advertising, publicity, signs, and so on, as well as trying to keep every exhibitor satisfied during the Show. The same problems were encountered in the U. S. six years ago when the first Audio Fair was held here, but now everyone knows the routine, and the entire operation functions quite smoothly. It must be remembered, however, that Canada has a population of about one-tenth of the U. S., and that it still costs just about the same to exhibit for a show there as it does here. Yet while the first Audio Fair in the U. S. drew 3022 visitors, the first Canadian show attracted over 5000, and the one in Toronto was still larger. This is a tribute to greater public interest in high fidelity now than back in 1949.

As to the equipment—many of the U. S. products with which we are all familiar were on hand. These included amplifiers, loudspeakers, turntables, pickups, tape recorders, tuners, and accessories. Names less familiar to the U. S. but well known in England were Baker speakers, Decca records, Vitavox speakers, Pye amplifiers and test equipment, Connoisseur phono equipment, Lowther speakers, Reslosound microphones, Cosmocord pickups, Goodsell amplifiers. Those from Canada included Dominion Electrohome phonographs, Micro Devices transcription-type turntables and pickup arms, and Northern Electric amplifiers and tuners. Most of the British names known in the U. S. were also in evidence—Tannoy, Wharfedale, Leak, Garrard, Goldring, Hallmark, Goodmans, Collaro, Ferrograph, Partridge, Philips, Acoustical QUAD—the latter being used almost universally by those exhibitors who had no amplifiers of their own to display but who needed them for demonstration.

In our opinion it was an excellent show, well attended, well operated, and well received by exhibitors and exhibitees alike. We enjoyed the visit, enjoyed meeting old friends from our neighbor country, and we'd go again tomorrow if there were another show.

## INFORMATION REPLY CARDS

Since the introduction of the reply cards in the back of each issue of AUDIO, we have enjoyed remarkable return—showing an interest on the part of the readers that was in excess of our expectations. And much as we'd like to be of complete service to everyone, we find it impossible to furnish the desired information when the inquirer fails to append his name and address to the card. Perhaps we should fingerprint every subscriber and keep this information on file—this would necessitate sending in the cards in envelopes to prevent receiving the fingerprints of the many people in the postal department before we get them. So if you didn't get the information you requested, think back and try to remember if you actually did sign the card. We have sent out over four thousand names to advertisers and to those whose new product and literature items were mentioned, and just possibly we didn't have your name to send. Maybe we should get a crystal ball.

## AN INNOVATION?

Magazines often publish constructional information, with additional help in the form of blue prints, drawings, templates, or what not being available to those who want to build the device themselves. Along the same lines, we have introduced a new approach with this issue—we will provide the unobtainable parts to permit construction of one of the amplifiers described. While most material used in the average article is readily available from radio jobbers; the printed circuit and the special chassis units would naturally not be, and the special 1-hy. choke would probably be impossible at the present time. A supply of these items has been made available, however, and will be furnished (approximately at cost) to those who wish. So far, we cannot supply just the printed circuit, nor can we furnish the choke alone, nor choke and printed circuit panel. If the demand is great enough, we can arrange to do this, but at present the "kit" is complete with the four chassis parts, the choke, and the printed circuit panel. We look forward with interest to readers' opinions.

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## *The Most Nearly Perfect Phono Pickups Ever Produced*

*. . . they are sold separately for all standard arms or mounted back-to-back to make up the famous PICKERING 260 TURNOVER PICKUP.*

MODEL 220—for 78 rpm records diamond or sapphire stylus

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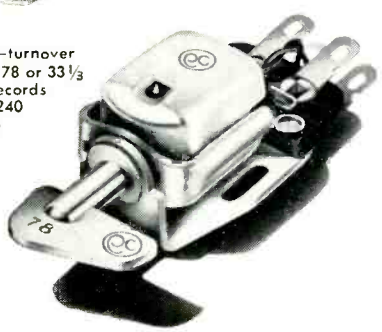

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*The* **220** *and* **240** *have*

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*These characteristics have real meaning to those who understand that maximum performance depends upon components which meet professional standards. If you want the best that high fidelity can offer, ask your dealer to demonstrate the 220, 240 and 260 Pickering cartridges . . .*

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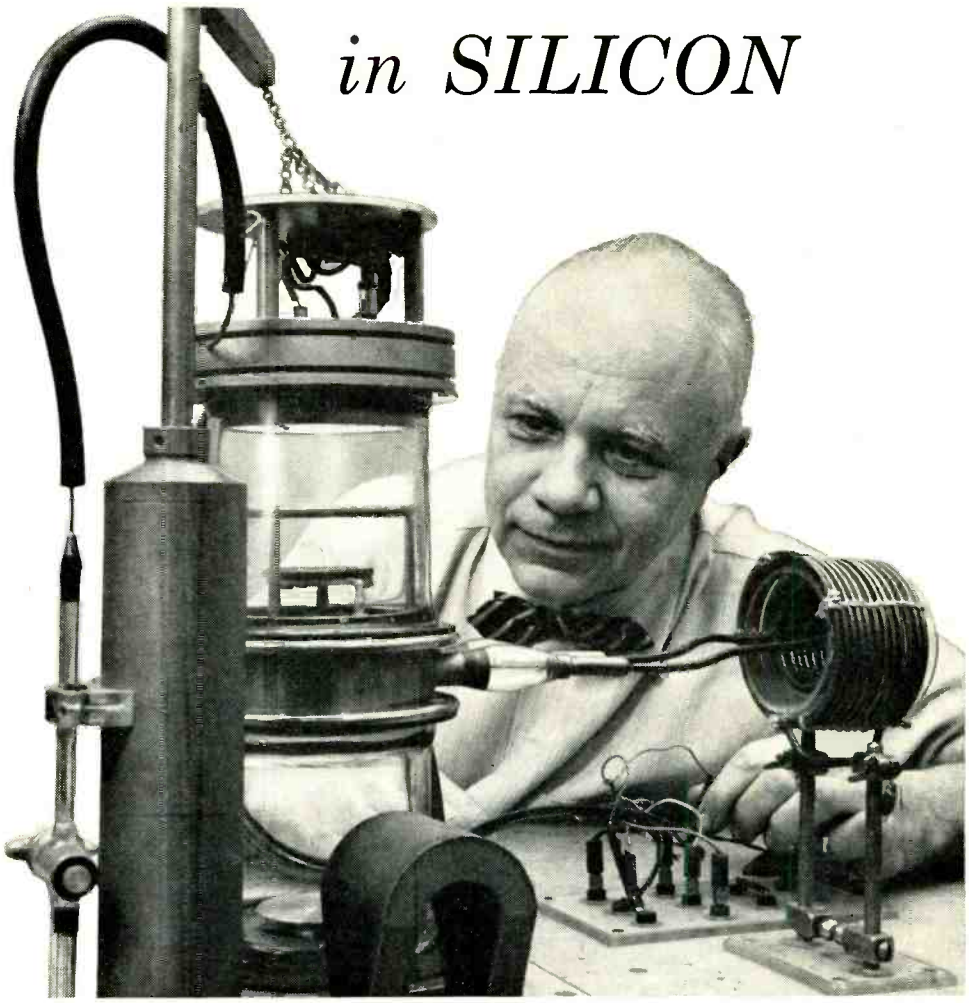
# AN ADVENTURE *in SILICON*



*One example of junction technology at Bell Laboratories. Here a junction is produced on the surface of silicon by bombardment with alpha particles. Bombardment enhances silicon's performance at very high frequencies.*

One day in the 'thirties a revolutionary adventure began for Bell scientists. They were testing an experimental silicon crystal they had grown to make microwave detectors.

Intriguingly, they found that one end of the crystal conducted by means of positive charges, the other end with negative. Positive and negative regions met in a mysterious barrier, or junction, that rectified, and was sensitive to light. It was something entirely new . . . with challenging possibilities.

The scientists went on to develop a theory of junction phenomena. They showed that two junctions placed back-to-back make an amplifier. They devised ways to make reproducible junctions. Thus, junction technology came into being, and the 20th Century had a new horizon in electronics.

This technology has already produced at Bell Telephone Laboratories the versatile junction transistor (useful in amplifiers and switches); the silicon alloy diode (surpassingly efficient in electronic switching for computers); and the Bell Solar Battery which turns sunshine directly into useful amounts of electric current.

This is one of many adventures in science which make up the day-to-day work at Bell Laboratories... aimed at keeping America's telephone service the world's best.

## *Bell Telephone Laboratories*

*Improving telephone service for America provides careers for creative men in scientific and technical fields*

# A Quality Amplifier For The Home

ALBERT PREISMAN*

**Mothers and wives can operate this unit, which has a built-in preamplifier and an absolute minimum of confusing knobs and dials. Even the selector switch is cleverly eliminated; manufacturers take note!**

THE HI-FI ENTHUSIAST has been the butt of innumerable jokes for many years. The most fanatic have been accused of listening, not to music, but only to white noise, and the somewhat more reasonable members of this irascible fraternity make a fetish of "systems" with a bewildering multiplicity of knobs and switches, so as to be able to control every conceivable characteristic of the reproduced sound (except, apparently, its loudness).

The writer was accused by his good frau of never having a radio or phonograph that was simple in operation, presentable in appearance, and satisfying in performance, and the thing that rankled most in his mind was, of course, the truth of the accusation. So he sat down to figure out a circuit that could accommodate a phonograph pickup, an FM tuner, and a magnetic tape recorder, to be housed in a presentable cabinet, and arranged to be operated with a minimum of switches and controls.

The pickup chosen was an ordinary GE variable-reluctance dual type having a 1-mil diamond stylus and a 3-mil sapphire stylus. The necessary preamplifier was built into the main amplifier rather than on a separate chassis. The power supply, however, was built on a separate chassis to minimize hum pickup.

The FM tuner happened to be a Meissner; of course any other make can be used. The important thing is that the output level is much higher than that of the phonograph pickup, hence the tuner can be connected into the system at a point immediately following the preamplifier.

The tape recorder happened to be a Magnacordette. This has its own preamplifier, which functions both for recording and reproducing, and in the latter case has an output level comparable to that of the FM tuner. Hence it would be only natural to connect the recorder into the system at about the same point as the tuner.

This, then, suggested the layout that is actually employed. Following the preamplifier is an amplifier stage consisting of two sections of a 12AX7 whose plates are connected in parallel to a common plate load resistor. The grid of one section connects to the preamplifier, but the grid of the other section is fed, through a pair of separate series 75,000-ohm resistors, from the FM and tape-recorder outputs. The two series resistors merely serve to isolate the tuner and recorder from one another to a satisfactory degree.

In other words, the stage following the phono preamplifier is an electronic mixer stage, and the grid of one section is in itself arranged to mix two inputs. Hence a total of three inputs can be accommodated, and any one, two, or all three sources can be used to feed the loudspeaker. It requires no particular technical savvy to operate: if you want to play the phonograph, you turn on the amplifier, start the turnable, place the pickup on the record, and there you are. If you want to play the FM tuner, turn on the tuner as well as the main amplifier; if your wish is the tape recorder, turn it on as well as the main amplifier. Should you—perish forbid—wish to play two at once, or all three, merely turn on those you want. This is all admittedly very obvious, hence it is a desirable characteristic for the family instrument.

Now, as to tone controls: Women are not interested in engineering; that's why engineers have to work overtime designing engineering gadgets that do the technical work for them. Witness automatic transmissions, power steering, automatic washing machines, pre-cooked oatmeal, etc. Hence no equalizer was employed in this system; it has a fixed amount of bass boost, and a flat high-frequency response. The only control is a tone control of the "chopper-offer" type; it provides a rather sharp cutoff at 10 kc, 8 kc, or 5 kc, as desired, and is used (only by me, of course) to cut down the excessive surface noise on some old 78-r.p.m records that I have.

Perhaps the rest of the family will be enticed in time to use it, but since they play only LP's and 45's, they appear to have little need for it. It is desirable to have this control act on all three inputs, hence it is arranged to follow the mixer stage, and so requires a separate tube section for this purpose.

The present horsepower race among manufacturers of the horseless carriage had its origin in the power output race that began in the 20's, when the UX 112-A supplanted WD-11 or UV 201-A tubes in push pull. There is a group of diehard moderates who claim one or two watts output is sufficient. However, audio power is relatively cheap, and so this amplifier employs two 1622 tubes in push-pull, with a power output of 16 watts. Such power output may not be necessary for the home, but then one is under no compulsion to turn the gain up to a maximum. And if it should be desired to employ this amplifier for a larger room, the power is there to use.

However, the amplifier described here is readily modified to suit the specific needs of the builder. The tone control can be eliminated if not desired; the bass boost can be made variable, and smaller power tubes can be employed. Other possible variations may occur to the reader as he persues the description that follows.

### The Phono Preamplifier

The complete amplifier diagram is shown in *Fig.* 1. The preamplifier consists of a 12AX7, with its two sections connected in cascade and employing feedback. But first we note the R-C input networks to the first grid; the use of these tends to cut down turntable rumble, although the best way to minimize this is to use a turntable as free of this characteristic as possible, and then to install it in a rock vault 10 feet underground.

Incidentally, the ordinary three-speed changer that I am using had excessive rumble until I slipped some rubber snubbers between the metal chassis and the wooden frame on which it is supported by three conical springs. It seems that the springs are too free and permit the whole assembly to quiver like a dowager's third chin at a gabfest; the rubber snubbers hold it in check like a whalebone corset.

The input resistor of 10.000 ohms seems to give the most satisfactory high-frequency response. An initial value of 20,000 ohms permitted the GE pickup to develop a double-humped peak at 6,000 and 10,000 cps, with a minimum at 8,000; the present value produces a reasonably smooth response.

Low-frequency boost is obtained by feeding back from the plate of the second tube to the cathode of the first via a .04-μf capacitor in series with a 47,000-ohm resistor. By varying the values of these two components, the low-frequency peak may be varied to a certain extent, both in magnitude and frequency. However, an additional boost is obtained by the .011-μf capacitor and 270,000-ohm resistor shunting the 50,000-ohm volume

* *Capitol Radio Engineering Institute, 16th & Park Road, N. W., Washington 10, D. C.*

control, together with the 75,000-ohm resistor above this combination.

This latter network produces a reduction in gain, but the gain is more than sufficient anyway, and the additional bass boost of 4.2 db raises the total to 19 db. Of course more can be had, but the response from a test record using the RCA New Orthophonic curve seems quite satisfactory for the values given.

One advantage of employing two separate circuits for bass boost is that their peaks may be staggered and thus used to shape the curve to a certain degree. The curve as obtained for the values shown is exhibited in *Fig. 2*; the curve marked "Phono Input" shows a peak centered at about 45 cps. This is to be compared with the response marked "FM Input," which is that of the amplifier stages following the preamplifier. The slight dip below 50 cps in the latter curve is mainly due to the output transformer.

The 75,000-ohm resistor in the bass-boost network can be made variable in order to vary the amount of bass boost. The 540-ohm cathode resistor of the first stage may be changed to a potentiometer, with the 47,000 ohm resistor connected to the arm. In this way the amount of bass boost can be varied in this network without varying the position of the peak in the frequency spectrum.

A switch in series with the feedback network can be used to disconnect it when a flat response is desired, such as when it is desired to connect a microphone. The concomitant increase in gain is usually desirable in such a case because of the normally lower output of the microphone. However, I prefer to use the preamplifier in the Magnecordette for this purpose, hence I have omitted the switch.

One further point to note is the .015-μf cathode bypass capacitor employed in the second stage. It does not take effect until about 4,000 cps, at which point it begins to decrease the inverse feedback in this stage and thus raise the high-frequency response. This appears necessary in the case of triodes because of the appreciable input capacitance of a triode stage owing to the Miller effect. The resulting attenuation of the higher frequencies by several such stages is counteracted to an appreciable degree by this small bypass capacitor. By varying its value, the point at which compensation begins to take effect can be varied; a smaller value causes the compensation to set in at a higher frequency.

When the amplifier was completed, it was found that the hum was appreciable, owing in part to the bass-boost. The solution was to feed the heater of the first 12AX7 (whose two sections constitute the preamplifier) with the plate current of the two 1622 tubes operating in push-pull. Since these operate essentially class A, the even-harmonic components that are present in the combined cathode current are relatively small, and produce no noticeable effects in the preamplifier. The reduction in hum is very marked; most of the residual hum now present is very small, and is mainly due to stray magnetic fields acting on the phono pickup, FM tuner, or Magnecordette. The latter is particularly sensitive to stray 60-cps magnetic fields.

The 12AX7 heater is placed in series with a 22-ohm resistor and 25-ohm potentiometer. This increases the voltage drop to a value adequate to serve as self bias for the push-pull output stage. The 25-ohm potentiometer serves further to vary the bias of one 1622 tube relative to the other: in this way two 1622 tubes can be equalized as to d.c. plate current flow in the output stage. The 10,000-ohm resistor is required to draw additional bleeder current because the 12AX7 heater requires more d.c. than do the plates of the 6L6 tubes at an operating potential of 250 volts. The 10,000-ohm resistor also serves as a bleeder for the power supply.

### Mixer and Equalizer Stages

The 50,000-ohm volume control following the preamplifier stages is for the phono pickup only, since it is assumed that the tuner and tape recorder have their own volume controls. In this way each volume control can be preset to its average position, so that there is no sudden blare of sound as the system is switched from one source to another.

The third stage employs the two sections of a 12AX7 tube in the form of an electronic mixer, as mentioned previously. The common plate resistor of 39,000 ohms was found to be the desirable value to use in conjunction with the bridged-T network following it. The latter employs a 2-henry Hycor toroidal inductor, which can be switched by two sections of a 3-gang switch to bridge various combinations of series capacitors.

The bridged-T configuration gives a sharp attenuation dip at the frequency at which the two capacitors and the in-

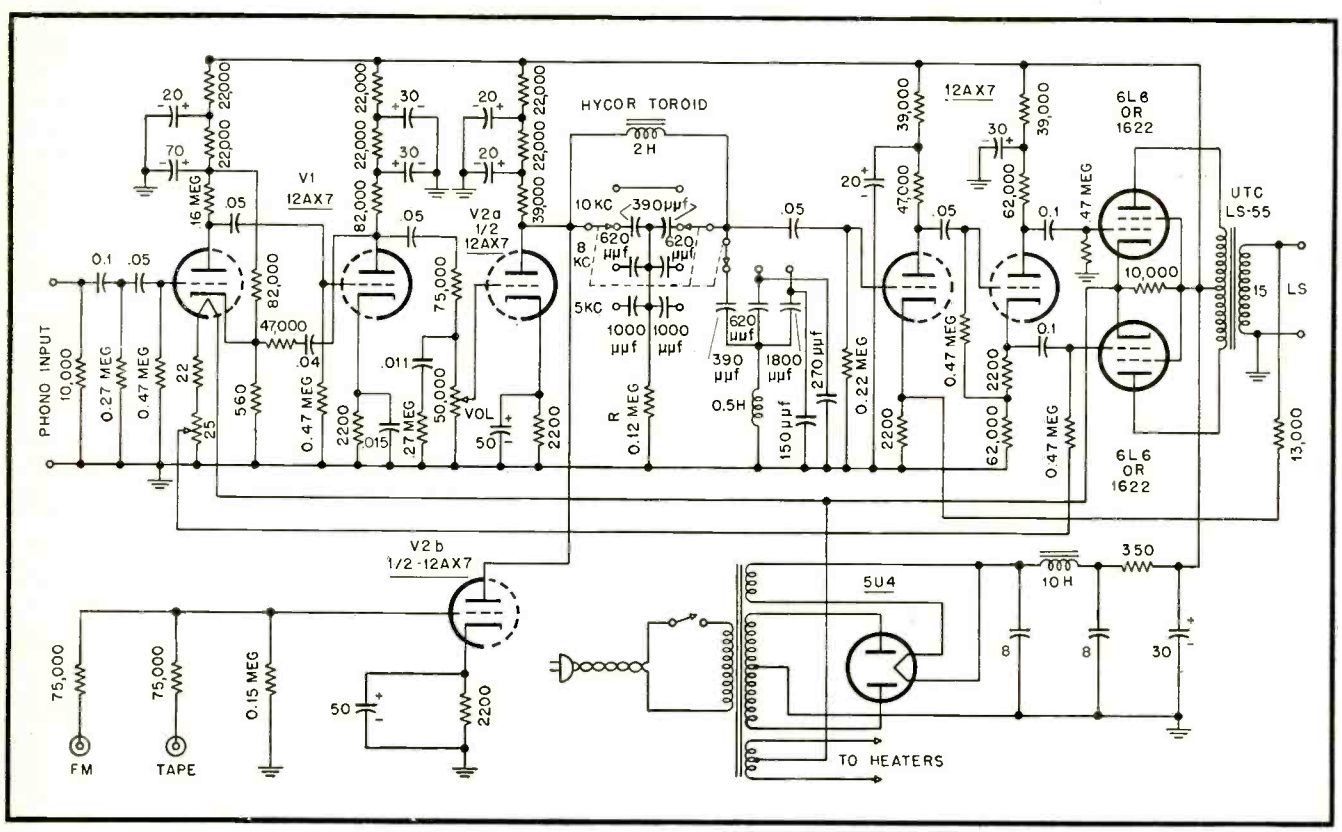



Fig. 1. Complete schematic of the amplifier. The input switch is eliminated by mixing all three sources so that it is only necessary to turn on tuner, phono, or tape machine as desired.

ductance are in series resonance. The value of $R$ must be adjusted to the proper value to produce this sharp selective attenuation effect, but its value is not particularly critical. The magnitude indicated is 120,000 ohms, but this value would differ with different inductors.

Approximate values of the capacitors used are indicated, but exact values are best determined experimentally by running a frequency response curve on the amplifier and adjusting the capacitor values until the proper response is obtained. Actually, odd values may be required to hit the desired frequency, and in this case a practical dodge is to use slightly unequal values of capacitors. A little patience and a number of capacitors will result in the response dropping off fairly sharply at the desired cutoff frequency.

However, the bridged-T network attenuates only in the vicinity of one frequency; above that frequency its transmission approaches the normal value once more. To hold down the response beyond the attenuation frequency, the series-resonant network following the bridged-T is employed. This involves a 0.5-henry choke and suitable series capacitors, mounted on the third section of the 3-gang switch, to operate in conjunction with the bridged-T.

Approximate values are shown for these capacitors also, but here again the capacitors should be chosen experimentally to resonate at a suitable higher frequency than the corresponding frequency of maximum attenuation of the bridged-T, and thus hold down the response to a suitably low value at the higher frequencies.

However, for the 8000- and 5000-cps attenuation frequencies, the simple series resonant circuits permit the response to rise again beyond its resonant frequency, because the amplifier still has adequate gain in this region. Hence, two additional shunting capacitors are employed from the corresponding two switch contacts to ground, and these hold the response down to an acceptably low value.

The response curves of the filters are shown in *Fig.* 3. The peaks shown are due to a tendency for the bridged-T choke to resonate with the following

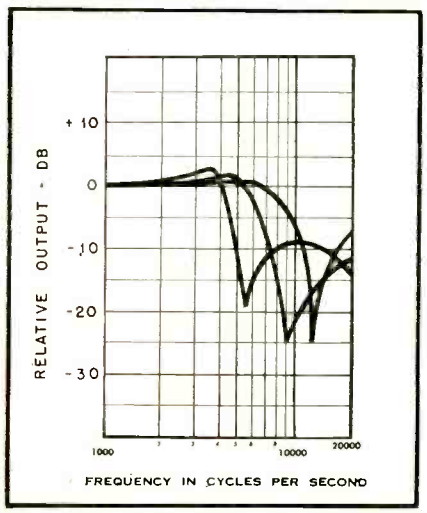



**Fig. 3. This graph shows the characteristic with each of the three filters switched in.**

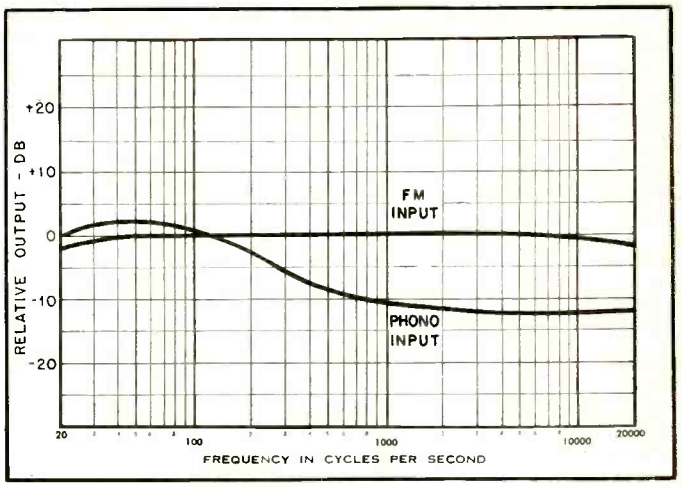



**Fig. 2. Amplifier response from the pickup and tuner inputs to output.**

series-resonant circuit; the rise in gain after the frequency of maximum attenuation is due to the inability of the series-resonant circuit to keep the response down. The results are quite satisfactory despite these peaks, and in spite of the grave admonitions to avoid peaks, the "ringing" of the system is not noticeable to the listener.

The main reason for employing such a rather involved network is to obtain as wide a frequency response as possible consistent with the surface noise of the record or other source. For LP's and even good 78's I use the amplifier wide open; I can take a certain amount of hiss. Incidentally, I seemed to get a sharper attenuation curve using the bridged-T insead of a parallel twin-T, which otherwise would have been more attractive because it requires only resistors and capacitors.

### Power Output Section

The next two stages are sections of a 12AX7 tube, as indicated. The reason two sections are employed is to obtain feedback from the secondary of the output transformer to the cathode of the first section, and then to use the second section as the phase-splitter stage.

The amount of feedback that can be employed is limited; for the UTC LS-55 output transformer the values of 13,000 ohms for the feedback resistor, and 2200 ohms for the cathode resistor seem to permit the greatest allowable amount of feedback. Tests made by measuring the regulation of the output voltage as the load resistance is varied indicate that the internal output impedance, looking into the 15-ohm secondary terminals, is reduced to 4 ohms.

The split cathode resistor employed in the phase-splitter stage affords the correct grid bias for the stage and at the same time the correct drive voltage for the connected 1622 grid.

The output stage in itself is conventional. The 1622 tubes are operated at values recommended by RCA, 250 volts on the plates and screen grids, and – 18 volts self bias. The output, as measured at the secondary of the output transformer, is 16 watts, and was determined by observing the output wave shape on a scope, and noting where it just began to flatten. The exact percentage is not important, as this is more power output than is required in the home.

The maximum gain was found to be about 102 db at 1000 cps. This is not only very high, considering that no input step-up transformer is employed, but it is also in excess of that required by any phonograph pickup; indeed, it reaches down into the thermal and microphonic noise levels of the first stage. This is particularly the case since the gain at low frequencies is an additional 18 db. A 12AU7 can be successfully substituted for the first 12AX7, with about 7 db reduction in gain. Hence, one might just as well use the 12AX7 and run the volume control a little lower.

The power supply is of conventional

(*continued on page 47*)

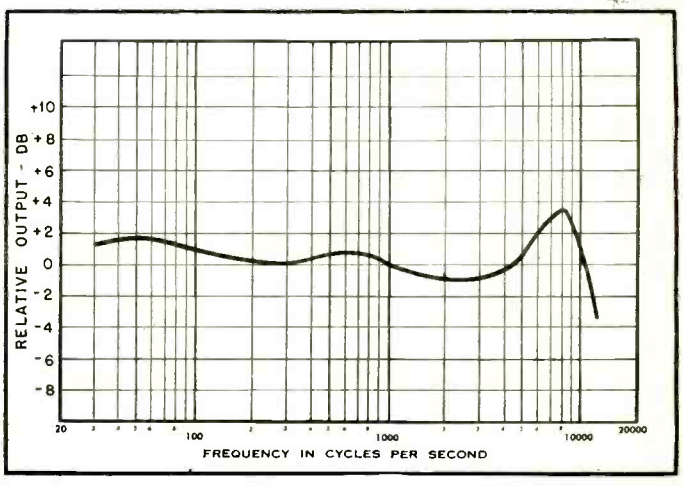



**Fig. 4. Over-all response from the grooves of a test disc to a dummy load resistor following the output transformer is satisfactorily flat.**

# A Tuned-Pipe Enclosure for Bass Enhancement

RAYMOND H. BATES*

**A simple and easily-built enclosure will give excellent sound quality from any good 12-inch loudspeaker, with low-frequency reproduction equivalent to many larger cabinets.**

ACCORDING TO LITERATURE presented in the September 1952 issue of AUDIO ENGINEERING—I refer specifically to the article written by Mr. John E. Karlson entitled "A New Approach in Loudspeaker Enclosures"—a long closed-end pipe, having a long notch at the open end, will give practically continuous radiation over the frequency range required for good audio reproduction. The pipe length must, of course, be considerably larger than the width and depth in order to achieve the proper effects. With these fundamental characteristics of the closed-end pipe in mind, I have developed a fairly simple yet effective corner enclosure for 12-in. speakers, shown in *Fig.* 1.

* *67 College Place, Hampton, Va.*

The configuration was generated by considering first a long triangular shaped pipe 6 ft. long with the speaker mounted at one end and the other end having an exponentially tapered slot, as shown in *Fig.* 2. Since this is obviously a back-loading device, and we are interested primarily in enhancing the low-frequency response, the slot or notch at the open end can be made reasonably short considerably less than the 2/3 indicated for broad coverage. Further, if we now fold the 6-ft. pipe, as shown in *Fig.* 3, we get a package that is of practical size. This configuration permits direct radiation of the middle and high frequencies while the lows are radiated directly and are also augmented by the back radiation through the short exponential slot. That was borne out by impedance measurements, and was verified by extended comparative listening tests. Note in *Fig.* 4 that the free air resonance of 65 cps for the Electro-Voice SP12B is broken up and smoothed out with the curve essentially flat down to 30 cps. The non-resonant character of this enclosure has been demonstrated by extended listening tests using such records as the Cook organ records as well as the Capitol test record. There is no audible boomy or boxy sound.

For those who are interested in constructing this enclosure the diagram shown in *Fig.* 5 will serve as a guide. The usual precautions of using wood screws and glueing all joints for an air-tight seal apply. The slot dimensions are indicated on the drawing.

*Figure* 6 indicates the various pieces needed to assemble the enclosure. In assembly the two sides should be nailed together first after wood glue has been applied to the contacting surfaces. Next the top and bottom pieces should be assembled, again using nails and wood glue, for a neat joint. Now the two

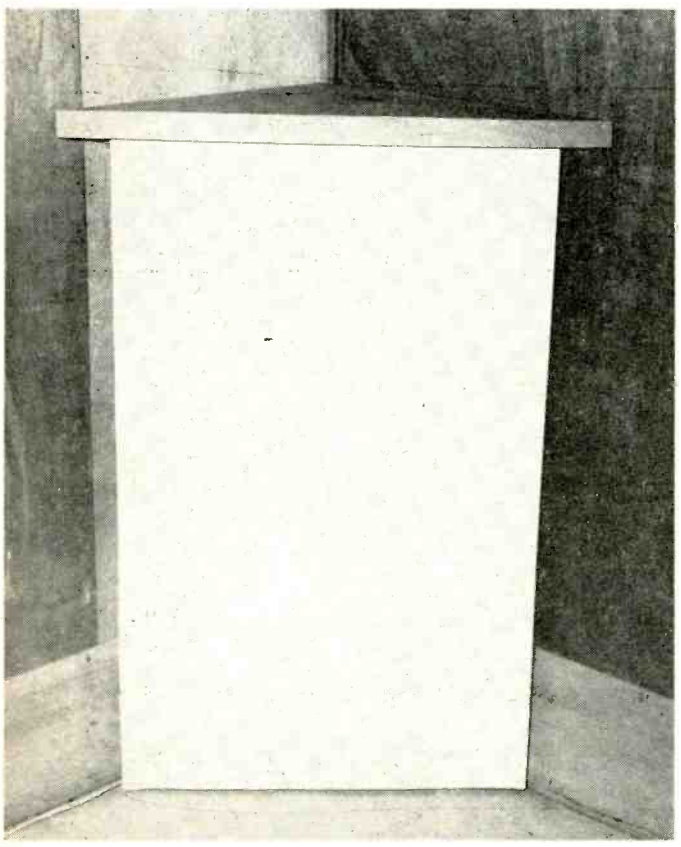


Fig. 1. The author's cabinet in finished form. Light appearance of front is due to the use of natural-colored monk's cloth for the grille.

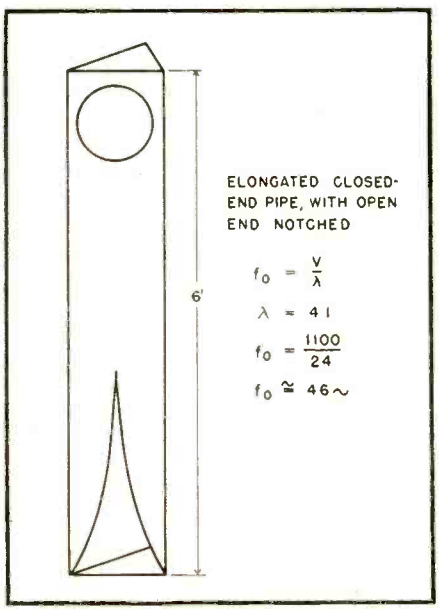



Fig. 2. Design of cabinet was developed from this long closed-end pipe with notched front.

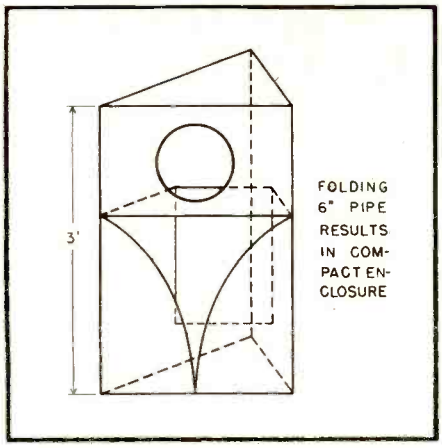



Fig. 3. Appearance of cabinet after folding from the original "pipe" of Fig. 2.

lower left pieces of *Fig.* 6 should be assembled using nails and wood glue, and then this sub-assembly should be glued and screwed to the two sides already assembled. See *Fig.* 5 for proper location of this sub-assembly. The front panel should next be fastened as indicated in *Fig.* 5, using wood screws and glue generously to insure an air tight seal at all contacting surfaces. This whole package should now be allowed to set for whatever time is indicated on the can of wood glue you may have used. I used Casco and let the enclosure set overnight, and should resemble *Fig.* 7.

The basic enclosure is now ready for final finishing. If you like the simple modern appearance that mine has, as shown in *Fig.* 8, you may now screw a foot piece to the bottom, cut the same size as the bottom piece, and then glue a ¼-in. sheet of foam rubber thereon for acoustic insulation from the floor. The enclosure should now be set in whatever corner you have chosen for it (preferably one on the longer axis of the listening room) so that the sides of the enclosure do not touch the moulding along the base of the corner walls of the room so you can measure the top finishing piece. This piece should be sufficiently large to fit snugly against the two corner walls and still jut out over the front grill of the enclosure approximately 1 inch for good appearances. In my case this turned out to give dimensions of 20 × 20 × 28 in. Mount this piece to the top by inserting wood screws through from the

(*continued on page 55*)

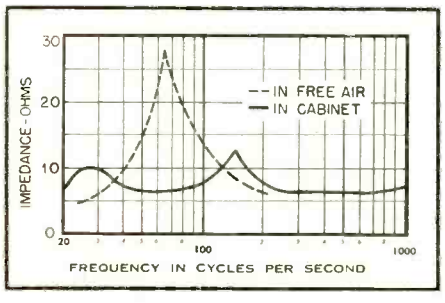



Fig. 4. Measured impedance curve of E-V SP-12B loudspeaker in the author's cabinet. Note reduction of natural resonant peak and extension of low-frequency range.

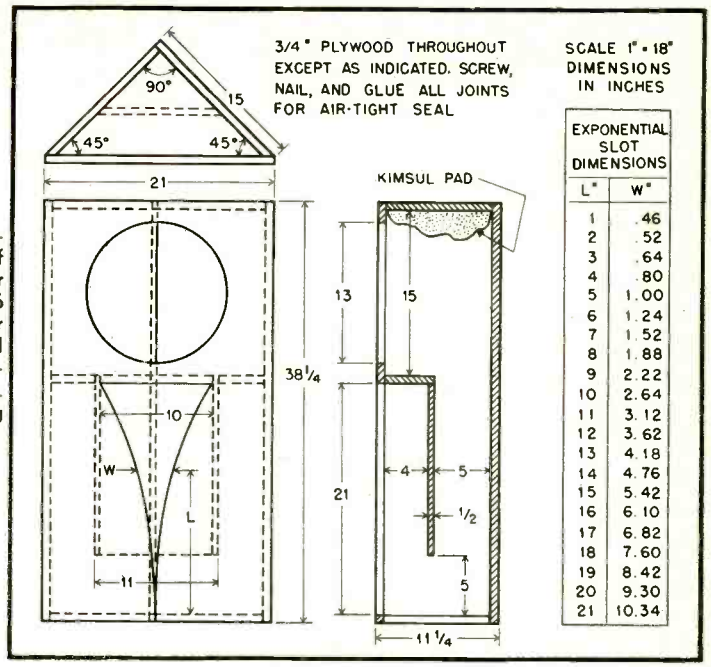
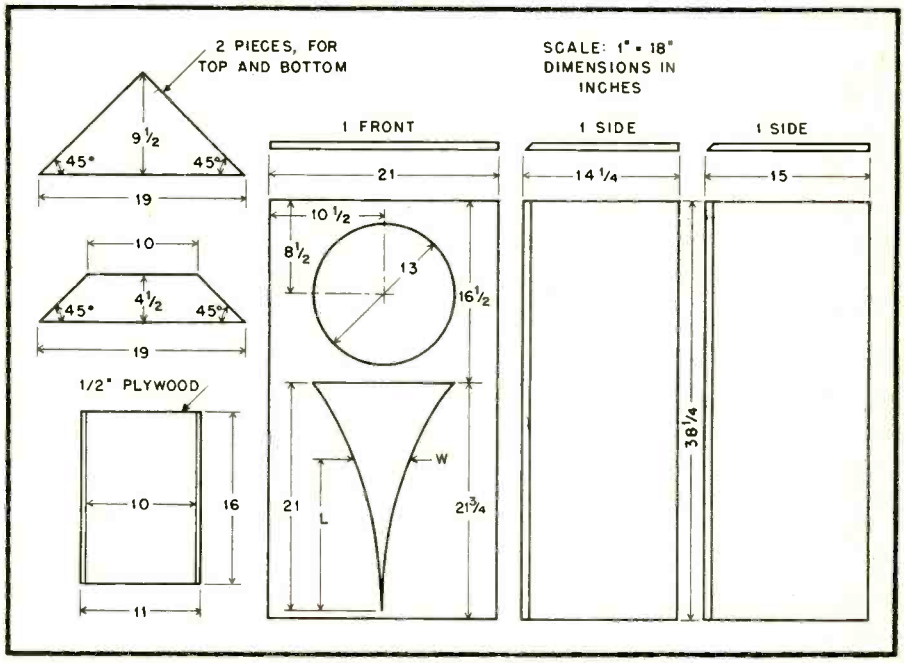



Fig. 5. (right). Sectional drawings of the simplified corner enclosure. Fig. 6 (below). Details for cutting plywood pieces for the cabinet. 15×15 in. speaker mounting panel.



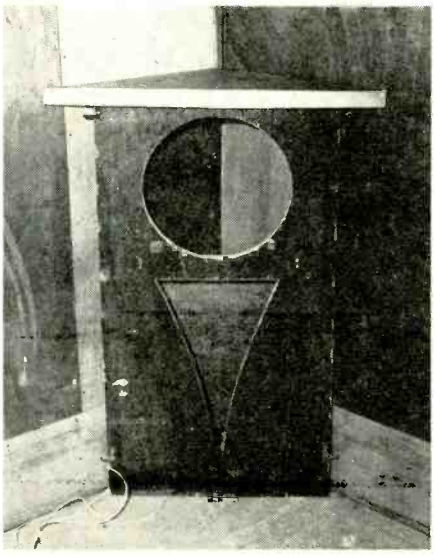



Fig. 7 (left). Cabinet in stage of construction before mounting loudspeaker panel.

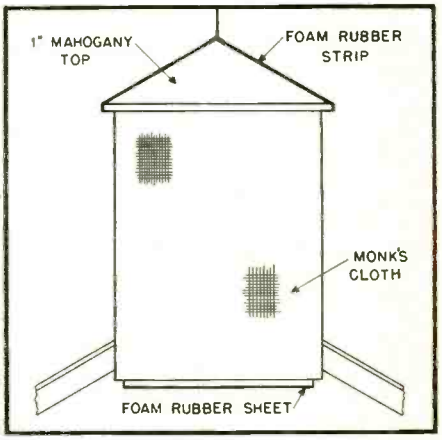



Fig. 8 (above). Sketch of finished appearance.

# Miniaturized "Preamp with Presence"

C. G. McPROUD

**Simplifying the construction of this popular circuit by eliminating the low-pass filter section, reducing the phono positions from five to three, and employing a printed circuit panel for the major part of the wiring.**

THE "PRESENCE" CONTROL, first introduced to the home music system in these pages over a year ago, has proved to be quite popular with those who appreciate an adequacy of control facilities—perhaps just that little shade of boost in the midfrequencies to move the principal instruments or singers a little further toward the spotlight.

Popular as the circuit was—and still is, for that matter—there is no denying that it was fairly complicated, that the two toroids used in the original model are expensive and not readily available on jobbers' shelves, and it is rather larger than usual for most control units of the present day. Coupled to that is an increasing interest in printed circuits, which are admirably adapted to production quantities but just short of impossible for the average experimenter. Anyone can design the circuit panel, but getting it built at a reasonable cost is something else again.

However, two of the problems have been eliminated in this design. In the first place, the printed circuit panels are already built, and are available.[1] Thus the construction is reduced to one of assembly and soldering, with reasonable assurance that the unit will work as described when it is completed.

[1] See last paragraph of article.

### Circuit Requirements

Before designing an amplifier circuit, it is first necessary to consider what facilities are to be required. A phono preamp is a necessity in a "front end," of course, so that is included. In the light of modern LP records, however, it is not felt necessary to provide as much flexibility today as it was two years ago, for most records will play quite well on the RIAA or New AES curve. For the older 78's, a higher turnover frequency is considered desirable, together with less rolloff. In this instance a compromise was made—a 650-cps turnover and a rolloff of 8 db at 10,000 cps—which is apparently a satisfactory choice judging from listening tests. A much lower turnover frequency is required for the early foreign records, so this curve was adjusted for a turnover frequency of 300 cps, and the high end was left flat—any touching up in that region can be done by the tone control.

The presence control was considered a necessity. It does not have a large effect on the reproduction, but it does provide the midrange boost that aids in making the instruments stand out slightly. This control gives a bump on the response curve of only 5 db maximum, with some effect extending about one octave each side of the resonant frequency.

Volume and tone controls are always required, and the writer believes firmly in the loudness control as a necessary adjunct to a modern music system. Since a combined volume and loudness control is available at jobbers, this unit was selected as being simple and effective. The tone control system is the same as that used in the original "Preamp with Presence"—a circuit first described by Baxendall, and adapted to a dual concentric control and a single printed circuit unit with most of the components combined into a package not much larger than a postage stamp.

The output section should be a cathode follower to provide for those installations where the front end would be located at some distance from the power amplifier. In addition, it was desired that the selector switch should silence all inputs except the one in use to avoid crosstalk under all conditions; and an additional output was desired to permit feeding a tape recorder without any effect from volume, loudness, or tone controls.

*Figure* 1 shows the top and panel view of a completed unit arranged to plug into a National Horizon 20 amplifier, drawing all operating power from that source, and feeding signal to the power section through an Amphenol plug on the rear panel. *Figure* 1a shows the suggested construction, a design that permits placing the amplifier in a conventional cabinet, supported only by the control bushings. In this form the entire unit is 2 in. high by 7¾ in. long by 4¼ in. deep. While it is probable that the unit could have been made somewhat

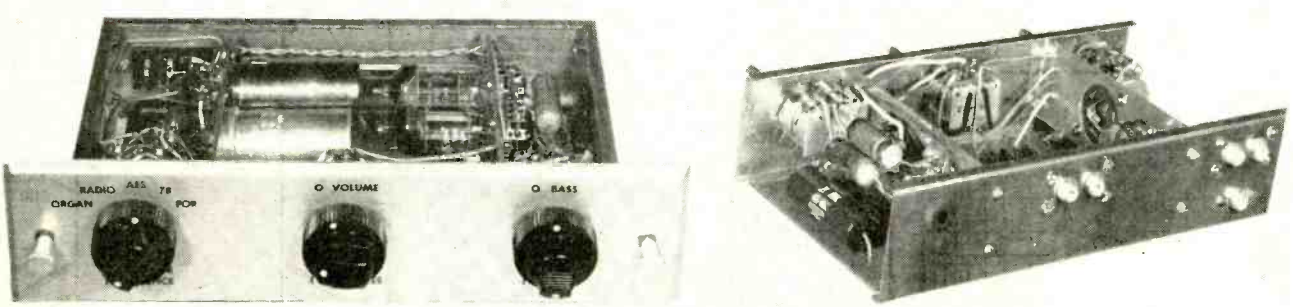



Fig. 1a (left). The completed preamp arranged for use with National Horizon 20 power amplifier. Fig. 1b (right). Finished preamp in recommended arrangement for use with any power amplifier, and suitable for mounting by means of control bushings.

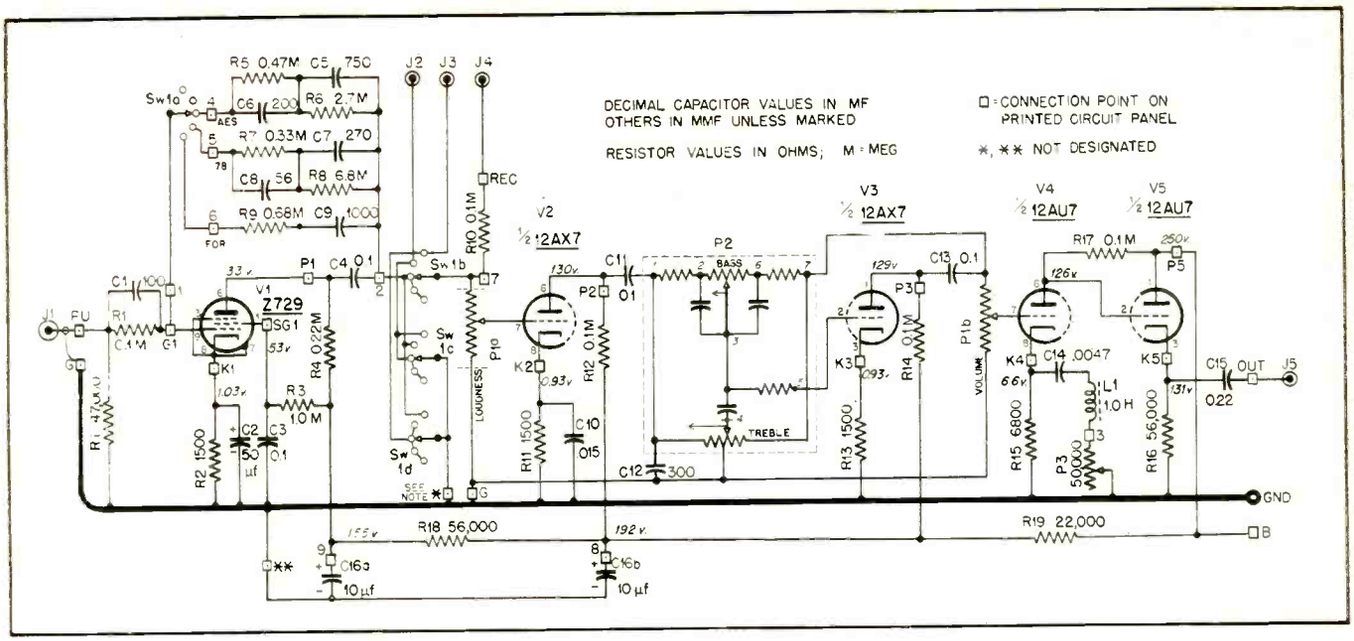



Fig. 3. Schematic of miniaturized preamp with presence.

smaller, it must be remembered that the tubes and a decoupling capacitor must be accommodated, and that the controls take up some space. In fact, it is recommended that the components be placed on the printed circuit panel before the tubes and the capacitor are put in place, and before the controls are mounted.

*Figure* 2 shows the unit of *Fig.* 1a in the construction stage.

### Circuit Description

The circuit arrangement is fairly conventional. The phono pickup is fed into the grid of the first tube which serves only as a preamplifier. Equalization is introduced by means of feedback around the first tube, much in the same manner as used by Leak in the TL/10 amplifier control unit, which is simple, effective, and easy of adjustment. In *Fig.* 3, feedback is shown from the right side of $C_4$ to the grid of $V_1$, with $R_1$ and $C_1$ serving as the stabilizing load into which the feedback voltage is fed. This practically eliminates the impedance of the pickup as part of the feedback network, and by varying the size of $C_1$ the response may be kept flat up to 20,000 cps, if desired. Three feedback networks are shown—$C_5$, $R_5$, $C_6$, and $R_6$ provide the RIAA or New AES curve; $C_7$, $R_7$, $C_8$, and $R_8$ provide the 78 curve; and $C_9$ and $R_9$ provide the FOREIGN curve.

Referring only to the AES curve, $C_6$ and $R_5$ control the turnover frequency, while $R_6$ adjusts the low-frequency rolloff, and $C_6$ adjusts the high-frequency rolloff. While there is some interaction between these components, it is not difficult to arrange practically any type of curve desired. With the components shown, the New AES curve is accommodated within 0.2 db. No rolloff—either high- or low-end—is provided for the FOREIGN curve, which accounts for the use of only one pair of components.

The preamplifier tube is the low-noise, high-gain Z-729 used in the original Preamp with Presence. At normal operating settings of the volume and loudness controls the hum-and-noise level is better than 60 db below the 1-volt nominal output with the heaters operated on a.c. With d.c. operation, the improvement is less than 3 db, which speaks well for the hum-free operation of the Z-729. Certain other types have been tested in the circuit, and while the 5879 has a low hum-and-noise level, its gain is lower, so the usable range is some 6 db less. With d.c. on the heaters, selected 6AU6's perform satisfactorily, but the trouble of selection eliminates them from consideration for reliable use in the home.

The phono preamp is followed by the selector switch—a four-gang, five-position rotary switch. Two of the sections are used for shorting out the unused inputs, the third section for changing the equalization network around the first tube, and the fourth section as the actual input selector. The arm of this section connects to the top end of the loudness control section of the dual volume-loudness control unit, $P_{1a}$. Tape recorder feed is connected at this point through the 0.1-meg resistor $R_{10}$ to provide isolation. The arm of the loudness control feeds the grid of the tone-control input stage, one half of a 12AX7. The cathode resistor is bypassed by $C_{10}$ sufficiently to give flat response over the last four stages. The plate is coupled to the tone-control network, and this in turn is coupled to the tone-control output stage, the second half of the 12AX7, which feeds the volume control, $P_{1b}$, and its arm is connected to the grid of the output driver, one half of a 12AU7. The presence-control action derives from the partial bypass of this tube through the L-C network composed of $C_{14}$ and $L_1$ and the 50,000-ohm potentiometer $P_3$. When the resistance is maximum, the cathode resistor is effectively unbypassed. As the control is turned, the resistor is bypassed more and more, but only at the resonant frequency of the tuned circuit, which is approximately

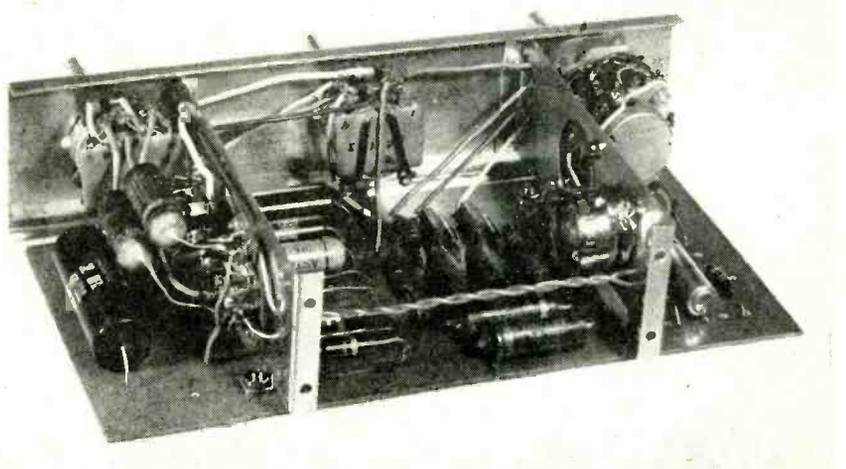


Fig. 2. Unit of Fig. 1a in construction.

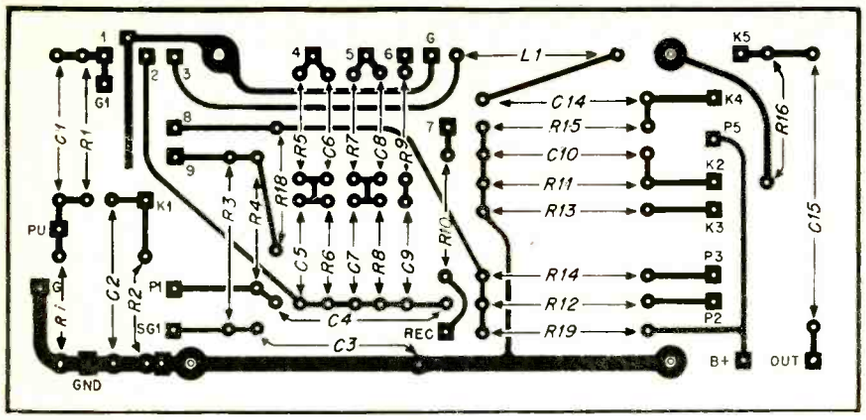



Fig. 4. Location of parts on printed wiring panel. Unmarked square between 1 and 2 connects to grounded arms of $SW_1$.

3000 cps. The cathode follower is directly coupled to $V_4$ and feeds the output line. $R_{18}$ and $R_{19}$, together with $C_{16a}$ and $C_{16b}$ serve as decoupling networks.

It will be noted that all of the controls are the same as those used in the original Preamp with Presence, and supplied by Centralab. The selector switch is combined with the presence control, and was used originally as the low-pass filter switch. Both volume-loudness and bass-treble controls are the same as those used in the original model.

The presence control is located relatively far back in the amplifier, and is consequently at a higher-level point than previously, which reduces the susceptibility to hum pickup and thus eliminates the need for a costly toroid coil. The coil specified for this circuit is part number CS-1051, manufactured by Aladdin Radio Industries, Inc., Nashville, Tenn. The coil is wound on a powdered iron core, and the entire unit is encased in a powdered iron shell, with resulting low hum pickup and a Q of the order of 15 at 1000 cps. However, since this unit will not be available from normal outlets, it is to be furnished along with the printed circuit and the sheet metal components. Any desired arrangement may be employed, of course, and the circuit may be built up in a conventional form. However, it is much easier to build on the printed circuit panel and is likely to be more compact. Furthermore, the arrangement of parts has been tested, and the unit is almost certain to work immediately on completion.

### Construction

The construction of electronic apparatus using printed circuits is very simple. In most instances the tube sockets become a part of the circuit panel itself, but for this unit it was desired that the tubes lay parallel to the panel so as to reduce the height. The process of building is simply that of inserting the component leads through holes in the panel, clipping them off 1/16 in. from the surface, and soldering them in place. This method is a complete reversal from the usual construction where it is always recommended that a strong mechanical joint be made before solder is applied. The components are inserted from the side opposite the one on which the wiring is, although leads can be connected from the wiring side with equal facility. In this unit, all components are located on the clear side, and are thus protected. Soldering presents only a slight problem —the principal caution being that a low-wattage iron be used. A person thoroughly experienced in soldering should have no trouble even with a 100-watt iron, but if too much heat is applied the copper is likely to lift from the phenolic panel or even to burn entirely off. With a 25-watt iron and a good multicore solder, the operation is comparatively slow, but it proceeds without any possibility of lifting the pattern. The copper coating on the panel furnished is tinned, and the usual procedure is to apply the tip of the iron to the lead and the wiring pattern simultaneously. The solder is then applied and the iron rotated around the lead slightly until the solder flows all around the lead, making a neat connection.

On the panel furnished, components are located as shown, the leads soldered into the small circles shown in *Fig.* 4. Connections from wires—such as those from power, input, and output connections—are indicated by small squares, and these are numbered. The schematic shows these squares. Connections to tubes, the decoupling capacitor, and other components are all indicated by the small squares.

*Figure* 5 shows the appearance of the underside of the panel after all the parts are soldered in place, while *Fig.* 6 shows the top of the panel with the components in place. The tube brackets are shown in *Fig.* 7, although they are supplied along with the circuit panel and $L_1$, and the front and back panels. The circuit panel is not drilled, but requires that the user drill these holes himself. A No. 55 drill is used for all component holes, while a No. 27 drill is used for the bracket mounting holes. The order of construction recommended is to mount

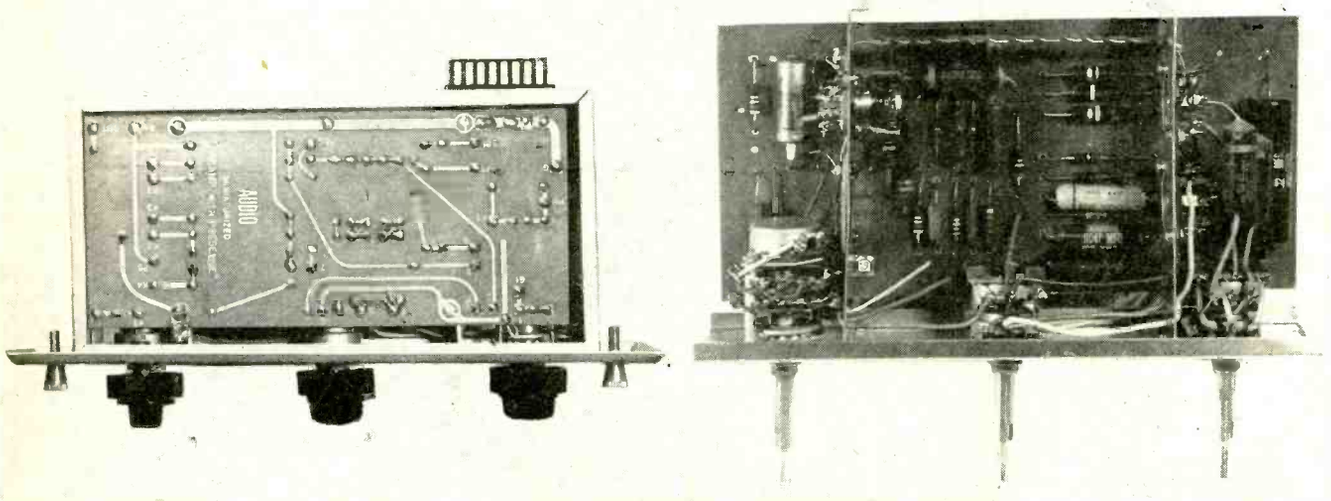



Fig. 5 (left). Underside view of completed amplifier to show soldered component leads. Fig. 6 (right). Top view of amplifier before attaching front and rear panels.

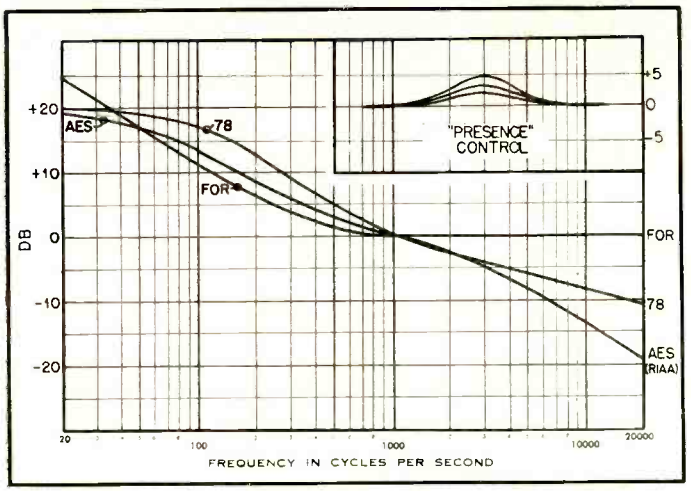



Fig. 7. Phono equalization and presence control curves.

the tube sockets and the capacitor wafer on the two tube brackets, and then assemble them to the wiring panel. Then insert all the components and solder in place, followed by the wire connections to the sockets. Leads should be connected to the controls and the latter mounted onto the front plate before attaching the plate to the brackets. The wires are then simply inserted in the proper holes and soldered in place. Small holes along the ends of the tube brackets are for leads running from one "compartment" to the other.

The back plate is next assembled with the two dual phono jacks and the single phono jack and the leads are connected in place before attaching to the tube brackets; the connections are then made and soldered. Because of the small space, the Z729 must be inserted in its socket and the shield applied before inserting the 12AX7 opposite it.

The voltages at the various points in the circuit are shown in italics in *Fig.* 3 for a supply voltage of 250. The circuit works satisfactorily with any supply voltage from 225 to 275, and if a higher voltage were to be used a series resistor should be connected between the source and the amplifier unit to reduce the voltage to a nominal value of 250. Total current drain is approximately 6.5 ma at a 250-volt supply. Filament requirements are 0.8 amps at 6.3 volts.

### Performance

A 1-volt output is obtained with both volume and loudness controls at maximum—bass and treble controls flat—at an input of 0.09 volts from the high-level inputs, and from an input of 1.6 mv on phono at the AES position. The other two phono positions give a 1-volt output from an input of only 1 mv. This is somewhat more sensitivity than usual, but with two volume controls in series —one the volume control and the other the loudness control—some additional gain is required to provide sufficient range of control. IM distortion at the 1-volt output is approximately 0.4 per cent, rising to 1.5 per cent at an output of 5 volts, which is more than is likely to be used with madern power amplifiers.

Response curves are shown in *Figs.* 7 and 8, the former being a composite of the phono curves and the presence control. The maximum range of the loudness control on the Centralab unit is 35 db, which prevents the user from turning the level down to an absolute minimum with this section. In listening tests it is found that with the volume control set at its midposition, the output level through a usual amplifier is about normal for average use, and the loudness control operates to give suitable control over the listening range.

*Figure* 8 shows the range of the tone controls, together with the effect obtained with the Baxendall circuit when using the Centralab components indicated. The loudness compensation is shown in dotted lines.

### PARTS LIST

| | |
|---|---|
| $C_1$ | 100 μμf, silver mica, El Menco type CM-15 |
| $C_2$ | 50 μf, 6 v, electrolytic, Sprague TVA-1100 |
| $C_3$, $C_4$, $C_{11}$, $C_{13}$ | 0.1 μf, 600 v, metallized paper |
| $C_5$ | 750 μμf, silver mica, El Menco CM-19 |
| $C_6$ | 200 μμf, silver mica, CM-15 |
| $C_7$ | 270 μμf, silver mica, CM-19 |
| $C_8$ | 56 μμf, silver mica, CM-15 |
| $C_9$ | 1000 μμf, silver mica, CM-19 |
| $C_{10}$ | .015 μf, 400 v, molded paper |
| $C_{12}$ | 300 μμf, silver mica, CM-15 |
| $C_{14}$ | .0047 μf, 400 v, molded paper |
| $C_{15}$ | 0.22 μf, 400 v, molded paper |
| $C_{16}$ | 10-10/450, electrolytic, Sprague TVL2750 |
| $J_1$ | Single phono jack, Cinch 81A |
| $J_2$, $J_3$, $J_4$, $J_5$ | Double phono jacks, Cinch 81B (2 req.) |
| $L_1$ | 1.0 Hy, Aladdin CS-1051 |
| $P_{1a, b}$ | Volume-loudness control, Centralab C2-100 |
| $P_{2a, b}$ | Tone Control unit, Centralab C3-300 |
| $P_3$ | 50,000-ohm potentiometer, linear (combined with $Sw_1$) Centralab SPB-3001 |
| $R_1$ | 47,000 ohms, ½ watt |
| $R_1$, $R_{10}$ | 0.1 meg, ½ watt |
| $R_2$, $R_{11}$, $R_{13}$ | 1500 ohms, ½ watt |
| $R_4$ | 1.0 meg, 1 watt |
| $R_5$ | 0.22 meg, 1 watt |
| $R_8$ | 0.47 meg, ½ watt |
| $R_6$ | 2.7 meg, ½ watt |
| $R_7$ | 0.33 meg, ½ watt |
| $R_8$ | 6.8 meg, ½ watt |
| $R_9$ | 0.68 meg, ½ watt |
| $R_{12}$, $R_{14}$, $R_{17}$ | 0.1 meg, 1 watt |
| $R_{15}$ | 6800 ohms, ½ watt |
| $R_{16}$, $R_{18}$ | 56,000 ohms, 1 watt |
| $R_{19}$ | 22,000 ohms, 1 watt |
| $Sw_{1a, b, c, d}$ | See $P_3$ |
| $V_1$ | Z729 high-gain, low-noise pentode |
| $V_{2-3}$ | 12AX7 |
| $V_{4-5}$ | 12AU7 |
| | 1—9-pin socket, molded, with shield |
| | 2—9-pin wafer sockets |

### "Kit" Availability

This circuit can be constructed in conventional form, if desired, but it is somewhat simpler and more compact when assembled on the printed circuit panel with the chassis parts shown. The four chassis parts are of 18-ga. cadmium plated steel and are drilled and punched to fit the tube sockets and capacitor mounting plate, as well as for all wiring and mounting holes. The printed circuit panel is 1/16-in. phenolic. Also furnished is the 1.0-Hy. choke, which fits in place on the printed circuit panel, as indicated. These five items, together with specific instructions, are now available and the author will be pleased to advise interested readers the sources.

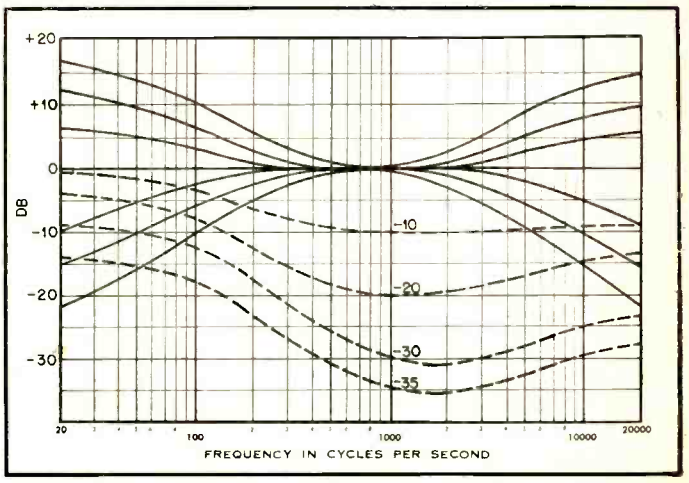



Fig. 8. Tone control and loudness contour curves.

# Selecting Your Loudspeaker

CHARLES T. MORROW*

**Suggestions to aid in the selection of a loudspeaker through listening tests, based on estimating the relative annoyance factor of the loudspeaker.**

THE PAST FEW DECADES have seen an increasing emphasis on extended frequency range in the reproduction of music, culminating in the present popular hi-fi craze. The frequency range has been extended below 100 cps and above 5000 cps. In equipments sold to the general public, there has been a secondary emphasis on better balance of highs and lows, and smoother frequency response.

While the frequencies above 5000 cps lend brilliance and realism when properly reproduced, they are more capable of causing extreme annoyance than any others if their subtle relationships to the sounds produced in the rest of the spectrum are distorted. They may be likened in some ways to discords scored by a great composer, which depend on their relationship to the harmonious chords for their effect. For this reason, many hi-fi systems purchased with enthusiasm may eventually become less than satisfying after their novelty has worn off.

The limiting factor in any music system—home or professional—is the loudspeaker. (The phonograph pickup, recording head and microphone are ordinarily the next limiting factors of importance but the user has no control over the last two). It is, in fact, quite easy to construct an amplifier to a performance far better than that of the best loudspeakers made. It is worthwhile having an amplifier that is somewhat better than any speaker contemplated for use with it, and some flexibility of control to compensate for inadequacies in the loudspeaker or elsewhere in the system, but the enthusiast who spends two hundred and fifty dollars for an amplifier and forty dollars for a loudspeaker is ordinarily investing his money in the wrong proportion. How common it is to use an amplifier flat within ± 1 db from 10 cps to 100,000 cps with a loudspeaker which does not hold to a ± 5 db tolerance over much of the audible range.

Loudspeakers are capable of many subtle distortions. In the range above 5000 cps, the more obvious annoyances are directionality and jagged frequency response. In general, it is not so important for the loudspeaker itself to have a flat response as to have a response which is easy to equalize. In short, the response should be smooth—it should not rise or fall many db at a rate much greater than 6 db per octave. In the long run, a speaker which is smooth from 100 cps to 8000 cps and properly equalized in this range will be more satisfying than one with a jagged response from 20 cps to 15,000 cps. Most of the music played is confined, with most of its overtones, between the narrower limits. Hearing an occasional sound outside them will not yield enough long-term satisfaction to compensate for much distortion inside the range.

There is no such thing as "startling realism" in the reproduction of music. The true high-fidelity system must be as inconspicuous to the ear as it may be imposing to the eye. Reproduction is satisfactory if the listener loses all sense of the reproducer as a musical instrument acting on its own. What is said here is not applicable to the use of a loudspeaker as part of an electronic organ or other electronic musical instrument. In such a case, distortions are a legitimate part of the system, provided the designer can utilize them to enhance musical effect and individuality of tone.

Recommending a loudspeaker to a friend is something that the author undertakes only with some concern, for he has not had access to a testing laboratory for several years. Nevertheless, many people must and do buy loudspeakers without access to reliable performance data. It is hoped that what is written here will be of some assistance.

### Selling Points

As in other sales operations, it is customary to make use of selling points in presenting particular loudspeakers to the public. In general these indicate a superior product but do not prove that superior performance has been achieved. Whether it has or not is dependent on how well many subtle details are engineered. There may even be cases where a speaker has been marketed because it has a large number of selling points, when a much better speaker could be produced for the same money through a slightly simpler approach.

The following comments are intended to encourage critical listening and less dependence on selling points in purchasing a loudspeaker:

1. The statement that a loudspeaker is "essentially flat from 30 cps to 15,000 cps" does not guarantee anything about quality of reproduction, for no tolerances are mentioned. Any speaker can be made to emit some sound over this range.
2. The tweeter (high-frequency speaker), especially if it is horn loaded, is ordinarily more efficient than the woofer (low-frequency speaker) of a two-way system. The dividing network is not always provided with a means of balancing the two speakers. If a variable control is provided, the purchaser is frequently told that it "controls the high-frequency cutoff." He is thus encouraged to use the top setting, which is not necessarily optimum. A recommended setting is not always given by the manufacturer. The best compromise would usually be to adjust for equal output from the two loudspeakers in the region of crossover and compensate for deficiencies elsewhere insofar as possible by equalization in the amplifier.
3. Horn loading of a diaphragm, particularly that of the tweeter, is potentially of great benefit. However, coaxial designs ordinarily require that the space for the tweeter horn be cramped. Thus a woofer with a smooth response to only 1000 cps may be combined with a horn-loaded tweeter that does not begin to attain satisfactory performance before 4000 cps.
4. When the total acoustic path length from the ear to the woofer diaphragm is noticeably different from that to the tweeter diaphragm, blurring of transient sounds results, since one frequency range arrives at the ear later than the other frequency range. Optical type interference between the two beams of sound often takes place in the region of the crossover frequency, resulting in one or more sharp valleys in the composite frequency-response curve. It is not always feasible to eliminate the valleys through phasing the speakers, nor through the use of a sharp crossover network. These effects are undoubtedly most prominent when the woofer incorporates a long folded horn, although the horn itself may be excellent, or when a horn loaded tweeter is mounted coaxially with the woofer. These factors are worth considering when buying a loudspeaker.
5. The past years have seen many variations of the base-reflex cabinet which "make use of the Helmholtz resonator principle" to extend the bass response. At their best, these are all undoubtedly an improvement over a closed box of the same size. However, their hoped for effect is easily

* *Ramo Wooldridge Corp., 8820 Bellanca Ave., Los Angeles, 45, Calif.*

swamped by panel resonances if the cabinet construction is flimsy. Such resonances quickly dispel the illusion of reality, for they introduce irregularities in the frequency response curve and they have directional characteristics that are different from those of the sound coming more directly from the speaker.

6. Bass-reflex cabinets which are sold separately from loudspeakers are usually made for use with speakers of particular diameters. The resonant frequency, cone mass, and damping are equally important factors in the bass performance of a speaker in a special cabinet. When possible the speaker should be listened to before a purchase is made in a cabinet acoustically identical to that in which it will be used.

7. High-efficiency speakers are frequently overdamped and deficient in bass when used with a feedback amplifier.

8. Even two-way systems are often directional at the higher frequencies toward 10,000 cps, although there are several effective ways of designing to minimize this. Such directionality is undesirable, for it was not characteristic of the original sound. It makes the effective reverberation of the listening room dependent on frequency, and it makes the effective frequency response depend on the position of the listener with respect to the speaker axis. When combined with a jagged tweeter frequency response, it imparts a piercing, irritating quality to needle scratch and similar background noises.

9. Loudspeakers of the same design may vary slightly in performance from one to another in production, particularly if the tweeter uses a direct-radiating diaphragm.

### Listening Tests

Ultimately most people who contemplate the purchase of a loudspeaker are dependent on comparative listening tests in evaluating it. Even a person who is fortunate enough to have facilities for exhaustive measurements will use such tests as a guide.

Unfortunately, comparative listening in a hi-fi showroom can be much more confusing than may be anticipated. The various loudspeakers differ in the way they sound, but they differ in many subtle ways. The amplifier adjustments are not necessarily such as to show off each speaker at its best. The prospective buyer may not be certain what to listen for, particularly if he is not familiar with musicial instruments as they actually sound in the concert hall. In his enthusiasm for hearing sounds that he has not heard reproduced before, he may rush into the purchase of a loudspeaker which has some noticeable irritating characteristics. In general, it is easier and safer to listen for defects than for apparent naturalness.

The listening approach recommended below is not infallible, but it may be helpful. The prospective buyer should also make use of any reliable information at hand about the loudspeakers on sale.

It is assumed that the prospective buyer lives near a hi-fi showroom with a wide selection of audio components on display which can be interconnected at will for listening tests. He should go there with several LP (or 45 rpm) records of known recording characteristics, with orchestral effects at both ends of the spectrum, such as bass drum, organ, tambourine, castanets, etc., and with the speaking or singing voice—records with which he is thoroughly familiar. If he knows the speaker or singer personally, so much the better. He should also take along a worn and scratchy record. He should play these records on one of the best pickups available at the store (even if he has no intention of buying it) and with the phono equalizer on the amplifier set to compensate as accurately as possible for the recording characteristic, and the loudness control (if present) set for a flat characteristic. He should use a volume setting appropriate for the program material, loud for fortissimo orchestral passages, and soft for folk songs. He may find additional program material from an FM tuner or one of the better magnetic tape reproducers. An oscillator or a frequency test record (preferably continuous) may be useful. He should plan to listen to several loudspeakers—in, below, and above his price range. The higher priced speakers may be useful as standards for comparison.

### Procedure for Listening Tests

1. Tap the panels of the loudspeaker cabinet with the knuckle. Do they resound like a drum, or do they sound adequately rigid or deadened?

2. Listen to the performance of the loudspeaker on orchestral music. Is there variety in the bass or do bass drums, plucked strings, etc. sound alike?

3. Adjust the woofer-tweeter balance (if available) for optimum results.

4. Adjust the bass and treble controls on the amplifier for optimum results. Verify that the response at the two ends of the spectrum is present and not far out of balance.

5. Listen to the performance of the loudspeaker on voice. Is it natural, muffled or harsh: Can it be improved by adjustment without compromising performance on orchestral music?

6. Determine whether using a different amplifier, properly adjusted, permits slightly better performance.

7. Listen to needle scratch or the between-station noise of an FM tuner. Is it highly directional or is it diffused throughout the room? Is it harsh and piercing or can it readily be ignored?

8. Connect an oscillator to the system if available or play a frequency-test record. Explore the range above 5000 cps to obtain a crude idea of the smoothness or jaggedness of response, listening moderately close to the speaker. This single-frequency test will not provide a clear idea of tonal balance over large portions of the spectrum unless the listener has acquired some skill. At low frequencies, smoothness of response will be obscured by room characteristics.

9. Compare with other loudspeakers, also used with optimum adjustments. Try to determine crudely the relative frequency range and annoyance factor of each. Compare the clarity of percussive and pizzicato sounds on the various speakers.

10. Buy your loudspeaker and use it with settings that provide the best results. Your judgement on these may change slightly with time and experience.

11. Forget about defects and enjoy listening.

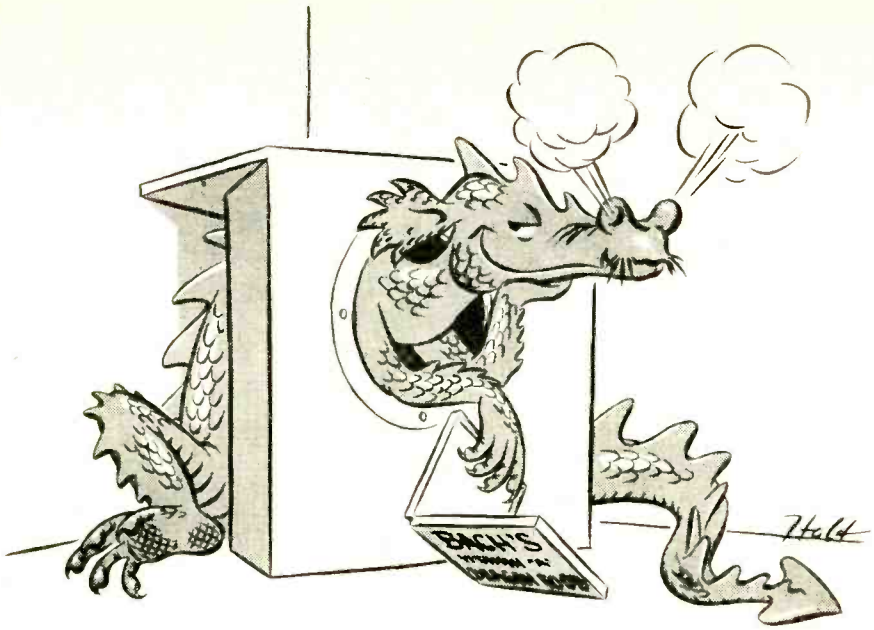
Of course, you will not want to evaluate every loudspeaker on display in this detailed way. A casual survey will determine those of greatest interest.

### Conclusion

The music lover will not be concerned if his loudspeaker does not provide continuing satisfaction for many years unless he has spent several hundred dollars for it. In fact, getting the best loudspeaker the first time might defeat his purposes. It is primarily the music lover of limited means for whom the selection of a loudspeaker is a critical problem.

A moderately priced amplifier with a built in phono-preamplifier and phono-equalizer and a selection of output impedances, response flat ± 1 db over the audible range, enough flexibility of control as is necessary or useful to compensate for deficiencies in the loudspeaker or elsewhere, and 10 to 20 watts of available power will probably be satisfactory. The difference between 10 watts and 20 watts is only 3 decibels, which is hardly noticeable.

While the discussion above has emphasized the possibility of defects in the reproduction of the frequency range above 5000 cps, a reasonable compromise here within the limits of one's budget can provide continuing hours of listening pleasure.




. . . but still he grew larger and more particular.

# Hi-Fi and the Dragon Pup

ELEANOR EDWARDS*

*ILLUSTRATIONS BY J. GORDON HOLT*

**Wherein two lessons are taught—one to the hi-fi-man in the house, and the other to the distaff side of the family. It could happen, you know, just as the author suggests. Some of this may sound familiar.**

ONCE UPON A TIME—back in the days when fidelity, while admirable, was not necessarily "high"—there lived a poor farmer. Well, maybe not so poor at that; he had a nice house, a reasonably good wife, several adequately promising children, and (with the aid of a little diligence) just enough currency of the realm to keep him thinking of more things he would like to buy. Not enough to buy them all, just enough to dream on.

* *Box 453, St. Simons Island, Ga.*

. . . maybe the plow would have been a better buy.

One day a friend took him aside and told him about a bargain that he simply couldn't pass up. The friend had a litter of dragon pups, and for old time's sake would let the farmer have the runt of the litter for next to nothing. The friend, of course, extrolled the advantages of dragons as pets, and made the buy seem irresistible. The upshot of it was that the farmer arrived home from market leading a small dragon.

You can imagine the reception that awaited them. It wasn't so much that the farmer's wife objected to dragons *per se,* but rather that she seemed to have a notion that the plow he had originally set out to buy might have been a better bargain. However, when the smoke of the battle had cleared away, the dragon was duly installed in a small den in the living room and the three of them settled down to a relatively peaceful coexistence.

That farmer was as happy as a child with his new toy. He spent all of his spare time hovering over that dragon. He kept thinking of new ways to enlarge or improve the dragon's den. He bought a special curry comb, a patented nail cutter, and various other gadgets for the care and upkeep of dragons. He could spend hours talking with other dragon-owners about the comparative merits of their pets and about ways to improve the manners and appearance of dragons

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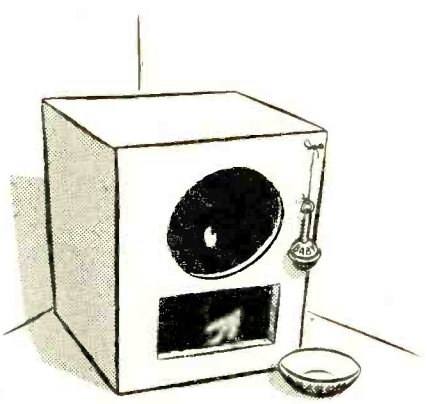


. . . in a small den in the living room.

# Patent Law Changes in the 1952 Statute

ALBERT WOODRUFF GRAY*

**Familiarity with patent law is not a necessity for those who serve large organizations with patent specialists constantly on tap, but the ingenious individual is well advised to keep abreast.**

THE revision of the United States Patent Law enacted in 1952 and effective on July 19th of that year introduces four new and important features.

(1) A provision defining the offense of contributory infringement which although a principle of patent law recognized by the courts for eighty years was not included in the former statute.

(2) A provision for the filing of a patent application by another than the inventor, a radical change from the rigid restrictions of the old statute limiting the making of such an application solely to the inventor.

(3) A tempering of the requirements of the former law governing applications by joint inventors, and lastly.

(4) A clarification of the definition of "first inventor," adopting the interpretation in the famous statement of Justice Holmes that, "The patentee must be the first inventor."

In the decision of an action for contributory infringement brought against a manufacturer of tubes used in the infringing production of radio receivers the Federal court said:

"The tubes were inserted in sockets and thereafter connected with circuits while in this manufacturer's plant and the entire combination was completed and used in testing receivers. Thereafter the tube was removed from its socket; then the receiver and the tube were packed in the receiver cabinet and thus sold. The tubes were placed in a separate carton and this, with the receiver, was placed in a larger carton. The purchaser to connect the tube need only insert it in the socket.

"While the elements of an invention were thus sold in unified and combined form, infringement may not be avoided by separation or division of parts which leaves to the purchaser a simple task of integration.

"No wrong is done the patentee until the combination is formed. His monopoly does not cover the manufacture or sale of separate elements capable of being but never actually associated to form the invention. Only when such association is made is there a direct infringement of the monopoly."

In an earlier decision relating to this same offense of contributory infringement the Federal court quoted from a well known legal text writer:

"Where a person furnishes one part of a patented combination intending that it shall be assembled with the other parts thereof and that the completed combination shall be used or sold, that person is liable to an action as infringer of the patent on the complete combination.

"Where a person furnishes a machine which is useful only for the purpose of making a patented article, intending that it shall be thus used, that person is himself liable for any infringement which is afterwards committed in the manufacture of that article with that machine.

"Furthermore, where a person furnishes a machine, composition of matter or other article which is particularly adapted to be used in performing a patented process and which the person furnishing the same intends shall be so used, that person is liable as a contributory infringer for any infringement which afterwards occurs in accordance with his intention."

This 1952 statute provides in relation to offenses of this character:

"Whoever sells a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial non-infringement use, shall be liable as a contributory infringer."

### Assignees Can Apply

A second innovation introduced by this statute was the change from the former statute which made it obligatory that only the inventor could file the application for a patent. The difficulties arising as a consequence of the sale or assignment of the invention before the issuance of the patent and the subsequent refusal or failure of the inventor to proceed with the application for the patent on behalf of his assignee are resolved by the provisions of this new law.

The patent statute now provides, "Whenever an inventor refuses to execute an application for a patent or cannot be found or reached after diligent effort, a person to whom the inventor has assigned or agreed in writing to assign the invention * * may make application for patent on behalf of and as agent for the inventor on proof of the pertinent facts and a showing that such action is necessary to preserve the rights of the parties or to prevent irreparable damage."

A Federal court said of this former patent statute provision that denied to an assignee of an inventor a right to undertake proceedings for the issuance of a patent:

"The applicant is the person who files the application; the only person authorized to file the application is the inventor. The statute makes no provision for the substitution of the name of the assignee as applicant."

### Joint Inventors

A further difficulty under the old statute frequently occurred in patent applications by joint inventors. The Federal Court of Appeals said in a definition of joint inventors who came within the purview of this law and the narrow pathway charted for safety by the former statute:

"Suggestions from another in order that they may be sufficient to defeat a patent subsequently issued must have embraced the plan of the improvement and must have furnished such information to the person to whom the communication was made that it would enable a mechanic, without the exercise of any ingenuity and special skill on his part, to construct and put the improvement in successful operation.

"As a corollary of this principle it has been held repeatedly that a valid patent can only be granted to the real inventor, that the original and first inventor must make the application and that, in the case of a patent which is a joint invention, a patent issued to only one of the inventors is void.

"But in order that an invention be truly called a joint invention, it must appear by clear and convincing proof that the two inventors collaborated in evolving the patented device. The two must have for a common end that which was finally accomplished by the contributions and united efforts of both."

The Senate Report on this law said of the new provisions relating to joint inventors and of those relating to the rights of assignees in the application for

(*continued on page 44*)

* *35:6 Seventy-Sixth St., Jackson Heights, L. I., New York.*

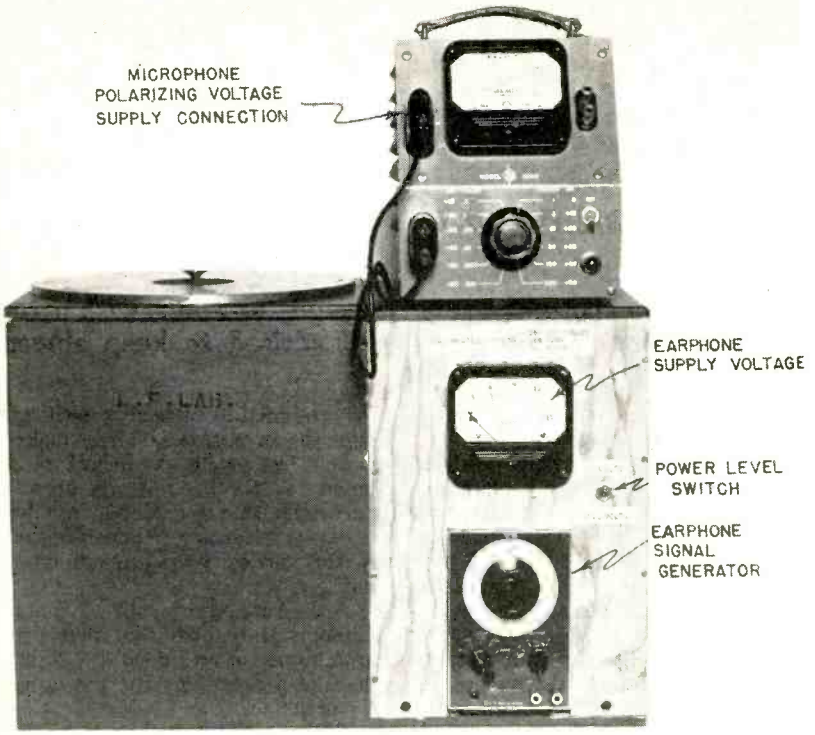



Fig. 1. Over-all view of the equipment in operating set-up. The vacuum-tube voltmeter furnishes polarizing voltage to the standard calibrated microphone and measures the sound pressure output. The signal source is a conventional oscillator, and the applied voltage is measured by a separate meter which is permanently installed in the equipment.

# An Artificial Ear for Measurement of Headset Response

CHANDLER STEWART*

**While subjective observations of performance may be the final test of suitability for a certain application, it is important that measurements be made to determine direction of further research toward improving the product. The author describes a simple instrument which is adequate for production use.**

THE NEED of the Engineer Research and Development Laboratories for acoustical response tests of headsets is not sufficiently continuous to justify the retention of specialists to operate and maintain the instruments, as is required at laboratories doing a larger amount of this type of work. This, besides a special need for low-level testing, has established special requirements which are not met by existing instrumentation.

The performance evaluation of earphones in the laboratory and in production has been accomplished generally by coupling them to a microphone through a cavity designed to simulate the acoustical constants of the human ear. In 1932,

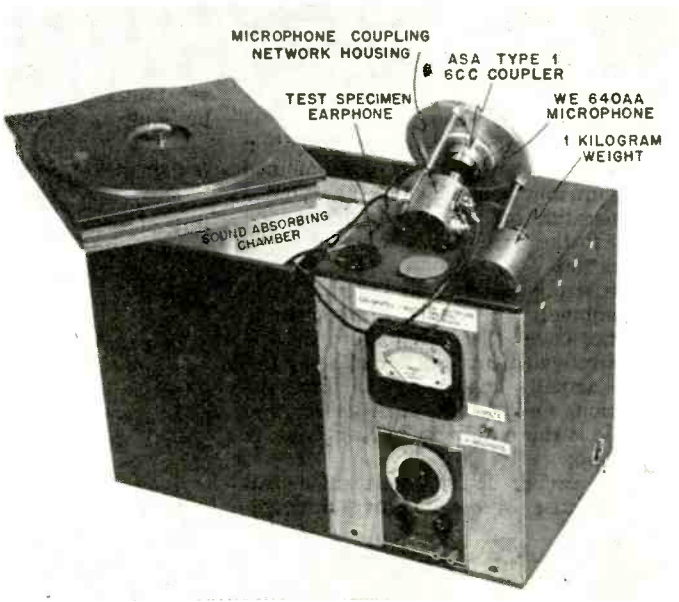



Fig. 2. Earphone mounting jig, coupler, and standard microphone—a complete assembly—removed from the sound absorbing chamber for change of earphone.

* *Chief, Electronics Laboratory, Corps of Engineers, U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia.*

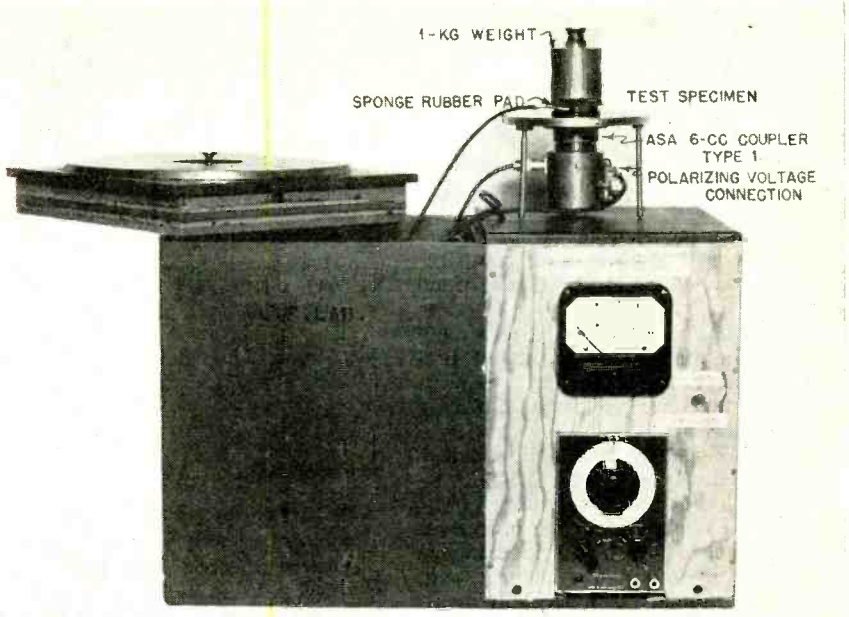



**Fig. 3. Earphone jig, coupler, and standard microphone in position for measurement before placing in sound absorbing chamber.**

Inglis, Gray, and Jenkins[1] designed such a coupler to act as a representative of the average human ear. However, this coupler was not readily reproducible.

During World War II, the relatively simple Joint Radio Board couplers were developed at Harvard University[2] and employed by defense agencies and their contractors for the evaluation and inspection of military earphones.

These couplers were compared with the Massa coupler by Glaser and Morrical[3] in 1948. A Standard defining the technique and equipment generally accepted by industry and government as the most suitable for acoustical response testing of earphones was prepared in 1949 by a group under the chairmanship of Professor Beranek of Massachusetts Institute of Technology. Also included in this group were Dr. R. K. Cook of the National Bureau of Standards, and Frank Massa, designer of the Massa coupler. This standard of acoustical response testing is a result of the Joint Radio Board (JRB) tests and was published by the American Standards Association (ASA) as Standard No. Z24.9-1949.

Although the accuracy of acoustical measurements by the JRB or ASA methods are generally unquestioned, no complete testing assembly is available commercially, and each laboratory engaged in testing earphones has been required to construct the necessary testing apparatus. This has often resulted in a complex arrangement which is unsatisfactory because (1) it requires several hours of setting up, calibration, and adjustment of the assembly prior to an earphone test run, (2) the complexity of the testing procedure incurs the risk of errors, particularly when changes in personnel responsible for the testing take place between tests, and (3) the custom-built nature of the apparatus requires that maintenance and repairs be done by technicians having a thorough knowledge of the special designs involved.

A provision for testing the earphones at lower levels was required because of a serious discrepancy between the frequency of maximum efficiency at the high (1 mw available power) ASA level and at the normal operation level (0.1 microwatt) of the type of earphone of current interest to the Corps of Engineers. The ASA and JRB apparatus, as generally used, are not suitable for low-power levels of testing because of the susceptibility to interference from extraneous sources such as room noises and building vibrations.

For these reasons, the following objectives were established for an earphone tester to meet the needs of the Corps of Engineers:

a. The apparatus should be self-contained, rather than of the type which must be set up and torn down for each series of tests.

b. It must incorporate a minimum of non-standard components to simplify and speed maintenance operations.

c. It should be ready for use upon

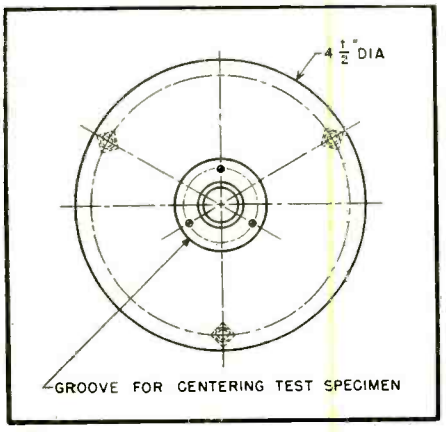



**Fig. 5. Detail of mounting plate showing groove for centering test specimen.**

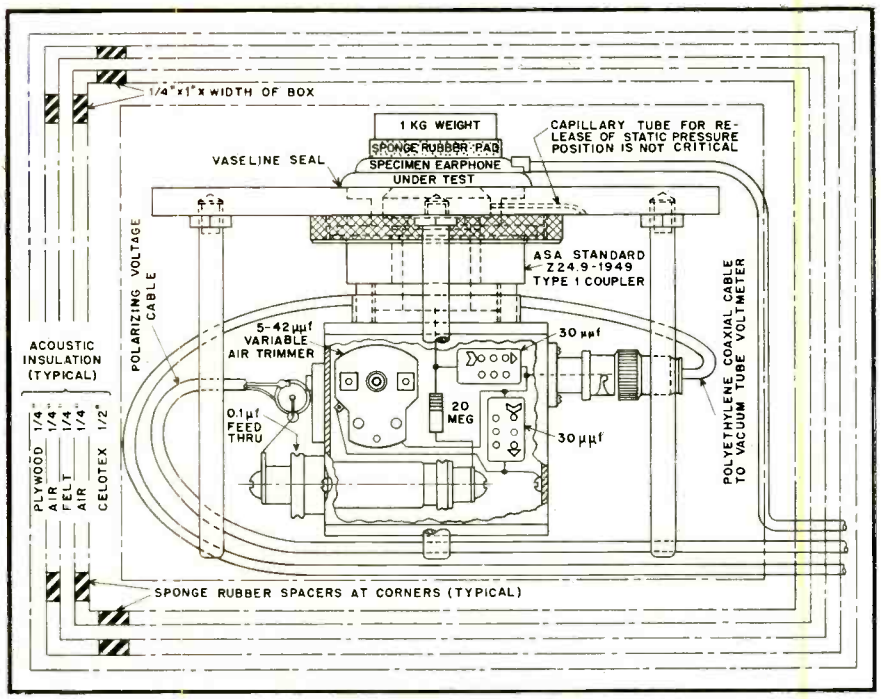



**Fig. 4 (left). Sectional drawing of jig, microphone, and coupler inside sound absorbing chamber. 1-kg weight provides reproducible weight on earphone.**

[1] A. H. Inglis, C. H. Gray, and R. T. Jenkins, "A voice and ear for telephone measurements," *B.S.T.J.*, Vol. II, 1932, p. 293.

[2] OSRD Report No. 3105, *"Response Characteristics of Interphone Equipment,"* Electro-Acoustic Laboratory, Harvard University, Cambridge, Mass., 1944.

[3] John L. Glaser and Keron C. Morrical, "A comparison of artificial ear couplers", *J. Acous. Soc. Am.*, Vol. 20, No. 6, Nov. 1948, pp. 771–775.

demand and not require amplifier calibrations and other adjustments prior to each test run.

d. It should be comparable in accuracy and reliability to ASA and JRB earphone testing equipment and should not require an operator to be familiar with the equipment or to have special skill in its use.

e. It must incorporate means of reliable testing at a power level comparable to that of mine detector background noise.

f. It should not employ batteries because of their effect on the calibration and accuracy of the testing apparatus and their need for continual checking and replacement.

After making the mathematical analysis shown in Appendix C, ERDL designed the artificial ear assembly (*Figs.* 1 through 7) which met the objectives required by the Corps of Engineers. This assembly consists of one integral unit, made up of standard commercially available components, that requires no preliminary setting up or adjusting. A sound absorbing chamber protects the coupler from damage while idle and from extraneous noise during the tests. The ASA available power of one milliwatt or the normal operation level of one tenth microwatt can be selected by means of a switch. The calibrations of the microphone and the earphone source voltmeter are shown in Appendices A and B, respectively. The procedure for using this artificial ear is outlined in Appendix D.

In addition to meeting the previously listed requirements of convenience and simplicity, the new ear has demonstrated an accuracy and reliability comparable to that achieved in the testing of earphones at recognized laboratories specializing in acoustical measurements.

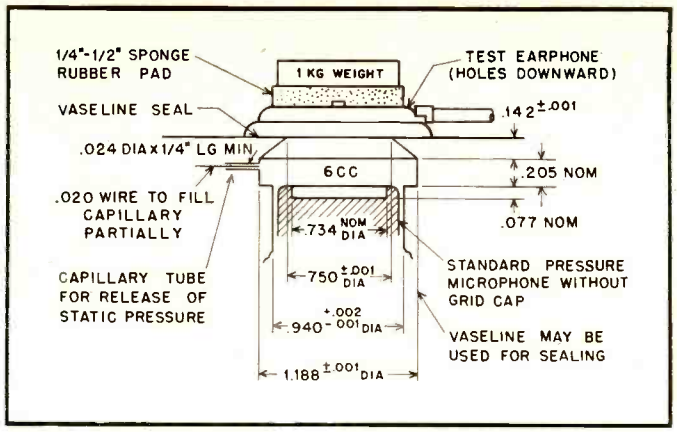



**Fig. 6. Detail of coupler, mounting jig, and microphone placement.**

## APPENDIX A

CONDENSER MICROPHONE CALIBRATIONS

Microphone Description:

Western Electric Type 640AA, Serial No. 450.

Response in decibels with respect to one volt per dyne per square centimeter of sound pressure. Polarizing voltage is 200 in each case.

| Frequency cps | Factory Calibration 6 Sept 46 | NBS Calibration 6 Nov 52 |
|---|---|---|
| 50 | | – 53.7 |
| 100 | – 55.1 | – 53.8 |
| 200 | – 55.1 | – 53.8 |
| 500 | – 55.1 | – 53.7 |
| 800 | – 55.1 | – 53.8 |
| 1000 | – 55.1 | – 53.8 |
| 1500 | – 55.0 | – 53.8 |
| 2000 | – 55.1 | – 53.9 |
| 3000 | – 55.0 | – 54.0 |
| 4000 | – 55.0 | – 54.3 |
| 5000 | – 55.0 | – 54.5 |
| 6000 | – 54.9 | – 54.8 |
| 7000 | – 54.9 | – 55.3 |
| 8000 | – 55.0 | – 55.4 |
| 9000 | – 55.3 | – 55.8 |
| 10,000 | – 55.5 | – 56.2 |

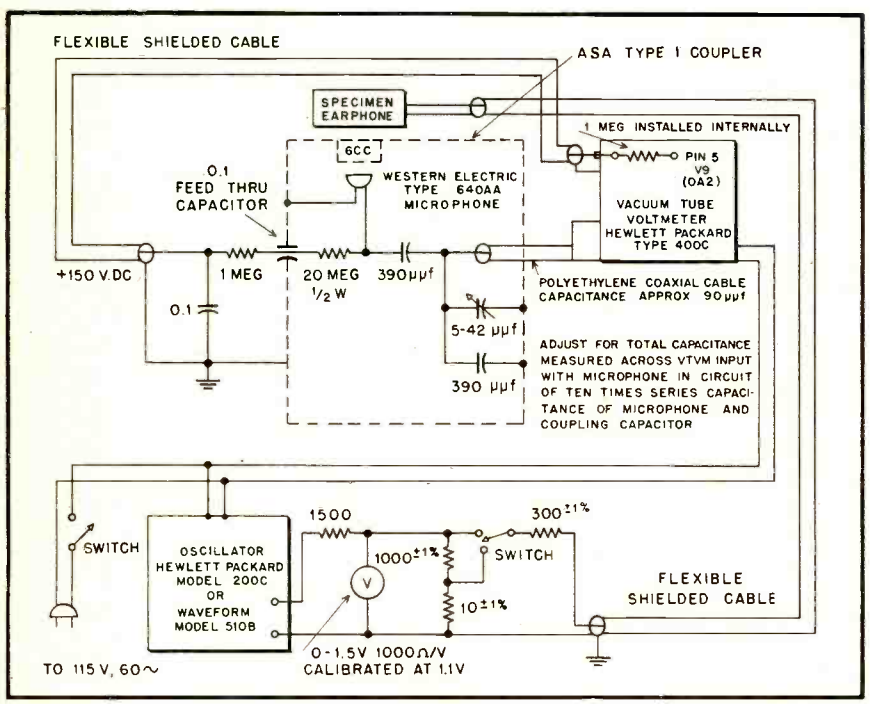



**Fig. 7. Schematic of equipment to show method of connecting microphone to VTVM, as well as calibrating circuit to feed earphone with standard signal.**

## APPENDIX B

A. C. VOLTMETER CALIBRATION

This meter is used to measure the voltage applied to the test specimen in series with a 300-ohm resistor.

| Frequency | 100 | 1000 | 10,000 |
|---|---|---|---|
| Deflection for 1.100 volts | 1.081 | 1.086 | 1.091 |

This calibration was made at the National Bureau of Standards on 28 July 1952, and reported in a letter of 30 July 1952, signed by Mr. F. L. Hermach, acting chief, Electrical Instruments Section.

## APPENDIX C

CALIBRATION OF ARTIFICIAL EAR CIRCUIT

**Definitions of Terms**

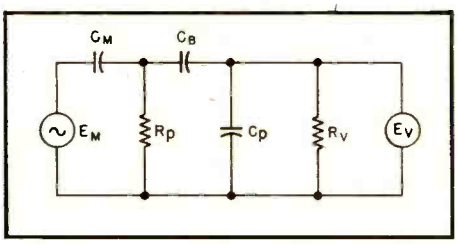
$\beta$ = correction factor defined by equation (11).

$C_B$ = d. c. blocking capacitor, in farads

$C_M$ = microphone capacitance, in farads

$C_P$ = total capacitance of voltmeter, cable, voltage-divider capacitor, and trimmer in parallel, in farads

$D_C$ = sound level in db above one dyne per square centimeter at the microphone to produce one volt for microphone calibration polarizing voltage




$D_m$ = non-linear microphone response loss due to $E_P$ being less than $E_C$

$D_R$ = sound level in db above standard reference level of 0.0002 dynes/cm²

$D_t$ = microphone calibration in db above one dyne/cm² per volt

$E_C$ = polarizing voltage used in standard calibration of microphone

$E_m$ = microphone open-circuit voltage

$E_P$ = microphone d. c. polarizing voltage

$E_V$ = voltage at voltmeter terminals

$R_P$ = microphone polarizing-voltage resistor, in ohms

$R_V$ = voltmeter input resistance

$\omega$ = frequency in radians per second

*(Continued on page 56)*

# Equipment Report

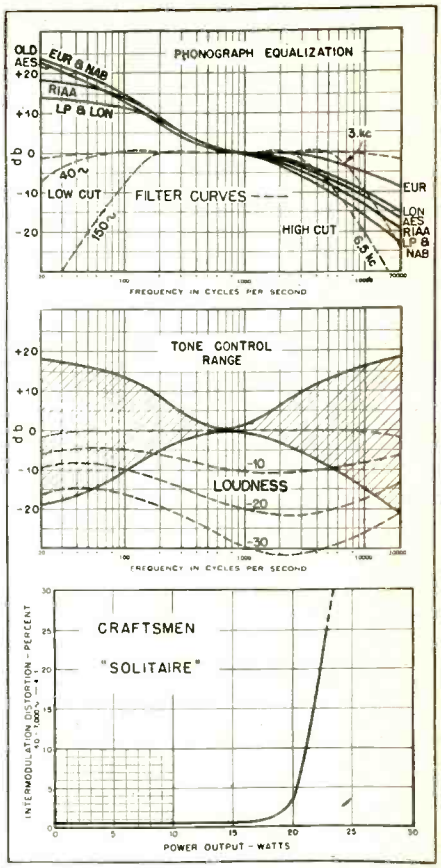
## Craftsmen "Solitaire" amplifier — Browning Model L-300 "Brownie" FM tuner—Rex-A Special Record Changer—Electro-Voice Model 666 Microphone

TRENDS during the past year have been in the direction of more compact apparatus for the home, particularly in amplifiers and control units. So far, no one has figured out a way to play a 12-inch phonograph record in a 6 by 6 in. cabinet, but that is undoubtedly in the offing. And while the miniaturization of loudspeaker enclosures must certainly reach a point of no return before long, there does not seem to be any good reason why an amplifier cannot be made smaller and smaller, provided the diminution does not encroach on the output transformer too much. In the case of the Craftsmen "Solitaire" it does not appear that the miniaturization has been carried too far, for performance belies the small size.

The Solitaire is essentially a "front end" in a metal cabinet, to the back of which has been added a power amplifier. The physical arrangement is practical, and eliminates wires from the rear apron of the unit—they simply go underneath and disappear. If the table on which the unit were to be used had a 2-inch hole in it, no wires need be visible at all, thus solving one of the problems of the table-top control unit.

The preamplifier is arranged so that the tubes plug into a sloping panel accessible from the bottom of the cabinet. All input connections and the connection to recorder feed are made on this panel. The connections to the speaker are made on the bottom also, but farther back on the amplifier unit.

Plenty of flexibility is provided in the controls, and some are included which are not common yet. *Figure 3* shows the external appearance of the unit, and the knobs —reading from right to left—are SELECTOR, BASS, LOUDNESS and LEVEL SET, TREBLE, and POWER. The two slide switches are low cut and high cut, respectively, and actuate the filter circuits for eliminating excessive low-frequency response — and especially rumble—on the one end and needle scratch,



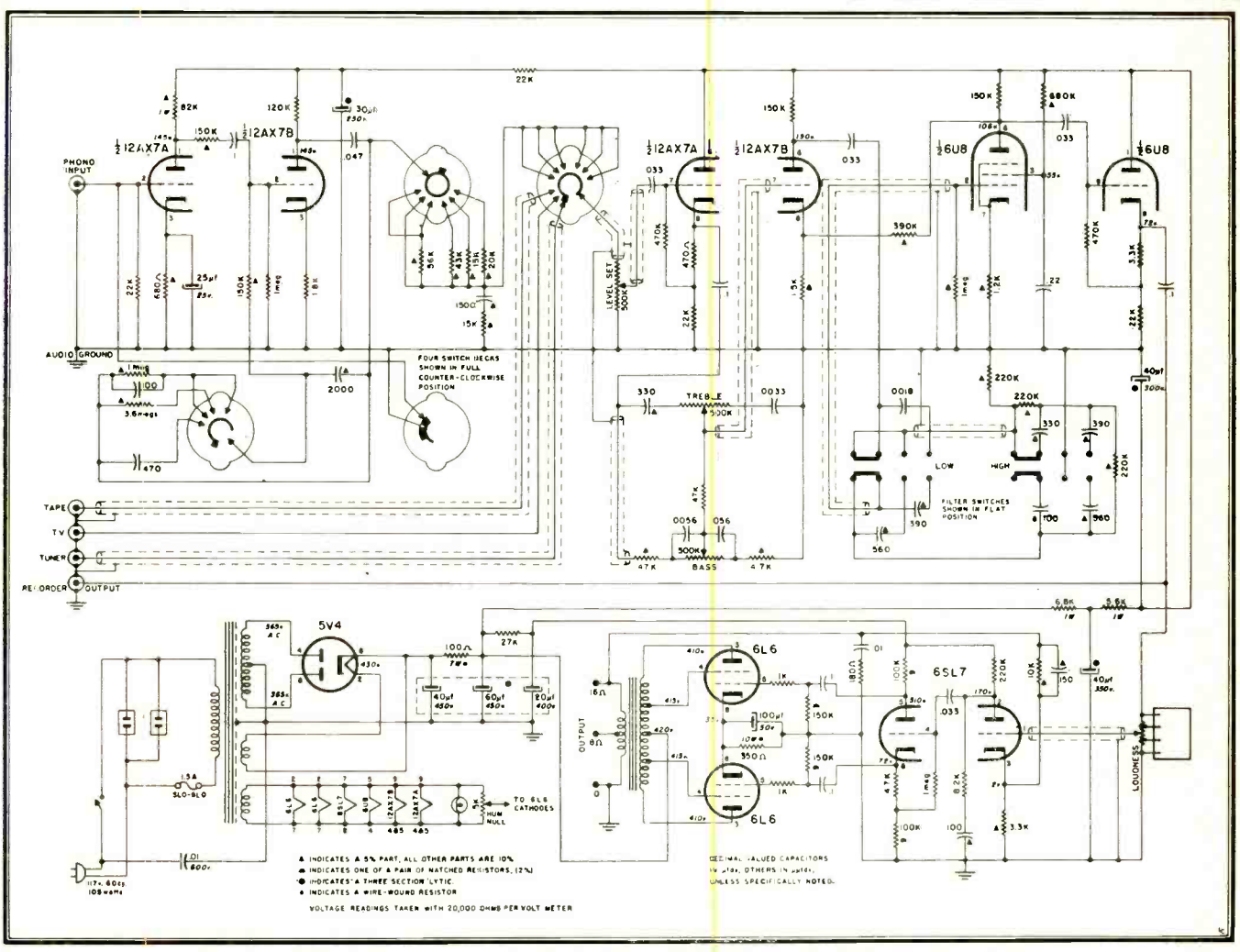
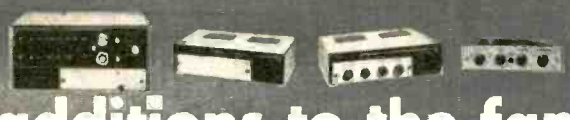




Fig. 1 (top right). Performance curves for the Craftsmen "Solitaire"; and Fig. 2, the complete schematic.



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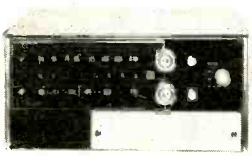

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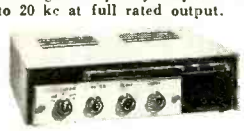
FM sensitivity — .5 microvolts for 20 db quieting! Exclusive FM mutomatic tuning. Full band AM. Binaural provision.

**HORIZON 20, 20 watt amplifier**

Utilizes revolutionary new "unity-coupled" output stage. Frequency response is ± 1 db 20 cps to 20 kc at full rated output.



**HORIZON 10, 10 watt amplifier**

Built-in preamp-control unit 3 inputs, 3 record equalization curves, loudness control, separate bass and treble controls. "Unity Coupled" output stage.

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NEW

Calibrated FM and AM logging scales


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**Compare these features combined in the NEW Criterion and found together in no other AM-FM tuner—**

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- Binaural or simultaneous AM-FM tuning and reception
- Drift free reception
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- Greatest sensitivity of any receiver
- .8 capture ratio—makes sensitivity usable for fringe area reception . . . areas formerly inaccessible to FM can now receive quality FM signals
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NEW

- "Lock-in" tuning—broad & non-critical. When you hear program the station is perfectly tuned—without meters, eyes or other complicated tuning indicators—the only non-critical tuning unit on the market.
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  *An exclusive National feature that eliminates all hiss and noise when tuning between stations. Music leaps out of velvety silence and stays locked in.
- Incomparable AM & FM selectivity — complete adjacent channel rejection.
- Superb stability both long and short term.
- Completely Hi-Fi AM reception — distortionless and burble free —
- The greatest sensitivity of *any* AM-FM tuner . . . *plus*
- .8 capture ratio—rejects all interfering signals up to 80% as strong as the desired signal—making signals "ghost" or "reflection" free.

†*Pictured with plug in pre amplifier*

National's complete line is offered through authorized high fidelity outlets only where professional advice and top quality service is assured. Reading the description is only part of your selection problem. High fidelity must be heard—and you can hear the superiority of National products in your local National Co. dealer's showroom.


Fig. 3. The Craftsmen Solitaire—a compact 20-watt amplifier.

noise, and inter-station whistle from AM tuners on the other end. We particularly like the arrangement of the switches—when the bass filter switch is at the left, the bass response is maximum; when the treble filter switch is at the right, the treble response is at maximum. Thus when the switches are pushed outward, the range of frequencies passed is maximum. Sliding the switches together—towards the center—gives the impression of reducing the bandwidth as it does so.

The center control is a dual unit combining LEVEL SET with LOUDNESS—the former being an uncompensated volume control while the latter is a typical compensated unit. This provides panel control of the amount of loudness compensation employed, and permits the user to adjust the input level to match every condition from the front panel. Separate tone controls are calibrated in db of boost or cut at 50 and 10,000 cps, and are quite accurate. The selector switch has 9 positions—three high level inputs labeled TAPE, TUNER, and TV, and six phono equalization positions labeled AES, LON, RIAA, LP, EUR, and NAB. Equalization is provided by feedback around the second half of a 12AX7, the first half being used as a voltage amplifier. This arrangement permits bypassing the cathode of the input tube to reduce hum. Curves for the various phono positions are shown in *Fig.* 1, as are the filter curves, tone-control range, and the loudness contours. Intermodulation distortion is also shown for the complete unit, measured from the tuner input. A 1-watt output is obtained from less than 2 mv input at the phono input jack, and from a signal of .075 volts at the high-level inputs.

At a 1-watt output signal, the voltage available at the recorder-feed jack was 1.35, for an input signal of .075 volts at the high-level inputs. Thus there is some gain in this circuit, since the feed to the recorder is after the tone controls and filters, but before the loudness control. The output signal was free from peaks up to 200 kc. and showed an excellent square wave response when the controls were in the flat position. Hum and noise measured 55 db below 1-watt output on the high-level inputs 48 db below 1 watt on the phono input with volume and loudness controls at maximum. However, the unit has considerably more gain than would be absolutely necessary were it not for the two volume controls—level set and loudness—so that with the controls at a typical position, the hum output is effectively 15 db below that measured.

The Solitaire is compact enough for modern requirements—being 14½ in. long by 11½ in. deep by 4 in. high. The panel is polished brass, and harmonizes nicely with the enameled case. Its 20-watt output should be adequate for most home applications where only one speaker was to be used, but it is felt that a higher output should be provided for those installations where several speakers were to be used throughout the house.

## BROWNING L-300 FM TUNER —MODEL 20CL WITH CLOCK

Available in a number of forms, the line of "Brownie" tuners offers a number of features that would naturally appeal to the music lover—particularly if he were limited in space for the equipment needed to obtain good FM reception as either prin-

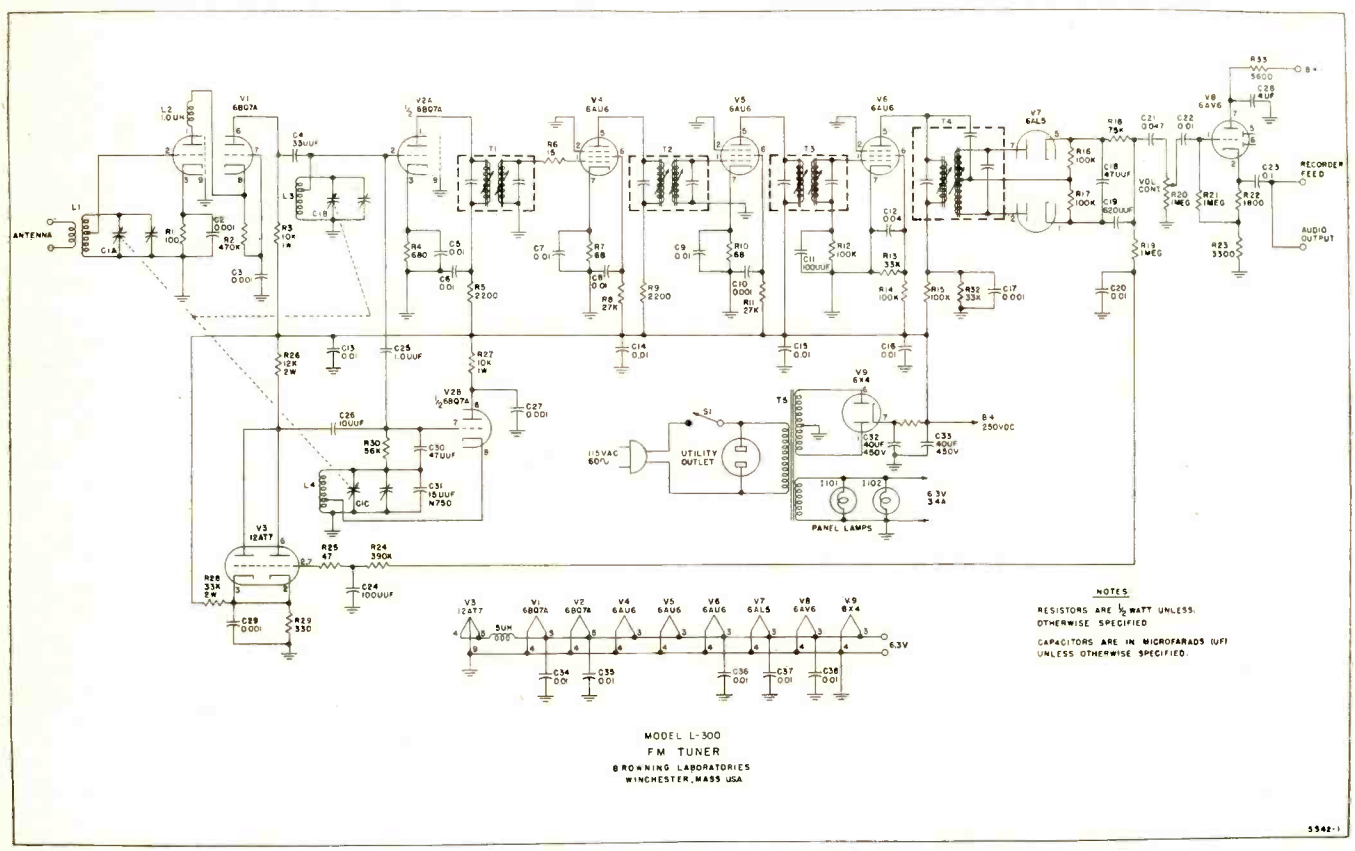
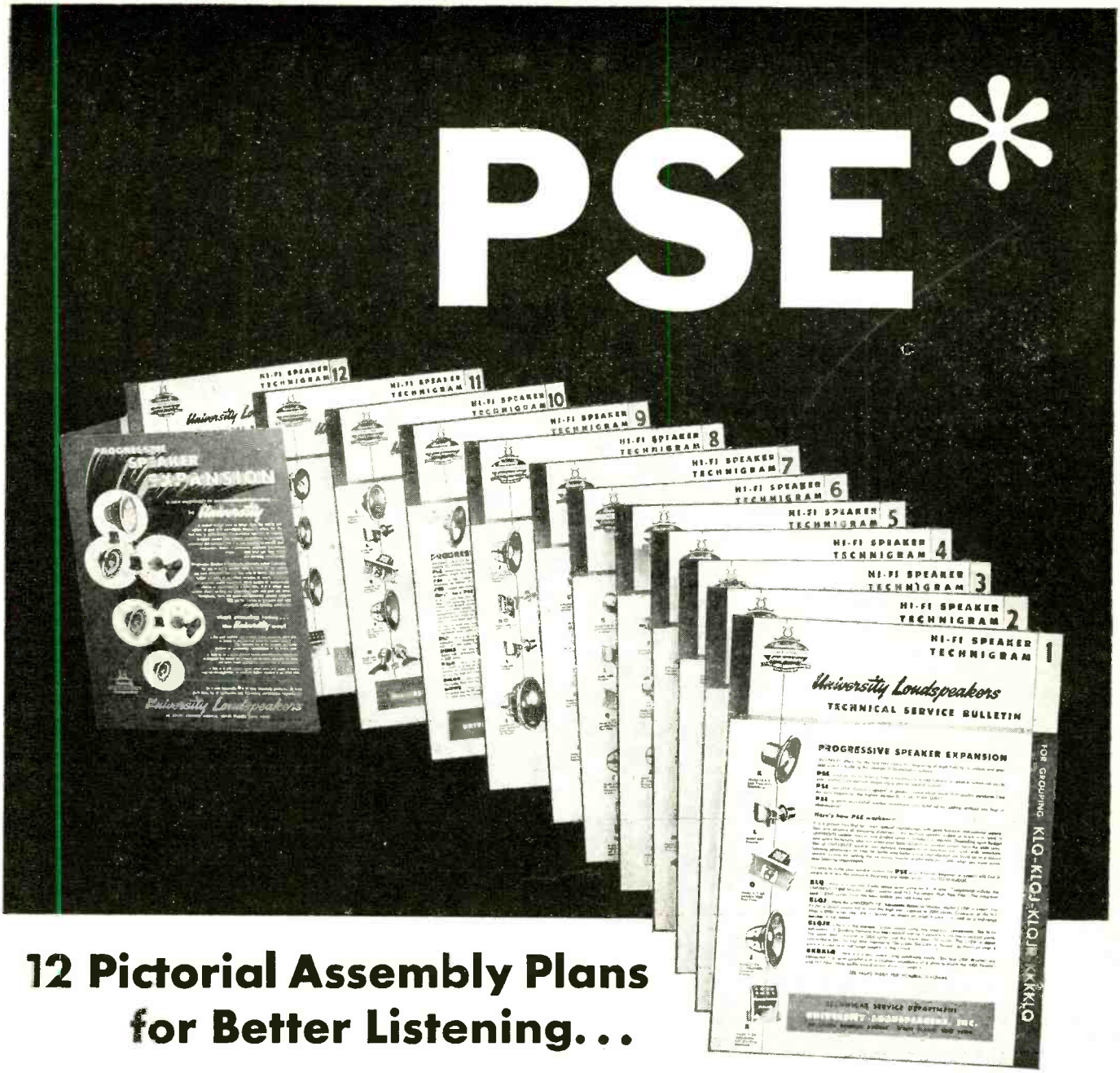



Fig. 4. Schematic of the Brownie L-300 FM tuner.

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cipal or auxiliary source of good music. While records may be the principal source of music for those in outlying districts, there is no doubt that the listener who lives near any of the major broadcasting centers can have good music practically throughout his waking hours—and in some places throughout most of the night.

The L-300 is available as a chassis alone, or in either mahogany or blonde cabinet, or in a cabinet of either finish with a Telechron clock timer. This can be a useful adjunct to the music lover, for the clock can be set to turn on the set at any desired time in the morning and thus serve as an alarm clock. In addition, it can be used to turn appliances on whenever desired—picture the idea of waking up to music, lying in bed and enjoying it for a few minutes, then getting up and finding the coffee already made. Furthermore, you can set it to turn your music system off any time up to one hour after you go to bed. And if you aren't awakened easily by music, you can use the alarm instead—or also. Besides all that, you can tell time by simply looking at the clock face.

The tuner itself—only 9 in. wide by 8 in. deep and 4⅞ in. high—can be used in any other cabinet desired, with only the escutcheon opening and the two holes for the control knobs being required. In the cabinet with the clock, it is 16 in. long, 9 in. deep, and 6 in. high, with the clock mounted at the left of the tuner. All clock controls except the time set are accessible from the front.

The tuner circuit—shown in *Fig. 4*—employs a 6BQ7A as a cascode tuned-r.f. stage, followed by another 6BQ7A as oscillator and mixer. The AFC tube is a 12AT7, which derives its control voltage from the discriminator circuit. The mixer is followed by two i.f. amplifier stages, using 6AU6's, a third 6AU6 as a limiter, and a 6AL7 as discriminator. A 6AV6 serves as a cathode follower output stage, and feeds both the audio circuit and a recorder in parallel. Plate voltage is supplied by a 6X4 rectifier. Controls consist of one for tuning, and one for the power switch and volume.

The tuner has a high sensitivity—being rated at 3.5 microvolts or better for 20 db quieting. The dial calibration is well spread out and is calibrated at 2-mc intervals, making it easy to read. The dial is illuminated from the sides, and is easily read even in the dark. The circuit is essentially the same as the original Armstrong, with the exception of using only one limiter stage. However, for all but those in fringe areas, the quieting is completely adequate. There is no noticeable drift from the time of turning the set on through eight hours of operation, and after retuning carefully when hot and then turning the set off for an overnight cooling period, the same station was accurately tuned in when the set was turned on again.

Frequency response was judged to range from 20 to well over 15,000 cps, since a 12,000-cps low-pass filter made an appreciable difference in response on live FM programs.

This is one of the more compact FM tuners we have had the opportunity of examining so far, although one other was reported some months ago. It appears that the general trend in equipment is toward more compact construction, which is all to the good provided the standards of quality are maintained. Browning has long had an excellent reputation for tuners, and this one seems to be in the same family.

While not examined for performance, a similar Brownie is available as an AM unit covering the broadcast band and the international short wave bands from 19 through 49 meters—continuous tuning from 6 to 18 mc. This model has a built-in whistle filter, adjustable-bandwidth i.f. amplifier, cathode-follower output to feed both amplifier and recorder, and a self-contained power supply. This is an example of applying hi-fi tuner practices to the AM and short-wave bands.

Fig. 5. The Rex-A Special record changer.

This model is also available in chassis form, as well as in either blonde or mahogany cabinet, and with or without clock.

Both tuners may also be obtained in a cabinet with a 5-watt audio amplifier and two small speakers, providing a complete radio set, if desired. All of the types of cabinets can also be obtained separately. This would permit the installation of a Brownie chassis in a permanent cabinet for home use, with the ability to remove it and place it in the cabinet with speaker and amplifier for summer use, if desired, with a minimum of effort. The Brownies are sufficiently adaptable to fit in with anyone's special requirements.

The music lover who takes a special interest in the many festivals that occur annually throughout Europe would find considerable enjoyment in the short-wave reception from the L-500 AM-short-wave model, for many of these programs are broadcast and may be heard simply by tuning in. No one should be led to believe that hi-fi reception might be expected from short-wave broadcasts because of atmospheric vagaries, but the limitations are not in the receiver itself—they come from conditions not under the control of the listener. It must be remembered that the networks, with the finest possible equipment available to them, do not succeed in capturing foreign broadcasts with what could be called "high fidelity." It is probable, however, that many a music lover would get considerable pleasure from hearing some of the music festivals broadcast directly from their points of origination, even though it might not be up to his desires as to quality of transmission.

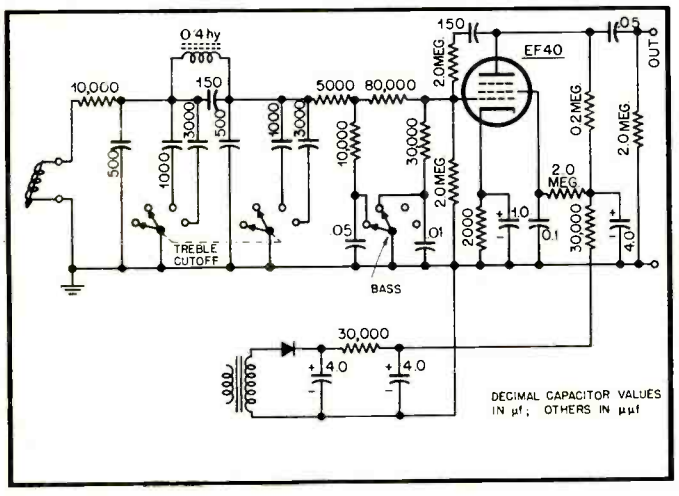


Fig. 6. Schematic of Rex-A built-in preamplifier for magnetic cartridges.

## REX-A SPECIAL RECORD CHANGER

The Perpetuum Ebner line of record playing equipment is unique in many particulars—not the least of which is the combination of a preamplifier as an integral part of the changer chassis, rather than being required as a separate item. This offers mixed blessings, however, since most audio fans will already have an amplifier with the preamp as an integral part of it, and they most certainly couldn't use both. However, for the newcomer to hi fi, the Rex-A Special offers a simple means of changing over from a low-quality record rotating mechanism—a fair description of some of the inexpensive

(*Continued on page 57*)


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**...The Bogen PR-100 preamplifier–audio control unit**

Have you ever opened up the throttle of a truly fine sports car? If so you've sampled a thrill similar to the one you'll get when you put this new Bogen PR-100 through its paces. Its official title, Deluxe Preamplifier and Audio Control Unit, barely describes the sparkling performance and versatility of control of this amazing new unit. For example:

- 2 Concentric Record Equalization Controls: 6 positions for high roll-off, 6 positions for low turnover.
- 2 5-position filter controls: Bass Cut eliminates turntable rumble, Treble eliminates scratch or distortion.
- DC on all filaments.
- Exclusive separate loudness contour selector: the only LCS that takes into account the *input* signal as well as output when you boost lows and highs.
- Produces rated output with any cartridge.
- 6-Pushbutton input selector: power off, phono, tape, radio, auxiliary, and *tape monitor* (Enables you to monitor a tape *while you are recording).*
- Response: 5 to 150,000 cycles ±0.5 db.

Four coaxial knobs plus selector pushbuttons take care of all the controls. The exclusive "red dot" on each control enables even your Aunt Minnie to hit optimum settings.

*Chassis only,* $99.50; *in mahogany veneer cabinet,* $119.50.

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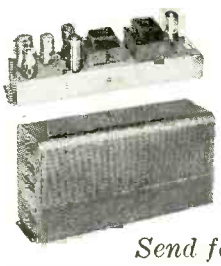

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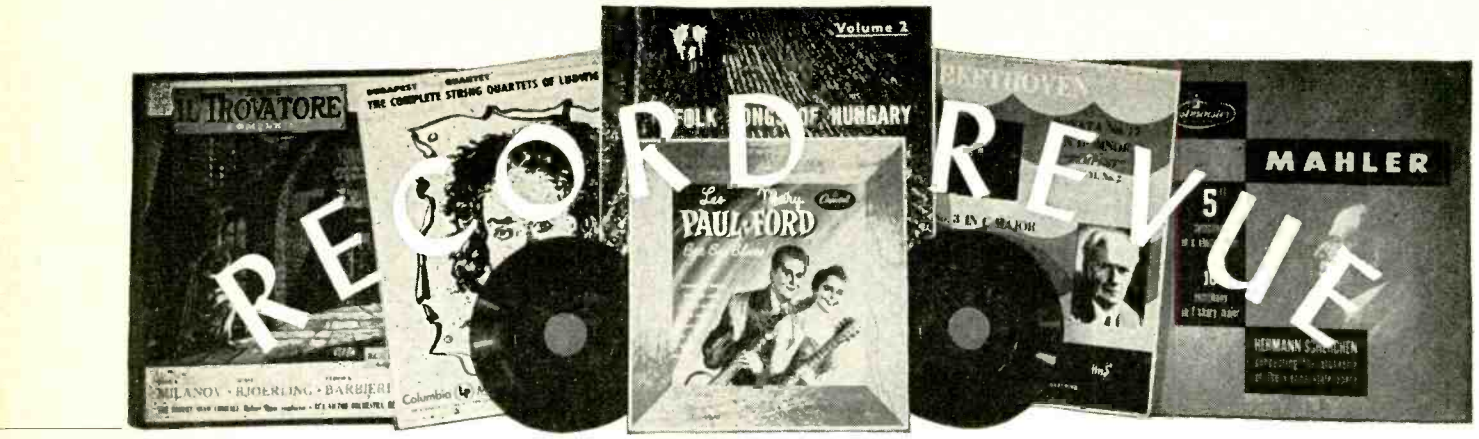


## EDWARD TATNALL CANBY*

**The Merry Organs of North Europe The Art of the Organ—E. Power Biggs.** (Purcell, Buxtehude, Pachelbel, Sweelinck, Bach.) Various European organs.
**Columbia SL-219 (2)**

Here is one variety of dream record. For those who are looking both for hi-fi and for music, with all the advantages of both! This is a wonderful collection of hi-fi organ material (both the lows and the highs) and at the same time represents one of the finest collections of interesting classic organ music so far assembled. I confess to having a special interest in it; I wrote a considerable hunk of the booklet that accompanies the records. I don't mind saying I had a wonderful time doing so and I'm ready to suggest that for anyone who found himself interested in earlier discussions of the organ—piped and pipeless—in these pages the hunk in question should make good reading, illustrated, of course, by the actual music on the records.

The plan is simple. Mr. Biggs made a tour of Northern Europe accompanied by a Columbia tape recordist and his equipment. In addition to giving recitals on many of the finest of the numerous older organs that still exist in that region, he played on each for the tape recorder. The present two LP records are selected from those tapes, featuring no less than twenty organs. Most of them are so old that the gorgeous sounds which come forth—so solid and new and alive—are almost a shock. (Somehow we feel as if an ancient organ should wheeze and groan, like a wornout circus calliope!) The oldest of all was put into commission in the year 1612 and now plays exactly as it did then, without change. Many of the others date from the middle 1600's and early 1700's. And for contrast there are several brand new instruments, right out of our own time which, remarkably enough, sound in general not a bit better—or newer—than the old ones.

But perhaps the most important feature of this collection, and that which "makes" it as a musical recording, rather than a mere hi-fi hodgepodge, is the program. What to record on the twenty-odd organs? The same piece, again and again? Interesting (and it was done, I think), but hardly suitable for pleasant listening. A series of works and composers, in great variety? Better, but even this is hardly ideal, for a confusion of works multiplied by a confusion of instruments is bound to leave the listener in a jumble.

The Biggs solution is excellent. Three of the top composers of the very period in which the old organs were constructed—and who played on some of them in person—were chosen to share the entire album, in a unified and shapely exposition of the music of the time. (The Purcell is a headpiece and the Bach Toccata in D Minor a tailpiece, in the only two English recordings.) There were giants in those days and their names were these three—Buxtehude, Pachelbel and Sweelinck. Each of these men is represented by a whole group of his works, one after the other—each on a different organ. The physical arrangement of the tour itself and the sequence of the composers are dovetailed neatly enough so that you may follow the geographical, the "organistic" and the musical progress each as easily as the other. In this way the tonal contrast of the organs adds variety to the works of each composer while unity is abundantly felt in the flow of the music from work to work and in the remarkable kinship between the various organs that emerges as we travel from town to town, church to church, organ-builder to organ-builder. (Organ-builders of the North were as renowned as the violin-builders of the same period in the South—the Stradivarii and the rest.)

Indeed—whether for the hi-fi fan, the musicologist or the plain lover of beautiful sound—these recordings bring out, in terms of the music itself, an extraordinary world of artistic activity that must have fairly buzzed with enthusiasm and excitement. The composers and the organ-builders clearly worked in the closest sort of relationship, each new wrinkle in sound production closely tied in with new wrinkles in music, each abetting the other. The tricks of both organ construction and musical construction were carried up and down and back and forth—in that day of utterly primitive transportation—throughout the North of Europe, from the towns of Denmark, Holland, Sweden, Norway to the old cities of North Germany. Though every hand-built organ had its own unique sound, the unity of style and purpose and the way that the music fits the organs and brings out their best qualities (and vice versa) is really astonishing to hear. The entire album fairly vibrates with life and communicativeness.

The album, with two records, is replete with background, including photos of the various edifices housing the organs and of Mr. and Mrs. Biggs, tourist-style; his running account of the expedition is quite informal but organists will find complete specs on every one of the organs on the back of the album. The month's finest hi-fi item.

## AUDITIES

**Tchaikowsky: Swan Lake Ballet (Complete).** Minneapolis Symphony, Dorati.
**Mercury OL-3-102 (3)**

A sequel to the Mercury-Dorati "Nutcracker", the one with the candy stripe album, this one is in blue silk and even more handsome, with the now-usual sumptuous bound-in booklet of photos and story-background. What's perhaps more important, the contents of the three records are pretty close to a recorded ideal for this sort of music—which, after all, was not written as concert music but rather as the musical power behind a long evening of top-quality dancing in the theatre.

In some other music Dorati shows himself a hard, if disciplined conductor, but he has had an extensive and very professional background in ballet conducting, an absolute essential for this type of music. The performance, then, is best described as business-like and without nonsense, with a minimum of sentimentality and a maximum of straight theatre—exactly what the score calls for.

And to set off the Dorati performance Mercury has somehow produced a typical theatre sound—not a concert-hall sound but that deader, closer, ultra-clear effect that we've all heard from the orchestra-in-the-pit, as constrasted to the orchestra-on-the-stage. No doubt an illusion and, possibly, unintentional in this case; but it is there and it's good, and perfectly suited to the occasion. This is a recording of a ballet, not a program of ballet music.

Hi-fi, needless to say, with the close-up sharpness and the big, full sharp bass that has characterized the "living presence" recordings from the first. You can't go wrong on this one and I make but one wee small suggestion: a few people may just possibly find six whole sides of "Swan Lake" a bit more than they can take. Frankly, I get bored. And why not? Tchaikowsky never dreamed that anyone would listen to this entire score minus the ballet itself. For concert use Tchaikowsky would have recommended a concert suite, tailored for listening only, and this is what we hear ordinarily.

Our biggest collective boner today is to take music out of its context—and then misjudge it by false standards. We are always putting boudoir music into the concert hall, ballet scores into living rooms, movie stuff onto symphony programs, chamber music into stadiums. Sometimes it's a swell idea and there are unexpected new benefits, as, for example, opera on records, complete with running libretto to be followed word for word with ease.

But in every case we should—and often do not—take the original intent and background rigorously to account and judge accordingly. If not we are unfair to the composer.

Frankly, I don't think the full-length Tchaikowsky ballets are really suitable for straight concert-style listening. Like listening to the sound track of a TV show without the picture. If you study up the story and know your ballet very well—then fine. Otherwise this kind of album is good (a) for hi-fi use—in bits and snippets; or (b) for background music on a changer.

Maybe that's plenty, come to think of it.

**Carnegie Hall Recital—Wilhelm Backhaus. (Five Beethoven Sonatas).**
**London LL 1108/9 (2)**

Backhaus is one of the supreme geniuses of present-day keyboard music. He is seventy. His last appearance in the United States had been 28 years before; this recital, Mar. 30, 1954, received—and rightly—the utmost in rave notices. Backhaus has recorded for London extensively before and in a fairly unusual move that company brings out, not a studio repeat under "ideal conditions," but the on-the-spot recording of the actual concert, complete with applause and coughs. Why? Because, no doubt, it was convenient but also because this was, indeed, an epochal concert as all accounts agreed and sometimes the historical function of recording outweighs the technical considerations that ordinarily call for a special performance.

And an extraordinary album it is. There are three "medium" sonatas, among the mediumly well known ones, plus the all-famous "Pathétique" and the incredible last sonata, Opus 111, the one that was once considered both crazy and unplayable. Of all these five I recommend most immediately to you that one, Opus 111, and this whether you are a Beethoven expert or a com-

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

pletely unknowing listener (and even though this one has the least satisfactory sound quality).

The reason is basic. I've always believed, and do now more then ever, that really great music when played by an interpretor equal to it will go straight through to anybody who will listen and allow it to exert its full power. Even Beethoven, or perhaps I should say especially Beethoven. Here is such a performer.

And there is a further specific that every jazz and popular musician, every folk performer should know: that though Beethoven indeed "wrote down" his music in notes, the fact is that these notes are mere mathematical symbols which set up the rough time-relationships and the pitch relationships he desired; the music itself must be brought alive by what is fundamentally improvisation. The rhythms are meaningless unless they are first understood and second put into action, into rhythmic drive and phrasing, into that minute variation from the exact that—again as every jazzman knows—is the very essence of musical expression.

Wilhelm Backhaus is one of the greatest rhythm pianists I have ever heard and Beethoven—as we hear him via Backhaus—was one of the most astonishingly wonderful masters of driving, searing, flowing, overpowering rhythm that can be imagined. And I mean precisely the same kind of rhythm, essentially, as one finds in the finest of jazz playing.

What I suggest, then, is that anybody with a half a sense for rhythm (not to mention pitch) will "get" this extraordinary composer-player combination, if he gives it half a chance, as he "gets" a jam session or what have you. I mean no disrespect in either direction; the subtleties and the power of rhythmic expression in the playing are evident in one medium as in the other. And so I suggest a serious and attentive listening to Backhaus in the Opus 111. It will require real attention—no background listening, no extraneous noise, no conversation; Beethoven is tough and demanding, but equally rewarding.

Try the second movement first, for it is uniquely related to jazz in two fundamental ways—it is a set of variations on a simple tune, and it is the most extraordinary tour de force of the dotted-note figure possibly ever conceived. Most pianists are incapable of holding its tremendous complexities together, and especially of playing its steady, rapid, fantastically mobile dotted figures that race all over the piano. Again, any good jazz man—and is not jazz founded on the dotted rhythm?—will hear Backhaus with amazement and joy; there never was such rhythm! And anybody else who listens with half an ear will find himself swept along on the mounting potency of these variations, that build from an almost standing start to a perfect Niagara of smoothly coordinated pianism.

Assez!, as the French say. How can a writer stop writing about an experience as tremendous as listening to this Beethoven! I'll say further only that the recording, under concert conditions, is only so-so; the piano tone is somewhat percussive and there is a degree of unsteadiness in the pitch reminiscent of some of the first piano LP's five or six years ago. But it's far from enough to kill the Backhaus appeal.

(For the cognoscenti—Backhaus makes an interesting contrast to Artur Schnabel; where Schnabel probes the mystic depths of Beethoven at slower tempi, Backhaus gets at the same intensities through rhythmic power and shaping, at faster speeds.)

**Strauss: Arabella—the Great Scenes.** Eliz. Schwarzkopf et al, Philharmonia Orch., Matacic. **Angel 35194**

It's interesting to see how differently the record world and the concert-opera world operate. Even critical values and judgments come out differently.

"Arabella," composed in 1933, is one of the numerous late Strauss works which are now—on records—finding a quite remarkable interest in this country. In concert and in our opera house, Strauss still officially is supposed to have pooched out about 1912 with "Rosenkavalier" or, even earlier, with "Salome" and her Dance of the Seven Veils. "Arabella" was put on at the Met. in New York this year. According to tradition it was promptly stepped on by most commentators.

But those who have heard late Strauss before and who know the tremendous reputation Strauss has in Europe for his later works are not so easily put off. This set of excerpts from the opera is, indeed, a gorgeous record to own and old Strauss is easily seen as one of the greatest masters of setting words to music of recent times.

A Libretto is attached, in German and English, and with its visual aid you can follow the breathtakingly lovely singing of Elizabeth Schwarzkopf, of Anny Felbermayer and the other superb Strauss singers. Rich, flowing, easy music, "old-fashioned" in harmony but highly modern in its operatic conception, in the thoroughly adult nature of the character development that is the basis of the Viennese (1860) plot, in the rapid and easy musical conversation that brings out the interesting personalities of the principals.

In one respect only was Strauss really old-fashioned—he didn't know when to stop. His operas (and other works too) continue inordinately long in the Wagnerian tradition. But that need not worry you here! Two LP sides and not a bit too much.

**Chants de la France.** Harmonized by Joseph Cantaloube. Lucie Daullene, soprano; J. Cantaloube, pf. **L'Ois.-Lyre OL 50047**

It never rains but . . . back in the March issue you'll find my write-up of "Christmas 'Round the World," choral arrangements by this same Joseph Cantaloube, (Westm. WL 5372) who has long been uniquely known over here for a single work, the famous "Chants de L'Auvergne," recorded years ago by Madeleine Gray and reissued again and again. (Susan Reed did them too awhile back.)

There was a peculiar beauty of melody and harmony to the "Songs of the Auvergne" that has kept them in the foreiront all this time; the Westminster disc of Christmas music showed some of the same characteristics, in a recording, however, that seemed to date from 78 days and could perhaps have been from the same times as the "Auvergne" job. Indeed I had assumed that M. Cantaloube belonged somewhere back in the late 19th century—when this new record appeared this month, with the Man himself, loud as life, and it's a brand new recording too.

These are more songs, from other regions, and the style is much like that of the "Auvergne" music; however, there is no orchestra, merely the piano, and for some this will be a slight disadvantage. The same warmly perfumed, very elaborate and highly musical settings, utterly devoid of the new "authenticity," art works pure and simple, but absolutely lovely even so.

And the glory of this record is the soprano—one of those peculiar French voices, all nasal, child-like fluency, high, fluty, thin and very lovely once you get used to it. What a strong people the French are! There could be no sound like this outside of France. Nice hi-fi recording.

**The Columbia World Library of Folk and Primitive Music, vol. 5: Australia & New Guinea.** Coll. and ed. Alan Lomax. **Columbia SL-208 (1)**

Here is the ultimate contrast in folk music, to follow M. Cantaloube's sophisticated French folk tune settings! This vast project, directed by Alan Lomax, already has some fourteen volumes and dozens more are promised; I've given up as hopeless the job of listening to the whole batch for review in toto—it would take me from now until Doomsday—and I'll take 'em up one by one as, if, and when feasible.

This one is something. Here is the real primitive, a collection of "music" that comes from primitive tribes who have virtually no contact as yet with civilization. Not even clothes. Indeed it is music, to be sure, and music in a good many fundamental ways that are most interesting to hear, music that is inseparable from other functions, from magic, trihal rites, from dance and speech and excitement and religion, music that is not intended to be "beautiful" and is in fact mostly very ugly—but highly expressive and thoroughly practical.

We must never forget that our present fancy concepts of beauty and of art are among the more ephemeral products of civilized thought—or civilized rationalization, if you wish. We must remember that the musical art originated in the most powerful of human needs, that it was always in deadly earnest and more often a matter of life and death than of mere entertainment. I would not suggest that you listen here with humorous indulgence. These shrieks, mutterings, ghastly howls, these chants and rhythms and confused babblings, these rough approximations of afixed pitch, half-sung, half shouted, represent the stuff of life to these people. They take their music a great deal more seriously than we do and put it to much more important uses, within the frame of their own lives. It is from this that we came, and to which we may yet return.

The excerpts are mostly short, modestly but intelligibly recorded, with brief spoken identifications that tie into the more detailed printed annotations. Good idea.

**Columbia World Library of Folk and Primitive Music, vol. 3: England.** Ed. Peter Kennedy and Alan Lomax.
**Columbia SL-206 (1)**

This one is of a very different sort. The folk music of England has been remarkably well documented in the past according to the old pre-recording methods pioneered by Cecil Sharpe a half century or so ago—that is, the songs have been "collected," written down as nearly as possible in actual notation (which is extremely inexact when it comes to folk music), then "arranged" as art songs, with piano accompaniment, more or less classical, or perhaps for four-part chorus. The resulting music has its own superb beauty, but little of it could so much as be recognized by the original singers from whom the music was "collected."

This record makes a conscious effort, instead, to portray what still exists of real folk music in England, music that is still alive of its own accord. Such music in its natural state, we sometimes forget, is constantly changing, taking on new styles, and so it is always more or less "modern" in sound. The English term for both songs and dances of this still-active type is "traditional," and the traditional music on this disc is often taken down in pubs, with accordions, with out-of-tune choruses from the bystanders; moreover, many of the singers are no artists but merely people singing the equivalent of our own eternal "Sweet Adeline" and "Down by the Old Mill Stream." (What if these were composed songs! Who cares?)

This material, then, is artistically nothing much, with a few big exceptions. Our own folk singers, from South and West, and all over, can do as well and better. The singing is often amateurish, if good humored, the songs are hardly the flower of England's folk, as written down by Sharpe and others.

Is this really all that is left of living, natural, traditional singing in England? If so, the progress of Modern Civilization is dismally fast. I am sure we have better things, still untouched by outsdie publicity and the eternal collector, in our own country. We are bigger and our backwoods areas are still isolated compared to the tight little isle.

The recording, considering that much of it is very recent (1951 or so) is just plain punk by modern standards. This seems to be the besetting weakness of the relatively few folk music experts, who really know this field. There is a steady succession of substandard records, year after year, and meanwhile the music that still is available, right now, goes begging (so to speak) for lack of a professional recorder! There is scarcely an item on this entire LP that, for instance, has any highs above 6000 cps or so: the all-essential intelligibility is drastically limited and the musical effect is equally restricted. Why?

Limited fidelity in the wilds of New Guinea is one thing but in England, today, it's something else again and inexcusable, from Lomax and the BBC (who made many of these recordings), or anybody else.

**Purcell: Come Ye Sons of Art.** Margaret Ritchie, sop., Alfred Deller, John Whitworth, counter-tenors, Bruce Boyce, bass; St. Anthony Singers, L'Ens. Orch. de L'Ois.-Lyre, Lewis.
**L'Ois.-Lyre DL 53004 (10")**

This and the disc below feature a newly popular oddity in the vocal field that is actually one of the oldest and most respected vocal sounds in Western music—the male falsetto.

Henry Purcell himself sang counter-tenor and wrote beautifully for it, though today's English-trained male altos, like most modern voices, aren't trained up to sing as fast or as accurately as Purcell intended. The sound is unique and very beautiful—not remotely like that of a female alto, nor yet like a boy alto; for these are mature men. The male alto simply trains his falsetto voice rather than his normal speaking "bass" voice; most of us gents have such a falsetto and anybody who has a good healthy one could presumably train it, exactly as the lower voice is trained.

The male alto or counter-tenor produces the same sound as the famous castrati of the 17th and 18th centuries who were the greatest singers ever to perform in Western music. They had a permanent falsetto, for biological reasons; the counter-tenor's is for singing only!

The Purcell music, an ode to celebrate the Queen's birthday, has a series of hearty choruses, trumpet-bedecked interludes, and some superbly beautiful contrasting slow music in his best style. The counter-tenors operate only part of the time. An excellent performance, the recording good except for a few overloadings on loud vocal tones.

**Elizabethan and Jacobean Music.** Alfred Deller, counter-tenor, D. Dupré, lute, G. Leonhardt, hps.; consort of viols.
**Bach Guild BG-539**

The glory of this record, and one of the most wonderful musical experiences I've lately had, is the counter-tenor's singing, to the lute (original) accompaniment, of songs by that superb English song writer, John Dowland. Here the music is less ornate by far and Mr. Deller, the same as in the Purcell above, can exert his full musicianship and beauty of tone, intonation and phrasing. A real revelation both as to the extraordinary sound of the counter-tenor voice and as to the depth of musical feeling that can be evoked from these simple songs when they are sung appropriately. No fancy modern operatic voices for this music, no wobbly modern vibrato! Instead, a purity and simplicity, an incredibly accurate pitch, a tone almost waver-free, and superbly clear diction.

There are other musical items too, several harpsichord solos, notably the vigorous variations by Farnaby on an old English tune, "Up Tails All," and three works for the "consort of viols"—a group of these flat-backed relatives of the violin family that also come in various sizes. The viols are more nasal and sweet-toned than the violins. They had frets and were played without vibrato. (Our modern horn player uses no vibrato, you'll note, except in France.)

Thus a trio or quartet of viols sounds utterly unlike a similar grouping of violins (string quartet) and the big difference is not in the tone quality but in the lack of vibrato. The works for viols on this record are played minus vibrato and their collective sound may remind you, oddly enough, of a harmonica or an accordion! Reason: harmonicas and accordions normally have no vibrato and their tone is not unlike that of the string viols.

(It is true that today the viols are often played without frets like members of the violin family, with vibrato added. The sound is much easier for our ears—though it would probably horrify any good musician of an earlier century. It's a serious question whether the music is improved in the long run by adding vibrato to please modern tastes.)

## WHAT DRIVES RECORD CRITICS NUTS. . . .

**Milhaud: Concerto for Percussion and Small Orch.; Chavez: Toccata for Percussion: Bartok: Music for Percussion, Strings, Celesta.** Conc. Arts. Orch., Slatkin; L. A. Chamb. Symph., Byrns.
**Capitol P 8299**

**Respighi: Brazilian Impressions; Granados: Two Span. Dances. Chavez: Toccata for Percussion.** Colonne Orch., Sebastian; Gotham Percussion Players.
**Urania URLP 7144**

**Spanish & Latin-American Music. Chavez: Toccata for Percussion. Revueltas: Ocho por Radio. Surnach: Ritmo Jondo. Villa-Lobos: Choros #7.)** M-G-M Orch., Solomon.
**M-G-M E3155**

**Farberman: Evolution. Chavez: Toccata for Percussion.** Boston Percussion Group.
**Boston B-207**

Phew! Not only four duplications of the Chavez—quaruple coincidence!—but the four so entangled with other works that I'm seeing and hearing double-quadruple already. (The smaller the record the longer the title, these days.) Let's settle for Chavez, mainly.

The Toccata rates fairly hi-fi, since its scoring calls for a good deal of noise both high and low and lots of interesting transients. The drums hit the bottom neatly and the assorted tinkles and rattles hit the top. On the other hand it is hardly sensational sound, nor is it radically exciting; it isn't easy to write at length for percussion alone with much coherence and form. The most exciting percussion is, inherently I think, the improvised sort where tension builds up in the unrehearsed performance. This is simply a well-put-together

and expertly scored work that sustains itself better than most such.

The interpretations are notably different in tempo and even in the tone quality of the indicated instruments—it's interesting to see how much variation is possible even in this rigid sort of writing due to the looseness of our notational system. To my personal ear the Boston group has the best rhythmic vitality and ensemble, with the Capitol Los Angeles group almost as good. The M-G-M group seems to me the weakest; perhaps not enough rehearsal. The Urania (Gotham) players have the most sonorous instruments, including a gorgeous chinese gong effect, and they are recorded at the highest level, by far. As to acoustics, all but M-G-M provide good liveness and varying distribution of the instruments—some near, some far—for vivid perspective; M-G-M's, like most of its current series, is recorded ultra-dead.

It is when we get to details that comparison becomes really complex, for the differences in loudness, in phrasings, in feeling, passage for passage, are enormous. One hand-beaten tom-tomish passage seems to fell into threes in one version and twos in others; a short cymbal note, quickly damped, is pianissimo in several versions but as loud as a steam explosion in Urania's reading. Where one reading is ominous and distant, another is blatant and loud. So it goes throughout the three movements and anybody who has the time and interest will find plenty to keep him busy for hours and hours.

It's enough to suggest that the other works are all different—providing plenty of alternative fare when Chavez gets on your nerves—and all more or less related, either as percussion works or as music in a Spanish or Latin-American vein. If you want to splurge in percussion (all are excellent recordings technically) you won't go wrong if you acquire all four.

## COMING EVENTS

May 16–19—Electronic Parts Distributors Show, Conrad Hilton Hotel, Chicago.

May 24–26—NARTB Broadcast Engineering Conference and the Annual Convention, Shoreham and Sheraton-Park Hotels, Washington, D. C.

May 26–27—Electronic Components Conference, Los Angeles, Calif.

July 18–21—MUSIC-ORAMA—Music Industry Trade Show. Palmer House, Chicago.

Aug. 24–26—Western Electronic Show and Convention, I.R.E., Civic Auditorium, San Francisco, Calif.

Sept. 30–Oct. 2—The 1955 High Fidelity Show, Palmer House, Chicago.

Oct. 3–5—National Electronics Conference, Hotel Sherman, Chicago.

Oct. 13–16—The Audio Fair, Hotel New Yorker, New York City.

Oct. 21–23—New England High Fidelity and Music Show, Hotel Touraine, Boston, Mass.

Nov. 4–6—Philadelphia High Fidelity Show, Benjamin Franklin Hotel, Philadelphia, Pa.

# PATENT LAW CHANGES

(*from page 27*)

patents on inventions transferred before the issuance of the patent:

(These sections) "introduce a new element in our statute. The existing statute is very strict in requiring that only the inventor may apply for a patent. These two sections provide for certain types of situations where it may be impossible for the inventor himself to apply, or where, in the case of a joint invention, one of the joint applicants has been inadvertently erroneously included, or a joint inventor inadvertently excluded; the sections provide all the safeguards necessary for the inventor."

In a famous case involving the infringement of the invention of the oxy-acetylene welding torch a feature of the invention was omitted from the claims set out in the original patent application by the inventor and was subsequently appropriated by others, who maintained in their defense that the invention had been disclosed in the original patent application, was consequently in the public domain and that no claim had been made to it by the patentee as a patentable invention.

The Federal appellate court, following the law as it had been until that time, said in its decision:

"The claims alone give new scope to the invention and some scope is essential to its value. It would seem that the invention must lie in the act of selecting out of the possible combinations which will read upon the disclosure such as are new and useful.

"Therefore, the invention must be found in the claims alone. If so, when the issue arises of prior invention between two persons, whether it be of interference or one raised by an infringement, it should be decided only by a comparison of the claims; i.e., of that part of the patent or application which sets out what combination of the elements disclosed the applicant says are his new and useful contributions to the art."

When this decision was reversed two years later by the Supreme Court of the United States on the opinion of Justice Holmes there was established the law determining the status of the first inventor in the right to patents, which is now incorporated in this statute.

Referring to the former statute Justice Holmes said in this decision:

"The patent law authorizes a person who has invented an improvement like the present, 'not known or used by others in this country before his invention,' etc., to obtain a patent for it. Among the defenses for infringement specified by the statute is that the patentee 'was not the original and first inventor or discoverer of the new material or substantial part of the thing patented.'

"Taking these words in their natural sense as they would be read by the common man, obviously one is not the first inventor if, as was the case here, somebody else has made a complete and adequate description of the thing claimed before the earliest moment to which the alleged inventor can carry his invention back.

"The fundamental rule, I repeat, is that the patentee must be the first inventor."

When twenty-six years later this new patent statute was enacted it included as a consequence of this decision the following provision:

"A person shall be entitled to a patent unless * * the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for the patent."

REFERENCES

Radio Corp. of America *v.* Andrea, 90 Fed. 2d 612.

A. B. Dick Co. *v.* Henry, 149 Fed. 424.

Wende *v.* Horine, 191 Fed. 620.

Pointer *v.* Six Wheel Corp., 177 Fed. 2d 153.

Davis-Bournonville Co. *v.* Alexander Milburn Co., 297 Fed. 846, rev'd 270 U. S. 390.

# NEW LITERATURE

• **Altec Lansing Corporation,** 161 Sixth Ave., New York 13, N. Y., has just issued a complete engineering catalog which will be of considerable interest to professional users of sound equipment. The catalog is the first of its type to be prepared by the company, and contains complete technical data on all Altec-engineered sound products. Included are data on AM-FM tuners, transcription arms, microphones, amplifiers and preamps, power supplies, control consoles, and speakers and associated equipment. Copy of the catalog is available without charge to all professional users of sound equipment. **N-1**

• **Conrac, Inc.,** Glendora, Calif., manufacturer of Fleetwood custom TV equipment, is distributing a helpful new booklet suggesting and illustrating various ways of installing custom-built TV sets in the home. Ideas are presented for installing a receiver in each room of the house. Particularly novel is the installation in which the set proper is mounted in the bedroom wall with a tuning unit in the bed headboard. Copy available on request. **N-2**

• **Frank L. Capps and Co.,** 20 Addison Place, Valley Stream, N. Y., details the basic construction of condenser microphones as well as their operational theory, and gives in chart form typical characteristics of the Capps condenser microphone as compared to microphones of other types in a new 8-page brochure titled "Technical Information on Condenser Microphones." The publication is written on a professional level and is aimed at helping engineers and others engaged in professional sound work to utilize condenser microphones to greatest advantage. The booklet will be mailed free on request to professional sound engineers. **N-3**

• **Cinema Engineering Company Division of Aerovox Corp.,** 1100 Chestnut St., Burbank, Calif., has just published Catalog 12E, a two-color 16-page booklet which covers the entire line of Cinema equalizers and wave filters. Completely illustrated and containing a large number of response curves, the catalog includes a great deal of worthwhile information on virtually all applications of filters and equalizers in the field of sound recording. A novel departure is a section devoted to case studies, in which data were selected from actual case histories furnished by Cinema customers. Available on written request. **N-4**

• **Bausch & Lomb Optical Co.,** 35 St. Paul St., Rochester 2, N. Y., describes the value of three-dimensional microscopes for industrial assembly lines and research laboratories in Catalog D-15, one of the most absorbing and attractive pieces of literature ever to cross this desk. The value of wide-field three-dimensional magnification for various assembly and inspection operations is explained in detail. The proper microscope for a specific type of work can be determined by using a ten-question automatic model-selector card. Copies of the 38-page publication may be obtained without charge. **N-5**

• **Superior Tube Company,** Norristown, Pa., has assembled basic data on cathodes and other vacuum-tube components manufactured by the firm in a new 20-page catalog which has just been published. Titled "Superior Tube Electronic Products," the booklet is highly professional in nature and is directed specifically toward tube manufacturers. In addition to information on manufacturing processes involved in the production of electron-tube components, the catalog contains a section on materials which gives detailed chemical and physical properties of 18 cathode alloys, also data on glass sealing alloy tubing, and alloys for fabricated tubular parts. Requests should specify Catalog No. 50-1610. **N-6**

*(Continued on page 62)*

## DRAGON PUP

*(from page 26)*

or their lairs. Countless other shining hours were improved in pouring over catalogs of dragon food.

All this time the farmer's wife was getting more and more jealous of that dragon. At first it had added spice and zest to their otherwise drab existence. A dragon's lair in the corner of the living room was certainly an unusual note in interior decoration. In fact, she was rather proud of it, if only because it showed what a broad-minded wife she was to allow it house-room. Also, since the neighbors all wanted to see the dragon for themselves, the family's social calendar became very crowded. But at these gatherings the dragon owners tended to get off by themselves and talk in a jargon unintelligible to the others. Gradually this jargon began to infiltrate the farmer's daily conversation more and more until his wife began to fear that he and she would become strangers if she did not learn to understand this new language.

So, between curiosity and a sense of self-preservation, Mrs. Farmer began to


. . . catalogs of dragon food.

browse through the dragon-owners' manuals that lay around the house in great numbers. She began to look on while her husband curried the dragon, even lending a hand now and then with the more difficult operations and taking her turn at feeding the animal. Before long she began to catch her husband's enthusiasm and eventually became very fond of their strange pet.

As the months went by, the dragon grew larger. He began to be fussier about his food, about the exact placing of his lair in the living room, and about what pieces of furniture he would allow near his lair. The family rearranged the furniture and built him a bigger den, but still he grew larger and more particular. Finally the farmer and his wife faced the fact that they would have to move to a larger house. This time they built a special room for the dragon, a splendid large room with all the features he particularly liked, and a smaller room nearly for storing the special food he required.

About this time the farmer noticed a funny thing. Not only did he no longer have any money left for the things he formerly had longed for, but he no longer had any time left for such fruitless yearnings. Dragon-keeping, he found, was a full-time hobby and intolerant of competition.

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Up to this point our own family's hi-fi life has paralleled the farmer's experience to an ominous degree. At present, our personal dragon seems fairly satisfied with his new quarters and life appears to be pretty peaceful. But I'm keeping a wary eye on his development because I know the end of the allegory. It seems one day the farmer came home and found that the dragon had eaten his wife and children. Not only that, but he had taken over the whole house and wouldn't even let the farmer come in. So the farmer pitched a tent outside and the last I heard was gazing fondly in at his dragon through the picture window.

## QUALITY AMPLIFIER

(*from page 17*)

design and needs little comment. The reason for the dropping resistor as a second filter is that a spare television power transformer was used, which developed an unexpectedly high voltage. This was reduced to meet the rated plate and screen voltages of the 1622 tubes; perhaps the transformer you may have available will not require the same treatment.

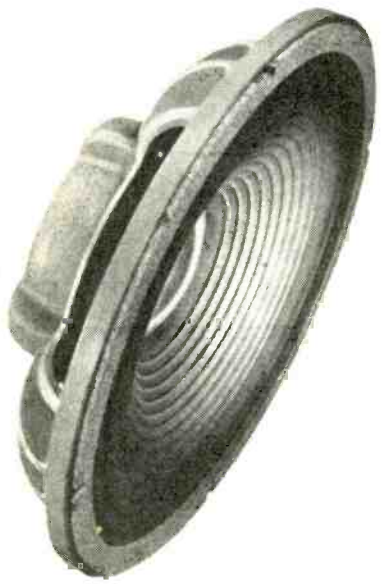
Oil-filled filter capacitors of relatively low values were employed rather than electrolytics; however, the writer is not particularly prejudiced against them. There is, however, a satisfaction in knowing that these components will stand up indefinitely, although, admittedly, large electrolytic capacitors were used for decoupling purposes in the various stages, and hence in time trouble may occur at these points. Although smaller decoupling capacitors could be used, the values indicated do stabilize the amplifier to a large extent against line surges and similar "bumps."

This amplifier is operated into an LC1A speaker installed in an infinite baffle of about 15 cubic feet volume. The results are generally approved by people who have listened to the system, and it appears to be very suitable for the home.

As a matter of final interest, *Fig.* 4 shows the response of the system from the G-E pickup to a 15-ohm load resistor, employing a Dubbings D-101A record for the RCA New Orthophonic curve. The results, it will be noted, are fairly flat, particularly at the low-frequency end of the spectrum, and confirm the satisfactory conclusions drawn from listening tests.

# NEW PRODUCTS

• **Extended Range Speaker.** Entirely unique in design, the new Signature Model 123 12-in. speaker, manufactured by James B. Lansing Sound, Inc., 2439 Fletcher Drive, Los Angeles 39, Calif., has a depth of only 3⅝ ins. It is ideally suited for mounting between studding

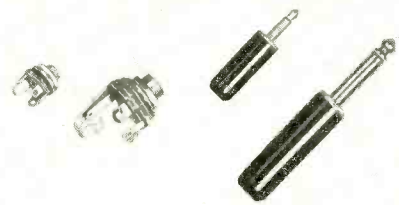


flush with the surface of any standard wall or partition. Equally effective in well-designed speaker enclosures, the unit has a frequency range of 20 to 15,000 cps. Power rating is 20 watts and impedance is 16 ohms. **N-8**

• **Bell Three-Speed Tape Recorder.** New in every respect, the Bell Model RT-75 tape recorder features three speeds, push-button control, and straight-line slot threading. A positive-action lever affords selection of three operating speeds—7½, 3¾, and 1⅞ ips. Frequency response at 7½ ips is stated to be 30 to 12,000 cps; 7500 and 4500 cps are top cut-off frequencies at 3¾ and 1⅞ ips, respectively. Equalization to compensate for the various speeds is accomplished automatically when the desired speed is selected. Exceptionally fast rewind speed permits a

standard 1200-ft. spool of tape to be rewound in 70 seconds. Controls include volume, tone, and push-button recording control with safety interlock which prevents accidental erasure. Inputs are provided for two microphones and tuner. Outputs include a 3.2-ohm jack for external speaker and a high-impedance jack for feeding a hi-fi amplifier. At 1⅞ ips the RT-75 provides six hours of recording on a standard 1800-ft. 7½ in. reel. Complete details will be supplied by Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio. **N-9**

• **Miniature Plugs and Jacks.** To meet the demand created by small tape recorders, musical instruments and similar devices, a new line of miniature plugs and jacks, approximately one-half the size of their standard counterparts, is now being man-

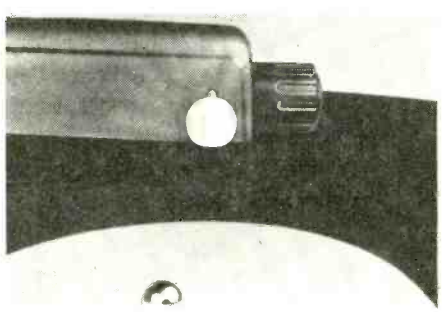


ufactured by Switchcraft, Inc., 1329 N. Halsted St., Chicago 22, Ill. The new items are known as "Tini-Plugs" and "Tini-Jax." Plugs are available with Tenite or shielded handles. Full details available on request. **N-10**

• **Preamp-Equalizer.** The new Knight self-powered preamplifier-equalizer, recently introduced by Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill., serves as a convenient control center for hi-fi music systems, and for modernization of outmoded component assemblies. It incorporates separate bass and treble controls, calibrated from −16 db to +16 db. Five input jacks accommodate all components normally used in music systems. A six-position input selector switch provides three positions of record compensation; FFRR, RIAA, and HICUT for old, noisy recordings. Two output jacks are provided, one each for feeding a tape recorder and a power amplifier. Rated output is 2.5 volts. Frequency response is

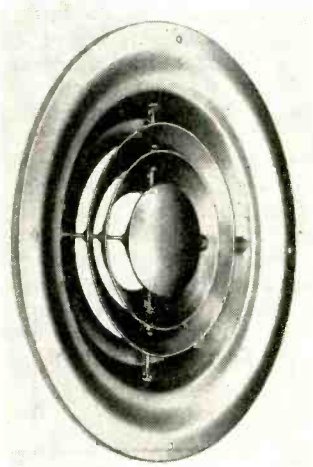
20 to 20,000 cps +1 db. Harmonic distortion at full output is 0.8 per cent. Although designed essentially for table use, the entire unit slides forward ¾ in. in its own case for simplified behind-panel mounting in cabinets. **N-11**

• **Static Neutralizer.** Styled in the form of a tiny ball of pearlescent plastic, "Magic Jewel" is only 9 mm. in diameter and weighs but 1/50 oz. It contains a small amount of radioactive material which automatically reduces the collection of dust on records by ionizing the



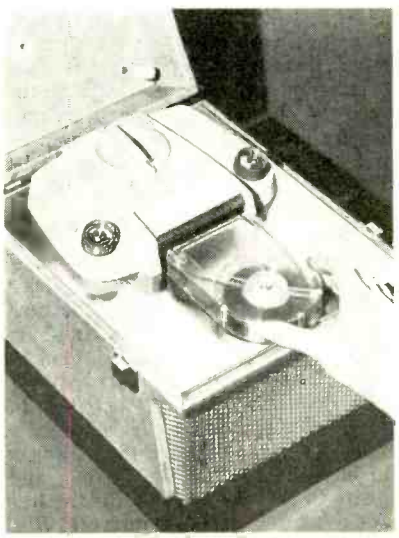
air at the record surface, thus neutralizing static charges. In operation it is clipped to the tone arm of any record player, where it is left permanently in position. Manufactured by Robins Industries Corp., 41-08 Bell Blvd., Bayside 61, N. Y. **N-12**

• **Low-Level P. A. Baffle.** The new Lowell Model STL baffle is constructed of a series of attractive louvres with an exclusive conical sound diffuser to provide 360-deg. dispersion of low-level sound. It is designed specifically for low-ceiling areas such as restaurants, offices, schools, railway cars and wired music installations where attractive decor, concealment, and high audio efficiency are requisites. Lowell STF baffles accommodate 6- to 12-in. speakers and mount in a variety of Lowell-made recessed protective speaker



enclosures. Metallic resonance is eliminated by "floating" the baffle assembly on small rubber grommets. Lowell Manufacturing Co., 3030 Laclede Station Road, St. Louis 17, Mo. **N-13**

• **Clip-In Tape Magazine.** A significant advance in tape recording and reproduction is the new tape magazine which eliminates threading and rewinding of magnetic recording tape, recently developed by American Molded Products, Dept. AOM, 2727 W. Chicago Ave., Chicago 22, Ill. Recorders and playbacks to handle the new magazines are now in design and manufacture by a number of leading companies. The magazine is so designed that the tape is never exposed and is completely protected during use by a plastic enclosure. It handles a 300-ft.



spool and plays in counter-clockwise direction. At the end of the 300-ft. span a Mobius loop arrangement automatically transfers playback or recording to the opposite side, thus providing an effective length of 600 ft. The device can be operated at any speed up to 60 ips. Use of the magazine brings to the tape field for the first time the convenience of instant change from one recording to another, heretofore afforded only by discs. **N-14**

# HARVEY
## The House of Audio
Presents BRITISH MADE
# BEAM
## HIGH FIDELITY COMPONENTS

## Q.C. II
### CONTROL UNIT

A preamplifier-equalizer designed for use in high quality systems. Three inputs are provided: phono with magnetic pickup and 2 for radio, tape, TV or other high level signals. One of the latter two is readily convertible to high gain for use with low level microphone. Separate bass and treble controls are developed in a feedback circuit and operate within 1db of published curves. Another useful feature is a variable-slope low-pass filter which permits cutoff at 10, 7 or 5 kc. A control permits slope of cutoff to be varied from gentle to sharp. A position on the control marked 'cancel' takes all tone and filter controls out of the circuit for flat response. Record equalization is enabled by means of front panel push buttons. These provide 4 different compensation curves covering most records in use today. Power is provided by main amplifier.

**Complete** with tubes ..... **$120.00**

## QUAD II
### AMPLIFIER

An unusually high quality amplifier with a rated undistorted power output of 15 watts, yet capable of 30 watts with less than 1½% distortion. Two KT-66 output tubes are employed, push-pull. Unique circuit design provides for a special cathode feedback loop in the primary of the output transformer. There is also a voltage feedback loop around the transformer and the output stage.

Frequency response is 20-20,000 cycles within .2db, and 10-50,000 cycles within .5db. Hum and noise is —84db below rated output. Power supply is built-in with provision for feeding heater and B+ voltages for control unit. Output impedances of 7 or 15 ohms are available.

**Complete** with tubes ..... **$130.00**

**Complete Quad Amplifier System** consisting of Quad II Amplifier and Q.C. II Control Unit ..... **$237.50**

## STENTORIAN W/B LOUDSPEAKERS

Truly superior extended frequency range loudspeakers, the Stentorians have had enthusiastic acceptance among the most critical listeners. Many have adopted the full range Stentorians for single speaker systems. Others have used them as woofers and mid-range units in combination with the Stentorian tweeters. In either case, the results have been most rewarding.

Stentorian cones are formed of impregnated bonded pulp and rim suspended with uncured cambric.

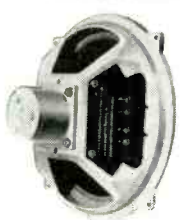
**Duplex Series**—A true coaxial speaker. Employs twin concentric series-magnet design and has machined high frequency horn. Crossover is built-in. Has 35-cycle fundamental resonance and nominal impedance of 15 ohms.

**12-Inch**
Response ..... 20-20,000 cps
Power Rating ..... 15 watts
Flux Density ..... 31,000 gauss
12-Inch Duplex ..... **$99.50**

**10-Inch**
Response ..... 30-16,000 cps
Power Rating ..... 10 watts
Flux Density ..... 25,000 gauss
10-Inch Duplex ..... **$44.50**

**Popular Series**—Single cone, direct radiator with amazingly smooth response. Nominal impedance: 15 ohms, 8, 9, 10 and 12-inch models now feature non-resonant die-cast chassis. Smaller model chassis are made of heavy pressed steel.

| SIZE | Model | Response Cycles/Sec. | Power Rating Watts | Resonance Cycles/Sec. | Flux Density Gauss | PRICE |
|---|---|---|---|---|---|---|
| 12 | HF 1214 | 25-14,000 | 15 | 39 | 14,000 | **$42.50** |
| 10 | HF 1012 | 30-14,000 | 10 | 35 | 12,000 | **14.95** |
| 9 | HF 912 | 40-13,000 | 7 | 45 | 12,000 | **11.55** |
| 8 | HF 812 | 50-12,000 | 5 | 65 | 12,000 | **10.95** |
| 6 | HF 610 | 60-12,000 | 3 | 70 | 10,000 | **6.95** |
| 5 | HF 510 | 100-12,000 | 2 | 150 | 10,000 | **6.55** |
| 3½ | HF 3.57 | 300-8000 | 2 | — | 7,000 | **4.25** |
| 2½ | HF 2.57 | 400-8000 | 3 | — | 7,000 | **3.75** |



**Variable Impedance Series**—Three extended range loudspeakers featuring voice coils providing outlets for three different impedances: 4, 8, and 15 ohms. This unique feature provides unusual versatility when matching speaker to available impedance whether from amplifier or crossover network, or in multispeaker installations. These speakers feature the non-resonant die-cast chassis. Flux density of these speakers is 12,000 gauss.

**HF 1012 U 10-Inch**
Response ..... 30-14,000 cps
Fundamental Resonance ..... 35 cps
Power Rating ..... 10 watts
HF 1012 U ..... **$15.95**

**HF 912 U 9-Inch**
Response ..... 40-13,000 cps
Fundamental Resonance ..... 45 cps
Power Rating ..... 7 watts
HF 912 U ..... **$12.55**

**HF 812 U 8-Inch**
Response ..... 50-12,000 cps
Fundamental Resonance ..... 65 cps
Power Rating ..... 5 watts
HF 812 U ..... **$11.95**

### TWEETERS

High frequency drivers equipped with acoustically matched horns. Employ edgewound Aluminum wire speech coils. Both have a nominal impedance of 15 ohms.

**T-12**
Response ..... 3000-20,000 cps
Power Rating ..... 15 watts
Flux Density ..... 16,000 gauss
T-12 ..... **$52.50**

**T-10**
Response ..... 2000-16,000 cps
Power Rating ..... 5 watts
Flux Density ..... 14,000 gauss
T-10 ..... **$17.95**

NOTE: Prices Net, F.O.B., N.Y.C Subject to change without notice

## 18-Inch
### Low Frequency WOOFER
### Model DC 1814

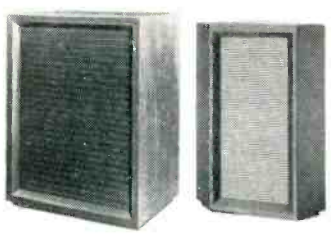
Response ..... 25-4000 cps
Fundamental Resonance ..... 40 cps
Power Rating ..... 30 watts
Flux Density ..... 14,000 gauss
Voice Coil Diameter ..... 2½"
**Model DC 1814** ..... **$179.00**

### CROSSOVER UNIT

A 3000-cycle crossover network employing 2 inductances and 2 capacitors. Input impedance is 15 ohms. Outputs match T-10 and T-12 Tweeters and can be used with any Stentorian cone speakers as Woofers.

**Crossover Unit** ..... **$8.25**

## LOUDSPEAKER ENCLOSURES
### *Westminster & Parliament*



The Westminster and Parliament enclosures are both of bass reflex design and provide optimum acoustic reproduction with any of the Stentorian loudspeakers. Sturdily and solidly constructed, employing heavy lumber, cabinet wall resonance is reduced to a minimum. Low frequencies are clean and crisp without hangover effect. Internal walls are effectively damped against internal standing waves. Reproduction across the entire audible spectrum is smooth and in perfect balance.

Two models of the Parliament are available—both are corner units. The Senior for 12 and 15-inch speakers and the Junior for 12-inch speakers and smaller. The Westminster is designed for flat wall use.

| Model | Height | Width | Depth | Mahogany | Korina |
|---|---|---|---|---|---|
| **Parliament Junior** | 33¼" | 22¾" | 16" | **$89.50** | **$99.00** |
| **Parliament Senior** | 40" | 30¼" | 20¾" | **110.00** | **120.00** |
| **Westminster** | 38¼" | 28" | 19¾" | **110.00** | **120.00** |

## Whitehall
### Bookshelf Speaker System

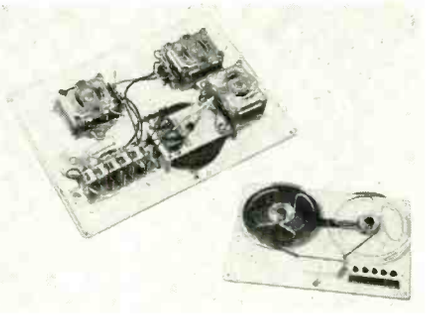
The latest addition to the W/B Stentorian line, the new Beam Whitehall is especially designed to give exemplary performance where space is limited. The system is fitted with an extended range W/B Stentorian Speaker with variable matching input impedances of 4, 8, and 15 ohms. Variable frequency response extends from 30 to 14,000 cycles. Heavy ¾" plywood construction is employed and is enhanced by a ridged high-gloss finish in either Mahogany or Korina. Dimensions: 23½" wide, 11" high, 10" deep.

**Complete** with loudspeaker assembly ..... **$49.75**
**Unfinished Complete** ..... **37.00**

***Harvey Ships Everywhere in the World***

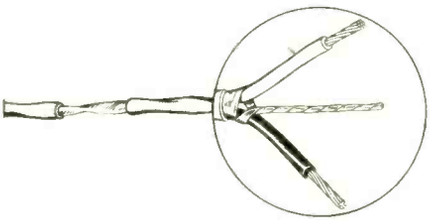
**HARVEY RADIO COMPANY, INC.** ESTABLISHED 1927
**103 W. 43rd Street, New York 36 • JU 2-1500**

• **Hi-Fi Tape Deck.** Three motors, one each for capstan drive, supply reel and take-up reel, are among the features of the new Motek tape deck recently placed on the market by Fenton Company, 15 Moore St., New York 4, N. Y. The Motek electrically interlocked switch and brake system reduces the moving parts of the entire transport mechanism to the motors, flywheel-capstan assembly, and the



tape pressure pad and pinch roller. Response with a suitable amplifier is greater than 50 to 10,000 cps. Wow and flutter are less than 0.3 per cent. Drive noise is reduced to negligibility. The Motek is shipped with a circuit diagram for a build-it yourself preamplifier and oscillator stage which can be plugged into any home music system. Also available for the unit is the Fen-Tone Model EAP-2 ready-assembled preamplifier. **N-15**

• **Sound-System Cable.** Definite improvements in convenience and economy of installation are inherent in the new Belden No. 8790 cable for p.a. and sound systems. The cable is a balanced twisted pair which features a spiral-wrapped tinned copper shield. The spiral wrap is stated to offer greater coverage than the average braided shield. Because it is



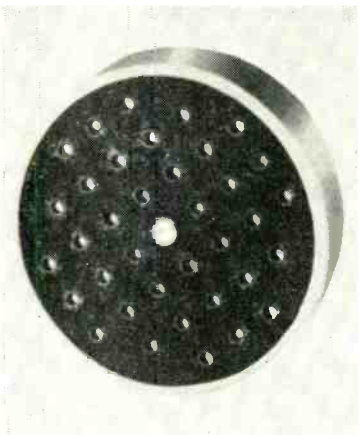
easily unwrapped, twisted and soldered, it eliminates time-consuming terminations. The color-coded twisted pair is accurately spaced to provide line balance and eliminate cross-talk. The cable is covered by a tough crome-finish vinyl plastic jacket which is entirely waterproof. Belden Manufacturing Co., Chicago, Ill. **N-16**

• **Ultra-Low-Distortion Power Amplifier.** Incorporation of 80 db of negative feedback results in extremely low distortion in the new Model UF-101 amplifier manufactured by Krohn-Hite Instrument Co., 580 Massachusetts Ave., Cambridge 39, Mass. Total intermodulation and harmonic distortion is less than 0.005 per cent at 50-watt rated output. Frequency response

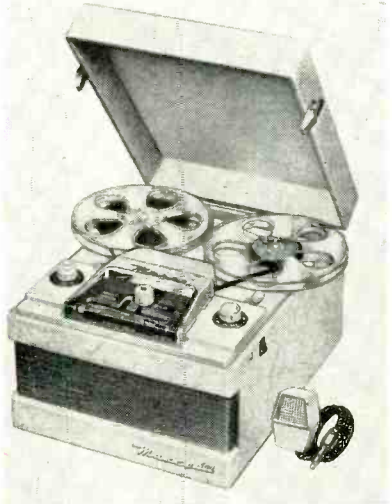
is 0.5 cps to 30 kc ± 0.5 db. D. c. on input stage heater results in noise level 110 db below full output. Excellent transient response is assured at all output impedances from 2 to 450 ohms by switching the feedback loop to the output transformer secondary winding in use. Controls include an input-impedance and low-

frequency cut-off selector, a gain potentiometer calibrated in db, an output impedance selector switch, and a high-low gain switch. The UF-101 fills the need for a low-distortion laboratory amplifier and is particularly useful in the development and testing of audio equipment. **N-17**

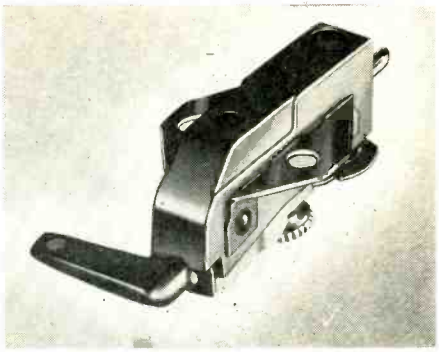
• **Crystal Tweeter.** Manufacturers of radio and TV receivers will find considerable interest in the new crystal tweeter now being marketed by Ronette Acoustical Corporation, 135 Front St., New York 5, N. Y. It is offered to manufacturers as a low-cost means of widening response and adding brilliance to mass-produced radio and TV receivers and to popular-priced record players. The tweeter requires no output transformer, being incorporated directly in the plate circuit of the output tube. A blocking capacitor used in the tweeter circuit effectively attenuates the lower frequencies. Frequency correction in the form of a damping network tuned to the resonant frequency of the crystal is built into the unit. The unit may be pre-tuned at the factory to give any response curve desired. Tweeters can be supplied to manufacturers' specifications with response curves designed for optimum results in the circuit into which they are to be incorporated. Complete information will be mailed on request. **N-18**



• **Masco Tape Recorder.** Frequency response of 50 to 12,000 cps ± 3 db is stated by the manufacturer to be among the features of the new Masco Model 500 tape recorder, a dual-speed twin-track unit which accepts up to 7-in. reels. Operating speeds are 7½ and 3¾ ips. A single knob controls all mechanical functions and is virtually foolproof in operation. Audio power output is 5 watts. Other features include two neon recording level indicators, positive braking action which brings the tape to an immediate stop at any speed, instantaneous changeover from fast forward to rewind without tape spillage or breakage, and a stand-by position which permits setting of volume level before recording. In tests conducted by the United States Testing Laboratory, a prototype of the Model 500 operated without failure over the equivalent of 15 years of use. Manufactured by Mark Simpson Mfg. Co., 32-28 49th St., Long Island City, N. Y. Complete specifications available on request. **N-19**



• **Shure "Music Lover" Cartridges.** Designed to provide naturalness to music reproduction and with sufficient definition to reproduce all instruments sharply and clearly yet with a subtle softness, the new Shure "Music Lover" ceramic cartridge is supplied with a magnetic input adapter which permits it to be used with conventional preamps to take advantage of adjustable equalization usually provided. The new cartridge eliminates the problem of induced hum, eliminates cartridge "drag" caused by magnetic attraction to steel turntables, has higher output, and increases record and needle life over that of conventional high-impedance cartridges. A unique "twin-lever" construction provides a means of shifting styli in a simple and effective manner offers lower mass and higher compliance than many previously available cartridges. Needle replacement requires no tools and can be done in seconds. For further data, write the Shure Brothers, Inc., 225 W. Huron St., Chicago, Ill. **N-20**



# AUDIO ETC.

## Edward Tatnall Canby

## LONG—play?

ONE TASK I do not intend to undertake unless forced to at gun point is the timing of all LP records. Not unless this magazine affords me a full-time secretary and a case of aspirin tablets to go with her.

Yes, I know. You pays yr money and you takes yr chrce and some LP records are very, very long, others very, very short. Yep, I am aware that certain records might be considered a semi-deliberate attempt to sell on 12-inch pressings what could as well fit 10-inch discs. Yes, I know very well that prices, even now, are more or less fixed by the size of the record, not by the number of grooves involved. And so I recognize what the thinkers might call a Potential Inequity in the situation. Maybe an Actual Inequity.

But what I want to know is, how far can you carry your objections, reasonably? True, every man to his own taste and nobody has to buy any fewer minutes of LP per side than he has a mind to. Heaven alone knows what is "reasonable"! I can only say that to my own way of thinking some of our recent correspondents have worked themselves into the unreasonable category and they're going to miss some mighty fine music because it costs more per minute than they think is rightful. (Not, you'll notice, more than they can afford—but more than they think it ought to cost, which is a wholly different matter.)

Now it is highly probable that many of those who are bothered by LP's that aren't long enough do not fully realize the plain physical factors involved in long-play LP. I'll take the risk of talking about what is plenty clear enough to most of us, since quality-vs.-long-play is a matter we should all get straight before making any sort of judgments.

### How Long?

*What is the optimum length for a 12-inch LP record cut for maximum tonal quality?* The figure could not be made exact, but I'm ready to guess that the longest practical compromise for home use, where the loss in quality, especially towards the inner grooves, might be negligible under home hi-fi conditions, would be from fifteen to seventeen minutes.

But even that is a gross generalization, speaking purely technically. If we had fifteen minutes of steady loud music for full orchestra or equivalent, with maximum level and high wave-form complexity, even this short play might be too much for good quality. On the other hand, if the music under consideration were largely *pianissimo*, if it conveniently died away to nothing in the inner grooves—like, perhaps, the "Afternoon of a Faun" by Debussy, then the safe limit for the same engineering standards of quality reproduction might be a lot longer—perhaps twenty minutes.

What about an average figure, then? I ask you, what good is an average? We don't buy average records and we must consider each recorded piece of music on its own. I think you'll find that Westminster's Lab series records—which contain some very loud music—have set up "reasonable" standards for technical excellence of recording quality from the purely physical standpoint. They are not very long.

On the other hand, Caedmon's new Poe recording has a long short story and several poems on each side, and the one-side length is around a half-hour. That is feasible with a single speaking voice and a reader like Basil Rathbone who knows how to control his peaks through long familiarity with the microphone.

Let every recording situation speak for itself, and let us judge each according to the material which is on it. Keep in mind that old Beethoven, one of the world's worst composers for recording (though it's hardly his fault), almost invariably saved his loudest climaxes for the last few measures of his works, which inevitably fall in those ultra-touchy inside record grooves; he also rejoiced in his famous dynamic contrasts, from ultra-soft to explosive loud in microseconds. Many another composer is nearly as bad, from the recording standpoint. But we want their music.

Variable control of groove spacing, it should be said, has vastly improved our ability to record Mr. Beethoven *et al* and achieve reasonable long play plus good quality. Squeeze in the grooves in the *pianissimo* passages, spread them out for the loud explosions (but be sure to spread soon enough)—yet even so, problems remain. No high-level, ultra-loud passage is any good in the small diameter grooves cut in close to an LP label. Groove-spacing or no, the ideal is to keep a wide, comfortable band of clean, unused plastic between *all* music and that label area—and this, of course, is precisely what inflames


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

the casual record buyer the most! It is, nevertheless, the sign of a well-cut recording.

For those who may not fully realize it, then, let's state at once that a really LONG long-play disc is just bound to suffer in quality, and in several unavoidable ways, even with variable groove spacing used to the maximum effect.

(1) For LONG play, groove depth must be reduced (along with it groove excursion or side-to-side "motion") and a lower sound level is inevitable, with greater likelihood of objectionable background noise and a higher likelihood of grainy distortion due to greater sound-magnification of the irregularities in the plastic.

(2) For LONG play, even with maximum groove-width control, the inner area of the LP must be utilized. The tonal quality in that area deteriorates rapidly even with ideal tracking, an ultra-fancy arm and a perfect stylus.

With less-than-perfect playing equipment —the sort 99 per cent of us use—the deterioration in the played sound is even more marked as we approach the center.

(3) Similarly, the inner-groove area, especially when it is loudly recorded, wears away appallingly fast. Highs are so close together and the wave-shapes so steep that tracking of them without distortion is about impossible; after numerous plays there just isn't much left—of highs or middles either.

(4) The phenomenon of "pre-echo," that ghostly anticipation or echo of very loud passages, is due to over-close grooving of loud music. As I think Westminster has pointed out, this echo exists, to distort music, even when it is not directly audible in an otherwise silent groove. It represents continuous distortion during all loud passages. Remedy: space the grooves farther apart. Or cut the grooves less deeply. I.e. reduce the playing time or cut down on the quality, as in (1) above.

Averages don't mean much, but experience does. Out of a lot of experience, I've developed some almost automatic feelings about long-play timings. In a certain sense I've acquired, as doubtless have other record collectors, a sort of instantaneous automatic inner computer that takes in a batch of factors at a glance and comes out with some such remark as "oh-oh," or "aha!" Which being interpreted respectively might mean "That piece is too long for one LP side and I'll bet the last part of it is distorted, especially the loud coda," and "Here's a well-planned LP, a bit short for the money but just bound to sound good —look how neatly they've put the loudest piece on the outside and that quiet piece on the inside grooves."

Yes, LP cutting requires careful planning and very often the combined problems just do not admit of a perfect solution. I quote a letter to reviewers from Decca concerning two new Berlin Philharmonic recordings of a Schubert and a Schumann symphony. It seems to me fairly stated:

"*. . . In issuing these sets we were faced with serious technical problems. The playing-time of the first two movements of the Schubert symphony is 31:40. If we had compressed the first two movements onto one record side, the level and quality of the entire side would have been impaired to a point where the remarkable sonority of this recording would have been completely lost. We therefore decided to split the second movement at a musically logical place. . . . thus reducing the playing time of the first side to a manageable 28:57.*

*"In the case of the Schumann Symphony (playing-time 30:43) we were forced to make a similar split, at the end of the introduction to the 4th movement.*

*"We made these decisions reluctantly and only after careful study and many tests. . . .*"

I certainly commend Decca's frankness here, and on technical grounds I could not possibly disapprove. Decca is most assuredly right.

But what of the music? On musical grounds I can only cringe! No Schubert symphony, nor yet any Schumann symphony, should be split in *any* way on any LP record and that is that. Here, then, are irreconcilable factors, even with all the aids of modern disc cutting. Other recordings have found other solutions—one being, of course, to play the music faster. But that, according to musical ethics, is strictly up to the conductor who, again according to every canon of good musical taste, is strictions upon his high art. If he wants the music slow, then the Company must

somehow deal with the resulting headache —as Decca has.

### Music by the Minute?

And so, by slow degrees, I have been led to the final and biggest consideration—the music. How much is music worth, per minute?

The answer is decidedly not simple! I can only suggest that there are so many musical value-factors, general and personal, that it is just plain foolish to set up time-value standards. Mere length is but one factor and an enormously variable one, at that.

I would willingly pay as much for one short song song by John Dowland of Elizabethan England, sung ideally and beautifully for perhaps two minutes or less, as for a brace of symphonic suites by Rimsky-Korsakoff lasting for an hour or two. You, whoever you are, no doubt have similar feelings—perhaps you'd trade a minute of Mugsy Spanier or Bessy Smith for an hour of the latest mambo.

We must add the complexities of musical value to the comp'lications of recording technique and in doing so we will never, but never, come up with any generalization about optinum recording length that's worth considering.

I mention, finally, part of another letter sent on to me, concerning my own review of the Angel recording "Hommage à Diaghileff" (AUDIO, January 1955). This gentleman was so impressed by my enthusiasm that he *almost* bought the album. That is, until he looked at the timing, as listed in another review, elsewhere.

*"Luckily"*, says this gentleman, the other review *"showed up this expensive fraud of three 12-inch—$17.85, that contained only 74 minutes of playing time. By a little judicious shaving, the whole thing could, and should, have been on one 12-incher."*

Now I hadn't checked the timing on this set, as I say. Indeed, I was wholly unconcious of it as I played the discs. Why? Because the contents of the record—and the superb accompanying booklet—so entranced me that the mere matter of elapsed time never entered my mind at all. To tell the truth, even at a mere 74 minutes I am quite sure that, had I the available cash, I would have acquired the album pronto. This was my own reaction to the gentleman's letter. Frankly I think he missed a very good thing.

But wait a minute. 74 minutes on six sides? That's a bit over 12 minutes a 12-inch side. Rather an extreme, I must admit. I think I'd like to look at those records . . . see what a 12-minute side looks like.

Yep, here's the album and its three records. The sides look mighty good to me, not short at all. But what's this? *The recording is done with variable groove spacing.*

Now *look* (I'm saying to myself); you don't have to use variable grooving on a 12-minute side! Something is cockeyed here. These sides are plenty long enough.

I have just checked with Angel. The correct and official timing on "Hommage à Diaghilef", three 12-inch records, is *two hours, eleven minutes and thirty four seconds, total.* That's just under 132 minutes. The sides average not twelve minutes but

around 22 minutes. Somebody made a drrreadful mistake and my friend here fell for it with a vengeance.

So the "expensive fraud" turns out to be only half as expensive, per minute! My friend can now go out and buy it if he wishes, but it seems to me that if he had worried less about playing length and thought more about content he might have got there sooner.

I admit that there is a possibility for trouble in the ultra-short LP length. There have been some mighty short sides put over on the buyer. But I'm willing to guess that if all factors, including a convenient and useful division of the musical sections, are honestly taken into account, most of these short-sided LP's can be put into a "matter-of-opinion" category.

As for myself, long, long experience with the LP breed makes me feel this-a-way: If I receive two LP records, one of which contains a single Beethoven symphony and the other two Beethoven symphonies, my immediate expectation is that (performance factors aside) the single-symphony disc is going to be the better bet.

I am aware of the new longer long-play records. There is no doubt at all that Vox, for instance, is doing a brilliant job in getting the absolute maximum of quality out of the disc medium at an extraordinary length-of-play. Few will doubt that Vox has managed to get better over-all sound for longer play than ever before (to use a safe advertising phrase!).

But there are still limits and always will be. The question is simply, how far into the potentially dangerous area is it worth while going, for longer play? I don't think any individual can decide. I think Vox is fully as well justified in working towards longer playing time as, say, Westminster is in working with a much shortened playing time in its Lab series. The point to keep in mind is that each one of us must juggle what the engineers like to call the parameters. The factors involved.

And so I shall continue to do no timing (and make no drrreadful mistakes) and I'll hope that the timing factor will take a reasonable but not undue importance in our readers' estimations.

Extra note: While many of our musical-minded correspondents have been objecting to the too-short LP records, most of my engineering friends are equally disturbed by the too-long LP records. Both sides are quite vehement about it. Dare I say that if you average the two you'll come out with . . . well, an average? Uh-uh.

## TUNED-PIPE ENCLOSURE

(*from page 19*)

inside of the enclosure. Now glue a thin strip of foam rubber along the edges that contact the wall in order to obviate any vibrations being set up at the points of contact. Next the Kimsul pad can be fastened to the top with glue and a few furniture tacks. You are now ready to mount the speaker. A 15 × 15 in. speaker mounting board should be cut from ⅝-in. plywood stock, with a 10½-in. circular hole cut in the center for mounting the 12-in. loudspeaker. Speaker lead-in wires should be connected through two ⅛-in. holes conveniently placed in one side of the enclosure near the top. The speaker board may now be mounted over the 13-in. hole in the front panel using eight wood screws equally spaced about the periphery of the mounting board as shown in *Fig.* 9. Finally the front grill frame, 38¼ × 23 in., should be fabricated from ¾-in. square pine stock. This frame should be covered with lumite in your choice of color. The completed front cover may now be fastened to the enclosure front by means of four cabinet door catches. These should be mounted on the sides, two near the top and two near the bottom. This expedient allows for ready access to the speaker in case you want to change speakers etc. In my case, the top was finished by sanding and then applying clear varnish to bring out the natural grain of the mahogany. The over-all effect is very modern. The simplicity of this basic enclosure permits of flexibility in final exterior finish so that if you do not like the modern approach you may apply some other type finish.

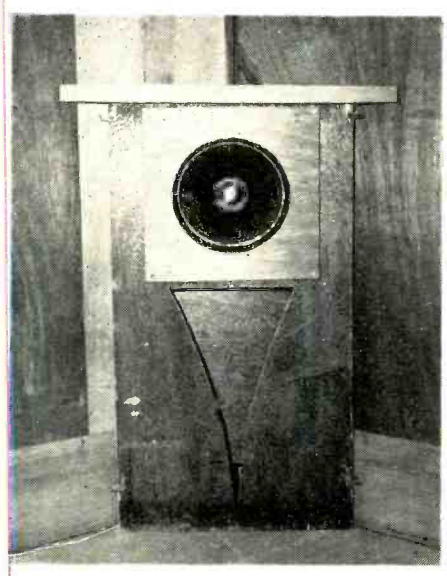


**Fig. 9. Semi-finished cabinet with loudspeaker in place on its mounting panel. Note brackets on edges of front panel for mounting the trimming frame.**

# ARTIFICIAL EAR

*(from page 30)*

**Derivation of Equation**

From circuit theory,

$$\frac{E_m}{E_V} = 1 + 1/j\omega C_m R_P + (1/R_V + j\omega C_P)\quad (1/j\omega C_B + 1/j\omega C_m - 1/\omega^2 C_B C_m R_P), \qquad (1)$$

from which,

$$\left|\frac{E_m}{E_V}\right|^2 = \left[1 + C_P(1/C_B + 1/C_m) - 1/\omega^2 C_B C_m R_P R_V\right]^2 + \left[1/\omega C_m R_P + 1/\omega C_B R_V + 1/\omega C_m R_V + C_P/(\omega C_B C_m R_P)\right]^2 \qquad (2)$$

In the normal adjustment, $C_P$ is adjusted so that

$$C_P + 1/(1/C_B + 1/C_m) = 10/(1/C_B + 1/C_m), \text{ from which} \qquad (3)$$

$$C_P = 9/(1/C_B + 1/C_m) \qquad (3a)$$

Substituting (3a) in (2),

$$(E_m/E_V)^2 = 100 + \left(\frac{1}{\omega C_m R_P} \times \frac{1}{\omega C_B R_V}\right)^2 - 20\left(\frac{1}{\omega C_m R_P} \times \frac{1}{\omega C_B R_V}\right) + \left[\frac{1}{\omega C_m R_P} + \frac{1}{\omega C_B R_V} + \frac{1}{\omega C_m R_V} + \frac{9}{\omega(C_B + C_m) R_P}\right]^2 \qquad (4)$$

At the lowest operating frequency, Eq (4) has its highest numerical value. For example, if $\omega = 3142$. $C_B = 390 \times 10^{-12}$, $C_m = 62 \times 10^{-12}$, $R_P = 10 \times 10^6$, and $R_V = 20 \times 10^6$,

$$1/\omega C_m R_P \cong 0.52 \qquad (5a)$$

$$1/\omega C_B R_V \cong 0.04 \qquad (5b)$$

$$1/\omega C_m R_V \cong 0.26 \qquad (5c)$$

$$9/\omega\,(C_B + C_m)\,R_P \cong 0.63 \qquad (5d)$$

Applying these specific values to (4),

$$|E_m/E_V|^2 = 100 + .00043 - 0.43 + (.52 + .04 + .26 + .63)^2 = 100 + 1.67 \qquad (6)$$

From (6) it can be seen that the second right hand term of (4) is negligible; it is therefore omitted in the following rearrangement of (4)

$$\frac{E_m}{E_V} = 10\left[1 - \left(\frac{1}{\omega C_m R_P} \times \frac{1}{\omega C_B R_V}\right)/5 + \left(\frac{1}{\omega C_m R_P} + \frac{1}{\omega C_B R_V} + \frac{1}{\omega C_m R_V} + \frac{9}{\omega(C_B + C_m) R_P}\right)^2/100\right]^{1/2} \qquad (7)$$

A common mathematical approximation formula is

$$(1 + a)^m = 1 + ma, \text{ where } a << 1. \qquad (8)$$

If we allow $a$ to equal all but the first of the bracketed terms in (7), and let $m = 1/2$, equation (6) justifies the application of (8) to (7), so that

$$E_m/E_V \cong 10\left[1 - \left(\frac{1}{\omega C_m R_P} \times \frac{1}{\omega C_B R_V}\right)/10 + \left(\frac{1}{\omega C_m R_P} + \frac{1}{\omega C_B R_V} + \frac{1}{\omega C_m R_V} + \frac{9}{\omega(C_B + C_m) R_P}\right)^2/200\right] \qquad (9)$$

This can be written as

$$E_m/E_V \cong 10\left[1 + \beta\right], \text{ where} \qquad (10)$$

$$\beta = \left(\frac{1}{\omega C_m R_P} + \frac{1}{\omega C_B R_V} + \frac{1}{\omega C_m R_V} + \frac{9}{\omega(C_B + C_m) R_P}\right)^2/200 - \left(\frac{1}{\omega C_m R_P} \times \frac{1}{\omega C_B R_V}\right)^{10} * \qquad (11)$$

The standard calibration of the microphone is such that

$$D_I = D_C + 20 \log_{10} E_C/E_P + 20 \log_{10} E_m + D_m \qquad (12)$$

By definition of $D_R$,

$$D_R = D_C + 20 \log_{10} E_C/E_P + 20 \log_{10} E_m + 20 \log_{10} (1/.0002) + D_m \qquad (13)$$

From (10)

$$\text{Log}_{10} E_m = 1 + \log_{10} E_V + \log_{10} (1 + \beta) \qquad (14)$$

Since $\beta << 1$,

$$\text{Log}_{10} (1 + \beta) \cong 0.4343\beta. \qquad (15)$$

Substituting (14) and (15) in (13), and combining terms gives

$$D_R = D_C + 20 \log_{10} E_C/E_P + 8.686\beta + 94 + 20 \log E_V + D_m \qquad (16)$$

For the case where $D_C = 53.8$ db, $D_m = 0.3$ db,

$E_C = 200$ volts, $\omega = 6283$, and

$E_P = 150$ volts; then

$\beta = 0.0047$, and (16) becomes

$$D_R = 150.6 + .041 + 20 \log E_V \qquad (17)$$

In this case, if accuracy better than ±0.1 db. is not required, the second term can be dropped, leaving

$$D_R = 150.6 + 20 \log E_V \qquad \text{(for 1000 cps)} \qquad (18)$$

## APPENDIX D

### Procedure for Sound Pressure Response Measurement of Earphone Types 9653-52 and 49507

1. Connect the earphone under test to the test circuit and mount on the 6 cc type 1 coupler as shown in Figs. 3, 6, and 7.
2. Adjust the oscillator output to the 1.1 volt calibration point for 1000 cps.
3. Set the oscillator to the specified frequency and the source voltage switch to the specified voltage.
4. Read the microphone network voltage on the vacuum tube voltmeter and insert the reading ($E_V$) in the following formula for constant available power response at frequencies near 1000 cps:

$$D_R = 150.6 + 20 \log E_V$$

The constant of 150.6 must be modified slightly for other frequencies or microphone sensitivities, in accordance with equation (16) of Appendix C.

# EQUIPMENT REPORT

(from page 36)

models available—in a combination radio-phonograph to a more reliable changer with magnetic pickup.

The complete line consists of the Rex-A Special which contains a built-in preamplifier, 3-stage bass control, 3-step high-cut filter, variable speed control over a range of ±3 r.p.m. for each of the three speeds, and two magnetic cartridges with sapphire styli; the Rex-AM is similar with the exception of not having the built-in preamplifier, while the Rex-A employs a reversible crystal cartridge. Both of these models have built in tone controls, however. Four other models are available as single-play units, with minor variations in equipment. A new model—the Rex-AA—will be introduced in the very near future and will combine the features of the changers already available with the ability to accommodate any conventional cartridge in a plug-in shell.

The changer mechanism is rather unique in operation. Dropping from a center spindle, the record falls only about half an inch, pauses for a second while the pickup arm measures it to determine where to set down. The record then drops to the turntable, the pickup arm moves in far enough to land on the run-in grooves, and the playing begins. Thus it makes no difference if the record is 6, 8, 10, or 12 inches in diameter, nor if it is 6⅞, 9½, or 11 9/32 in. in diameter—the pickup arm moves over, tries the record for size, and then proceeds to set down at the right place and play the record. This procedure is followed with all records—33 1/3, 78, or 45, the latter with a separate spindle. A short solid spindle disables the changer operation for manual playing, except for moving the pickup arm over to the stop at the end of a record and shutting off the power.

Speed change is accomplished by bringing one of the three shafts into bearing with the idler wheel—two of the shafts being driven by the motor shaft using short belts. This is accomplished by moving the entire motor assembly by means of a lever at the left front corner of the chassis. On top of this lever is a speed adjusting arm, which moves a magnet in or out over an eddy-current disc to provide the speed variation. The model tested was arranged to work on any voltage from 110 to 250—the motor itself being a 110-volt unit but working in conjunction with a tapped trans-

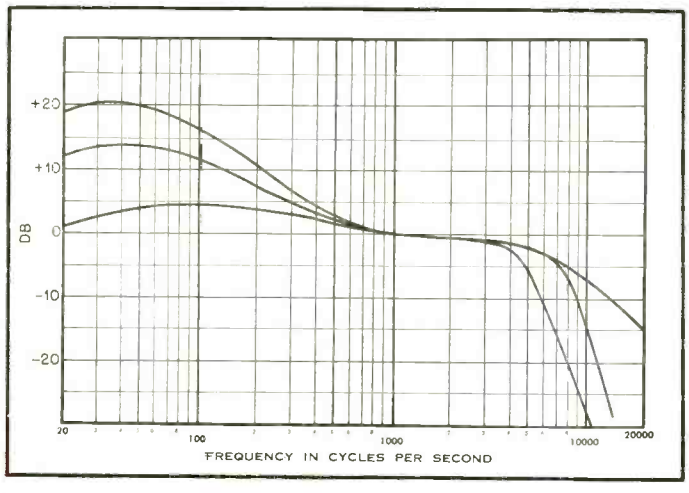



Fig. 7. Response curves obtainable from preamplier in Rex-A Special changer.

former—so that the machine would be suitable for a phonograph that was likely to have to work under many conditions of power supply. The transformer was not a luxury put there only to provide for variable voltage input, but was necessary to supply plate and filament voltage to the preamplifier, which uses an EF-40 pentode. The schematic of the preamplifier is shown in *Fig. 6*, and the response curves are shown in *Fig. 7* for the three positions of bass and for the three positions of high-frequency cutoff. As can be observed, the preamplifier does not provide complete compensation for current recording curves, but would undoubtedly function satisfactorily with conventional tone-control circuits usually available in amplifiers.

Rumble was satisfactorily low, although not comparable with a good professional turntable, as would be expected. Coupling between the unit and the mounting base provides a tuned damping of the mounting springs so as to reduce the fundamental of the motor vibration, and is quite effective in removing motor noise from the audio output.

The pickup cartridges furnished with the Rex-A Special were of the plug-in type, fitting neatly into the arm shell and making contact at the top with two flat springs. The tracking force required for good operation was 9 grams, and the signal output was 0.105 volts at a 7.5-cm/sec groove. Impedance of the cartridge at 1000 cps was 4000 ohms. With this output, the available audio output from the preamplifier was of the order of 0.6 volts for a 7.5-cm/sec groove. Both cartridges—microgroove and standard—appeared to be of the same characteristics, and the claimed response is linear and flat ± 1 db from 30 to 18,000 cps. We were unable to confirm this because of not having any suitable records with an 18,000 cps signal recorded on them. However, on listening tests, it appeared that the response extended suitably over 10,000 cps. Tone control action of the following amplifier was used to provide the required high-frequency rolloff.

Typically European in appearance and construction, the Rex-A changer is attractive, offers many interesting features, and would make an ideal unit for the traveler who was likely to encounter voltages ranging from 110 to 250 and minor variations in supply frequency which would affect speed.

## ELECTRO-VOICE SUPER-CARDIOID MICROPHONE, MODEL 666

Testing microphones without elaborate facilities for absolute measurements is of necessity somewhat subjective, whereas the testing of amplifiers resolves itself to a simple and reproducible series of measurements. However, most anyone will concede that when a microphone user arrives at his conclusions as to the suitability of a microphone for his specific purposes, his evaluation is also likely to be subjective. On the other hand, a trained observer knows what to look for in any piece of audio equipment, and his observations should, conceivably, be as valuable as those of the broadcast engineer who is comparing components.

The Electro-Voice Super-Cardioid microphone, model 666, is essentially a dynamic unit which employs the variable discrimination principle to effect cancellation of frequencies reaching the unit from the rear. In other words, instead of combining the electrical output of a pressure-type microphone with that of a velocity-sensitive unit, the variable discrimination unit effects the phase change acoustically before the signal becomes an electrical one.

The earlier types of cardioid microphones employed a pressure-type unit with a velocity-type unit, so that when a signal arrived at the microphone from the front the outputs of the two units were in phase and added; when the signal came from the rear, the two units were out of phase, and cancelled each other. This construction—while working satisfactorily—requires two microphone units, and is consequently relatively expensive. By designing the acoustic chamber of the microphone so that a signal reaching the unit from the rear effectively reaches both sides of the diaphragm at the same time, the same effect is obtained.

While somewhat difficult to understand, let it suffice to say that the principle works, and in open air the cancellation is well over 20 db from front to back. This figure is modified somewhat in rooms, depending upon the reflectivity of the walls. However, in usual applications, the cancellation is sufficient to permit working at a much higher gain setting before feedback starts—a useful feature in p.a. applications, and for broadcast use with audience shows where the speech reenforcement system is turned on continually.

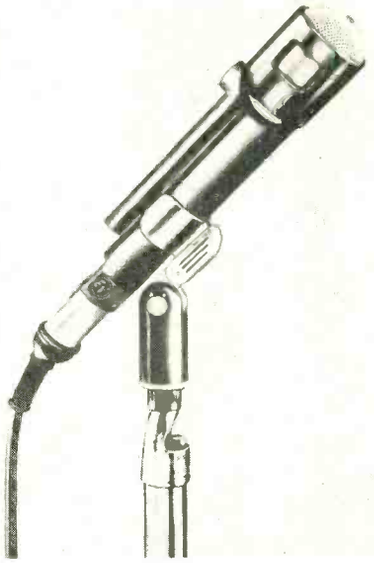


Fig. 8. Electro-Voice Model 666 microphone.

The 666 is extremely sturdy—we have actually seen an engineer (in the factory) pounding on the case with a hammer without cracking it. This is not a recommended practice, but microphones do get dropped occasionally, and it's good to know that no damage will result from dropping, or from swinging a TV mike boom against a wall or a light fixture.

We actually used the 666 in recording an extemporaneous jam session in a private home where the "studio" was some 8 by 14 ft. in size, and where piano, sax, drums, trombone, doghouse, and vibes were all playing—usually at once. The results were more than could be expected from a conventional microphone in such a small space, and the finished tapes give no indication of the cramped quarters. Response is claimed to be flat from 30 to 15,000 cps, which appears to be borne out by sibilants and other indications of wide-range sound. The E-V 655, a conventional dynamic model is slightly brighter when worked "head on" but side by side there is little difference in quality if the 655 is worked with the dia-

phragm pointing up to give a 90-deg. angle of incidence.

The microphone is finished in a non-reflecting TV gray, and attached to the mike stand with an unusual clip arrangement which permits instant but noiseless removal —a useful feature in studio work. In direct comparison with the 655 we found it to have equivalent quality—and the 655 has already acquired an excellent reputation in the quality field—and to have some advantages which were not present with the 655. If a user is limited to a single microphone, it is probable that he would be best served by the cardioid, since it becomes effectively non-directional when used with most of the sound reaching the unit with a 90-deg. angle of incidence. The cardioid is also especially useful in locations where there is likely to be considerable reflection from the area back of the microphone, such as for announcers in small booths.

### THE B-J PHONO ARM

In last month's report, it was stated that the pivots were needly-pointed screws seating in holes in the tubular aluminum arms—without mentioning that the actual bearings were in steel inserts set into the aluminum arms. Obviously steel to aluminum does not make a bearing which is reliable over a long period, whereas the steel to steel contact does.

## AUDIO PATENTS

(*from page 4*)

can systems. The *caveat* is allowed, as is application in some cases by the assignee (a reform which has recently been added to the U. S. patent laws). The patent must be worked within three years of granting, and any person may sue for a declaratory judgement on the scope of a patent and its validity, rather than going through an infringement proceeding. It is interesting to note that the marking of patented articles with the patent number as a constructive warning against infringement is desirable in most countries since lack of knowledge that he was infringing is then no defense by an infringer. However, in Canada this marking is compulsory, and a fine or imprisonment can be imposed for failing to do so!

All the world's patent systems have, of course, many devious and intriguing feature which would fill many volumes. In France, for example, so much is the *haut couture* regarded jealously as a national industry that copying of clothing designs without authorization is actually a penal offense!

A good deal of this information on foreign patents was obtained from a reading of "Inventions and Their Management," a very fine book by A. K. Berle and L. Sprague de Camp, published by International Textbook Company. Unlike most volumes on patent law, this one not only covers all conceivable legal problems in its 742 pages, but also devotes lengthy chapters to the very important questions of what and when to patent, how to go about getting someone to give you money for your ideas, and the like. It is the most complete work this writer has ever seen on the subject, and should without question be in the library of anyone who is concerned in any way with patents, ideas, inventions, or research. Aside from everything else, it is fascinating reading, as might be expected from knowledge that Mr. de Camp is a well known writer of fiction in addition to being an engineer. A new third edition was published just last year and it is thoroughly up to date.

# ABOUT MUSIC


HAROLD LAWRENCE*


## Heard but Not Seen?

AMONG music lovers, the following question comes up quite frequently: Does this tenor or that violinist sound as good, not as good, or better than his records? Such queries are based on the correct assumption that the microphone, tape, and studio environment can add to, subtract from, or otherwise alter "live" sound. It's an absorbing topic, because of the many variable factors involved.

Take the case of Maria Callas. Her Chicago debut last November left a very lasting impression upon public and critics. The Chicago Civic Opera House was packed and Callas, who is first and foremost a stage personality, rose to the occasion with a vibrant interpretation that was heightened by every means at her disposal: gesture, pose, inflection, a trim figure (weight 135 lbs.), and a commanding stature . . . all of which made her Norma a very convincing heroine. By isolating the voice from the total artist, however, certain qualities came into prominence which, in the heat of performance, generally go unnoticed. For one thing, Mme. Callas cannot always control her top notes which have a tendency to sound thin and edgy, sharping often at the most important point in the aria. On sustained high notes, her tremolo can sometimes resemble a slow trill. To the discophile unfamiliar with the "live" artist and disturbed by her vocal imperfections, Callas's chief talents lie in her expressive phrasing and her unusual flair for the dramatic. Apparently this is enough to assure a continuing success for her recordings. But, even her best discs do not begin to convey the tremendous impact of her full personality.

Another artist whose live performances surpass his recordings is 71-year-old Wilhelm Backhaus. Over a year ago, he made a triumphal return to the United States after an absence of some 28 years. The ovations he received at Carnegie Hall were spontaneous, not reverential. After the opening chords of the *Pathétique*, you forgot about age, time, and technique. As Harold C. Schonberg put it in the New York Times, "his playing is immense, monolithic, carved out of granite . . . when Mr. Backhaus goes about his work, the music emerges in gigantic proportions." The proportions are almost imperceptibly diminished in Backhaus's recordings of the Beethoven sonatas. Not that the performances are lacking in vitality and imagination; the calibre of musicianship is the same. But, in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A Flamenco dancer in typical costume
Details of Andalusian dance and costume.
Both photos courtesy Spanish Tourist Office.

comparison with the live Backhaus, one is aware of a less urgent propulsion, of a slackening of tension.

The absence of the visual element in the above cases is a trifling detraction next to recordings of folk music. Listening to a number of cante flamenco disks, for example, is like being restricted to the sound track of a film which features practically no dialogue and a lot of action. Flamenco melodies are generally held down to the range of a sixth. The voices are untrained, crude, often ugly, and sometimes downright unbearable especially when a note is repeated over and over again. (The motto of most flamenco singers seems to be: "Ay, ay, blow the mike down!") Snapping fingers, stamping heels, clicking castanets, exclamations on the part of onlookers, and even, in the case of a good recording, the swish of a skirt . . . all these ornamental features of the dance may be captured on disc, and still the effect is unsatisfying as an artistic entity.

Sargent's magnificent painting, "El Jaleo," expresses more in oils than the sound of the artists themselves. The dimensions of color, movement, form—all the details that go into an "authentic" flamenco dance are here: the line of men and women sitting against the wall of an old building whose bricks are showing through plaster; two men playing guitars; another clapping his hands; a fourth, his face thrust upward, eyes closed, appears to be singing; the characteristic gestures of the woman dancer in foreground, her rosy flesh tones a dramatic contrast to her dark hair and black shawl.

Flamenco recordings must therefore be considered as artistic supplements. To those familiar with the real thing, of course, memories and even excitement will be conjured up. But when a composer incorporates folk songs and dances into a larger musical canvas, the results take on a broader, more integral meaning. Canteloube's arrangements of the songs of the Auvergne are a case in point. The most popular in the set, *Bailero*, is a haunting tune whose first dozen notes are the same and whose range seldom exceeds a fourth. Critics have hailed Canteloube's arrangement as "an absolute masterpiece." Why? The answer lies in Canteloube's evocative orchestration. Madeleine Grey, whose recording of these songs (Columbia ML 4459) has become legendary, relates how the melody was discovered:

"Finding himself one day, in the course of a ramble through Auvergne . . . he paused on a rather lofty peak, from which a vast and magnificent landscape revealed itself. A musical composition occupied his thoughts at that time. To dream about it completely at his ease, he sat down on a meadow near a thick hedge. Suddenly, just behind him on the other side of the hedge, the voice of a shepherdess burst forth at the top of her lungs with the song of the bailero.

"Canteloube immediately wrote down—a true musical dictation—the entire song, being careful not to show himself in order not to frighten the shepherdess, who believed herself to be alone. A voice answered, but from so far away that it was sacrcely perceptible and at moments it disappeared as if blown away by the breeze

that rises in the evening on the mountains."

*Baïlero* is more than a harmonization of a folk melody. Canteloube injects into it the landscape, the flavor of the province, the mood of the shepherdess. Some call this "dressing up." Yet without the touch of the "couturier," *Baïlero* might never have been apotheosized into an expressive musical composition. And the same applies to the "dressed up" scores of Falla, Kodály, Bartók, Vaughan Williams, and Copland.

Although unable to transmit intact some musical personalities and forms of music, recording techniques can enhance others. Shortly after the war, HMV released a version of Brahms's Variations on a Theme by Handel played by Solomon. It was and still is a model of piano playing. Yet when Solomon performed this work in public, one was not conscious of the supreme control that characterizes the recording. In the recording studios, where the artist is given "breathers" between 'takes,' and permitted to smooth out ruffled spots, a fresh, top drawer approach can be maintained over a longer period of "recorded" time.

Then there are those who simply record well, the way some people are photogenic. In some instances, their records are too good—that is, microphone placement can result in a larger-than-life tone, one that will lead the public to expect "big things" from an artist, and be disappointed when the real article doesn't come up to the discs.

The British novelist, Graham Greene, finds that he prefers to describe his characters only by their actions. "It has always seemed to me," he wrote, "that in the novel the reader should be allowed to imagine a character in any way he chooses. I do not want to supply him with ready-made illustrations." After being repelled by clumsy Cavaradossis, silly Salomés, middle-aged Mélisandes, and tubby Tristans, the operagoer who tires of "ready-made illustrations" may prefer to relax with his recordings and select his own ideal versions of these operatic characters.

To sum up, the discophile would do well to intersperse his home listening with an occasional trip to the concert hall. There he will re-acquaint himself with the source and return to his music system with a fresh perspective. All of which goes to prove that you can't always tell an artist by the grooves he cuts.

## NEW LITERATURE

(*from page 45*)

● **Sylvania Electric Products, Inc.,** 1100 Main St., Buffalo 9, N. Y., has recently published a new manual of practical applications for junction transistors. Titled "28 Uses for Junction Transistors," the 48-page booklet is directed primarily to the experimenter and electronics hobbyist, although it also contains much information of interest to engineers and technicians. The book is divided into five chapters: Elementary Transistor Theory, Transistorized Amplifiers, Transistorized Oscillators, Transistorized Control Devices, and Transistorized Instruments. It is profusely illustrated with charts and diagrams. Requests for copies must be sent to the address shown above, and must contain a remittance of twenty-five cents. **N-7**

## CLASSIFIED

**Rates: 10¢ per word per insertion for noncommercial advertisements; 25¢ per word for commercial advertisements. Rates are net, and no discounts will be allowed. Copy must be accompanied by remittance in full, and must reach the New York office by the first of the month preceding the date of issue.**

# *Industry People . . .*

**Gordon Gow,** sales manager for McIntosh Laboratory, Inc., made flying trip to New York to stimulate sales of McIntosh amplifiers . . . **Nat** and **Chuck Mendelsohn,** the father-and-son team which owns Music Age, Inc., the lavish audio salon on Highway 4 in Paramus, New Jersey, enthused over sales figures which more than double those for the same period last year . . . History repeats itself in the return of **Edwin Cornfield** to Avnet Electronic Supply Co., New York, after an absence of several years . . . **Philip Erhorn** has resigned from Audio & Video Products Corporation to join Audiofax Associates, New York.

**Lt. Paul Sampson, USA,** son of **Harvey E. Sampson,** president of New York's Harvey Radio Company, visiting home on final leave prior to embarkation for overseas duty . . . **Russ Tinkham,** sales manager for Ampex Corporation, conspicuous by his absence at recent I.R.E. Convention, was attending exhibit of instrumentation equipment in Chicago. **Jim Ford,** Ampex advertising manager, carried the ball for the home office at the I.R.E. show, then followed through by officiating at the Ampex exhibit before a convention of geophysical equipment users the succeeding week.

**Jeanne Lowe,** who has been handling public relations for Minnesota Mining & Manufacturing Company as a member of the firm of Roger Brown, Inc., has resigned to become head of magazine publicity for ACTION, Inc., a new non-profit organization formed by the Advertising Council. "ACTION" means American Council To Improve Our Neighborhoods . . . **John H. Waddell,** veteran specialist in high-speed photography, has joined Fairchild Camera and Instrument Corporation as sales and applications engineer . . . Recent promotions at International Resistance Company find **Leo J. Jacobson** named chief engineer; **George Williams** appointed group leader in product engineering; **Benjamin F. Gerding** named manager of manufacturing engineering, and **Carl Smith** promoted to manager of quality control.

**Harry N. Reizes,** managing director of the New York Audio Fair, reports that more than 60 per cent of last year's exhibitors have signed contracts for participation in the 1955 event; the 1955 Fair is scheduled for October 13–16 in the Hotel New Yorker . . . **Norman Sanders,** formerly with Leonard Radio, Inc., in downtown New York, has made the trek uptown to the fabulous Liberty Music Shop on Madison Avenue, where he is handling sales in the audio department; he is working directly with **Frank Donnola,** manager of Liberty's record department, who is a hi-fi enthusiast from 'way back . . . **Al Polak** has been named assistant to **Floyd J. Van Alstyne,** distributor sales manager of Permoflux Corporation . . .

# *Industry Notes . . .*

**Altec Lansing Corporation** conducted a national sales meeting April 19–21 at the famous Desert Inn in Las Vegas, Nev.

In attendance from the company's New York headquarters were D. C. Collins and H. S. Morris, product sales manager. Representing the firm's west coast plants were George Carrington, president; A. A. Ward, executive vice-president, and R. J. Carrington, advertising manager. Altec sales representatives from various parts of the country were R. W. Amos, Dallas, Tex.; W. H. Johnson, Chicago, Ill.; G. L. Carrington, Jr., Los Angeles, Calif; William Hazlett, New York City, and E. Grigsby, Beverly Hills, Calif.

The Desert Inn, incidentally, is equipped with an Altec Lansing sound-reinforcement system which was installed only recently by Altec Engineers.

**Webster-Chicago Corporation** announced recently the formation of a British corporation, **Webcor of Great Britain, Ltd.,** to manufacture and sell Webcor phonographs, tape recorders, and record changers. The first public showing of the British-made Webcor products is planned for the National Radio and Television Exhibition to be held in London in August. Webcor of Great Britain will not confine its selling activities to England and the sterling countries, but will sell in any market where conditions are favorable, according to Norman C. Owen, Webcor president.

## ADVERTISING INDEX

# SIMPLE AS A B C

To make it just as easy as possible for AUDIO's readers to subscribe, order books, get further information about the new products and the new literature mentioned in the pages of the magazine, or to get catalog sheets and brochures describing articles advertised, we provide herewith three cards. We know that many readers are loath to cut coupons from the pages of their favorite magazine because they have told us so. And we know that many times one would like to have complete and thorough data about something he sees in these pages, yet he considers it too much trouble to hunt up paper and envelop—not to mention the stamp—and write a long letter detailing what he wants to know. This is just as simple as we know how to make it with the exception of stenciling each subscriber's name and address on each of the postcards—an operation which would be highly impractical from the printing standpoint. But from now on, when you want more information about something you have seen advertised or mentioned in AUDIO you need only indicate it on the appropriate card, print your name and address, and drop it in the nearest postbox. We pay the postage, and it goes without saying that we wouldn't include these cards if we didn't welcome your use of them. And, for the first time, you can enter your subscription without sending a penny with your order—we'll bill you later. For books, we'll have to ask for the money in advance, but only for books.

Readers have told us that they often want to know more about some of the items mentioned in the *New Products* and *New Literature* pages of the magazine, but that they do not want to take the time and effort to write to each one of the sources individually to get all the information they need. As a matter of fact, in an average issue there are usually ten items in the *New Literature* column, and between ten and fifteen on the *New Products* pages. It is conceivable that the average reader might want information on at least ten of these items, since they are selected with the interests of most of AUDIO's readers in mind. Thus one would have to have ten envelopes, ten sheets of paper, and ten three-cent stamps, together with the need for writing the ten letters and inscribing each with name and address. We do it all for you, assuming that you are willing to circle the items about which more information is desired and to write your name and address once. We will forward your inquiries to the organization involved, and you will receive the data you want with only one inquiry. Isn't that as simple as A B C?

In just the same way you can get more information about any product that is *advertised* in the pages of AUDIO. But there is a little more work involved in this, since you must indicate the item in which you are interested and the name of the manufacturer. However, you still have to write your name and address only once for all the information you want about advertised items from a single issue—unless you want to know all about everything. If your cards indicate that this is likely to be the case, we will make them larger to fit your requirements. In the meantime, if you *do* need more space, you might subscribe to *two* copies.

FOR OFFICE USE

N

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Unfortunately, we do have to have money with your order in the case of books, for many of those our readers order are those which we must purchase from other sources. And even with our own publications, we do have to pay the printer if we expect to have him print the next book we put out. But we can help in this fashion—if you want any book from any publisher, just list the name of the book and the author and we'll get it for you. It helps if you know the name of the publisher, but that isn't necessary. If you aren't sure about the price, make a good guess and enclose that amount—we'll mail the book COD for the difference, or we will refund the overpayment if you are too generous. In any case, we pay the postage on the book, although you will have to pay the postage on the envelope you use to send us the order card. Try it once and see how easy it is!

●

At the end of each item of **New Literature** or **New Products** you will notice a letter and a number—the letter indicates the month and the number indicates which item it is. All you have to do to get full information about the product or to get the literature described is to circle the appropriate number, add your name and address—printed if possible, so the information doesn't end up in the Post Office at Washington—and mail it to us. We'll do the rest, and you may be sure that we'll be prompt because we are just as anxious for your inquiries to get to their destination as you are—and besides, we don't have room enough around the office to accumulate a lot of cards. Circle one item, if you wish, or all of them—we'll carry on from there. This whole system breaks down if there is a charge for the **New Literature** described, so if you can suggest any improvements in this service, we would appreciate hearing about them.

●

We can't think of any way to simplify this card without actually listing every product mentioned throughout the magazine, and this becomes an impossibility—we don't always get the ads sufficiently far in advance of printing time to make it possible to plan such an elaborate card. So if you want to know more about any product advertised—except from the Classified section—just write down the product and the name of the advertiser as well as your own name and address. We can't promise that no salesman will call, but we think it highly unlikely, because very few manufacturers have enough salesmen to answer all the inquiries individually in person. But we are sure that each manufacturer will be glad to send you the information you want without any obligation. If we find that this card doesn't have enough room for all the information you want, we will have to enlarge it, but let's try this one for size.