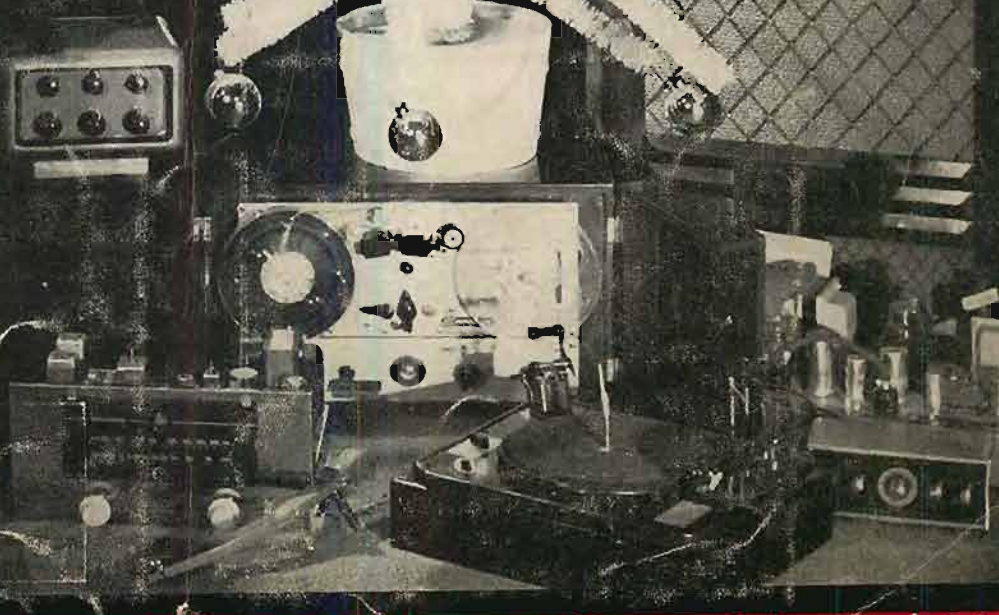


How to Brace a Speaker Cabinet - See Page 24

AUDIO ENGINEERING

and *Audio in the Home*

DECEMBER
1953
35c



THE WORLD OF SOUND

audiotape

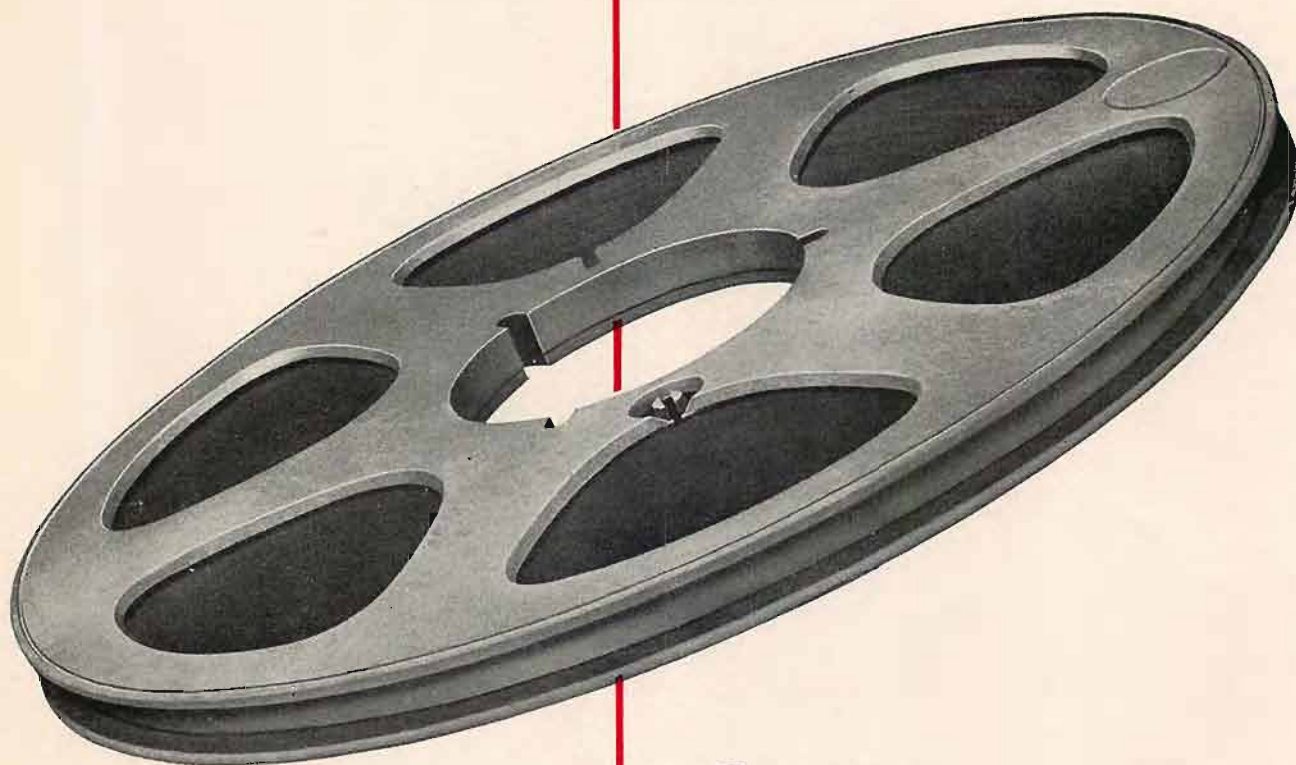
TRADE MARK

now available

on new

Fiberglas

10½" reel



SOLID, ONE-PIECE CONSTRUCTION

STANDARD N.A.B. HUB DIAMETER

25% LIGHTER THAN ALUMINUM REEL

HAS SMOOTHER FLANGE EDGES

WILL NOT BEND

RESISTS WARPING AND DISTORTION

PRACTICALLY INDESTRUCTIBLE

HERE'S A NEW 2500-foot reel with a number of improved design features that will appeal to many tape recordists.

Audiotape can now be supplied on this light-weight Fiberglas reel at *no increase in price*. For a trial order, get in touch with your nearest Audio distributor. If he doesn't have the new reels in stock, have him contact our New York, Chicago or Hollywood office and we'll see that your requirements are promptly filled.

This is another example of how Audiotape gives you *extra value* at no extra cost. Its performance speaks for itself. Output, frequency response, noise level and distortion are correctly proportioned for the most satisfactory end result—with no compromise on quality anywhere along the line.

AUDIO DEVICES, Inc.

444 MADISON AVE., NEW YORK 22, N. Y.

Offices in Hollywood — Chicago

Export Dept., 13 East 40th St., New York 16, N. Y., Cables "ARLAB"



**audioreels
audiotape
audiofilm
audiopoints**

Successor to **RADIO** —Established 1917

AUDIO ENGINEERING

INCLUDING



C. G. McProud, Editor and Publisher

Henry A. Schober, Business Manager

Harrie K. Richardson, Associate Editor Edgar M. Villchur, Contributing Editor
Robin Melton, Production Manager S. L. Cahn, Advertising Director
Edgar E. Newman, Circulation Director H. N. Reizes, Advertising Manager

Representatives

H. Thorp Covington, Special Representative
7530 North Sheridan Road, Chicago 26, Ill.
Sanford R. Cowan, Mid-West Representative
67 W. 44th St., New York 18, N. Y.

West Coast

James C. Galloway J. W. Harbison
816 W. 5th St., Los Angeles 17, Calif.



CONTENTS DECEMBER, 1953 Vol. 37, No. 12

Audio Patents—Richard H. Dorf	2
Book Review	6
Letters	8
Audiology—W. R. Ayres	12
Coming Events	14
Editor's Report	16
Magnetic Transfer of Stainless Steel Recording Wire—Samuel Storchheim	19
An Automatic Disc Recorder—Curtiss R. Schafer	21
A New Wide-Range Phonograph Cartridge—John F. Wood	22
Vibration Reduction in Loudspeaker Enclosures—G. B. Houch	24
Tired Business Man's Radio Cabinet and Speaker—C. C. Fraser	26
The Audio Fair Review—Harrie K. Richardson	28
Handbook of Sound Reproduction—Chap. 15, Part 1—Edgar M. Villchur	34
Audio ETC—Edward Tatnall Canby	40
Record Revue—Edward Tatnall Canby	42
Technicana	46
New Products	48
New Literature	50
Industry Notes and People	71
Annual Index	73
Advertising Index	76

COVER

Most Christmas trees throughout the nation will feature toys and dolls this month—the former for little boys and the latter for little girls. However, lives there an audio hobbyist with soul so dead who never to himself has admitted inclinations toward both—"toys" in the form of amplifiers, speakers, tape recorders, and other paraphernalia dear to the heart of those who search for good music reproduction, and "dolls" such as model Marta Roman. This photo, conceived three years ago, awaited realization until the right doll could be located. Studio and equipment were supplied by Air Tone Sound & Recording Company, of Philadelphia.

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

AUDIO ENGINEERING (title registered U. S. Pat. Off.) is published monthly at 10 McGovern Avenue, Lancaster, Pa. by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary, Executive and Editorial Offices: 204 Front St., Mineola, N. Y. Subscription rates—United States, U. S. Possessions and Canada, \$3.00 for 1 year, \$5.00 for 2 years; elsewhere \$4.00 per year. Single copies 35c. Printed in U. S. A. All rights reserved. Entire contents copyright 1953 by Radio Magazines, Inc. Entered as Second Class Matter February 9, 1950, at the Post Office, Lancaster, Pa. under the Act of March 3, 1879.

Engineering

WRITERS

ENGINEERS, E. E. or PHYSICS GRADUATES, for preparation of technical manuals...

HUGHES RESEARCH AND DEVELOPMENT LABORATORIES' expanding program for production of radar, electronic digital computers, guided missiles and other military advanced electronic systems and devices requires the following:

- 1 ELECTRICAL ENGINEERING AND PHYSICS GRADUATES** to prepare operating, servicing and overhauling instructions for complex electronic equipment. Those with previous maintenance experience on military equipment preferred. Writers will participate in a three-month program in our technical training school to become familiar with the latest Hughes equipment prior to writing assignments.
- 2 ENGINEERS EXPERIENCED** in the writing and preparation of maintenance manuals for electronic equipment or guided missiles. These specialists will work step-by-step with the people designing, developing and manufacturing the products involved. Experience in the writing of engineering reports is of value.

HOW TO APPLY

Write full details of your qualifications to

HUGHES

Research and Development Laboratories

SCIENTIFIC AND ENGINEERING STAFF
Culver City, Los Angeles County California

Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

**NEXT TIME
BE SURE!**

Next time insist on
PEERLESS transformers

Peerless quality is
ECONOMICAL

Peerless quality is
UNIFORM

Peerless quality is
DEPENDABLE

For years Peerless engineers have designed transformers to meet the most unusual and stringent specifications submitted by civilian manufacturers and government contractors, and have manufactured these transformers with tight quality control. The small difference in price means a BIG difference in performance.



Next time let us quote on your transformer requirements.

PEERLESS
Electrical Products

A DIVISION OF **ALTEC**
TRANSFORMER CORPORATION

9356 Santa Monica Blvd., Beverly Hills, Calif.
161 Sixth Avenue, New York 13, New York



AUDIO PATENTS

RICHARD H. DORF*

TODAY'S BEST AUDIO AMPLIFIERS are becoming better and better; in fact, it is quite possible that they are—from the performance standpoint—as good as they ever need to be. Distortion is down to negligible values which cannot affect our ears; frequency curves are flat as a pancake; and output powers are more than enough. This may sound a little like the statements that were said to be made sometime in the late eighties that all the inventions that could be made were already made.

That is not the sense of the remark. A good many more inventions and developments need to be made in the audio field—not to improve the possible quality of amplifiers, but to improve the normal individual's chances of obtaining an amplifier with optimum characteristics for something less than an arm and a leg. In other words, now that we know we can have amplifiers with fidelity better than the original music,¹ let's simplify and cheapen the circuits and components so that everybody can have one.

One of the paradoxical reasons for high cost in amplifiers is that the band to be transmitted must usually be very much wider than the band anyone can hear. A few amplifiers are flat up to the apparently ridiculous frequency of 100,000 cps. and more where even a bat would need a hearing aid. But this is required to provide for the large percentage of negative feedback, which is primarily responsible for high audio quality. If there is attenuation of the pass band anywhere near the ends of the audible spectrum, there will also be phase shift which spells death by oscillation to

the feedback loops because of reversing phase at certain points.

It seems to the writer that John M. Miller has struck out along the right path in his patent No. 2,652,458, which is assigned to Bendix. The patent covers an "amplifier with positive and negative feedback," but there is as much horse sense as engineering in the approach, and more than immediately meets the eye.

The advantages of negative feedback are well known—reduction of distortion of all kinds, including frequency, and loudspeaker damping. In the last couple of years the advantages of adding positive current feedback within the amplifier have come into the open; with it some of the offset in gain caused by negative voltage feedback can be reduced and the output impedance can be brought right down to zero, or even negative values, for almost perfect speaker damping. The rub is that the usual method of applying optimally large amounts of positive and negative feedback requires highly expensive output transformers and wideband coupling in all the stages.

Mr. Miller's amplifier has both negative and positive feedback loops. His trick is principally (a) to recognize that with a transformer of good but not premium quality, the negative feedback will, after the extremes of the audible band, turn positive; and (b) to simply incorporate a very elementary network in the positive feedback loop so that when the negative feedback tends to become positive and the positive feedback tends to become negative and keeps the amplifier from oscillating.

Figure 1 shows the schematic diagram of an amplifier designed according to the invention. The amplifier proper (which be-

* 255 W. 84th St., New York 24, N. Y.
¹ Joke. No indignant letters, please!

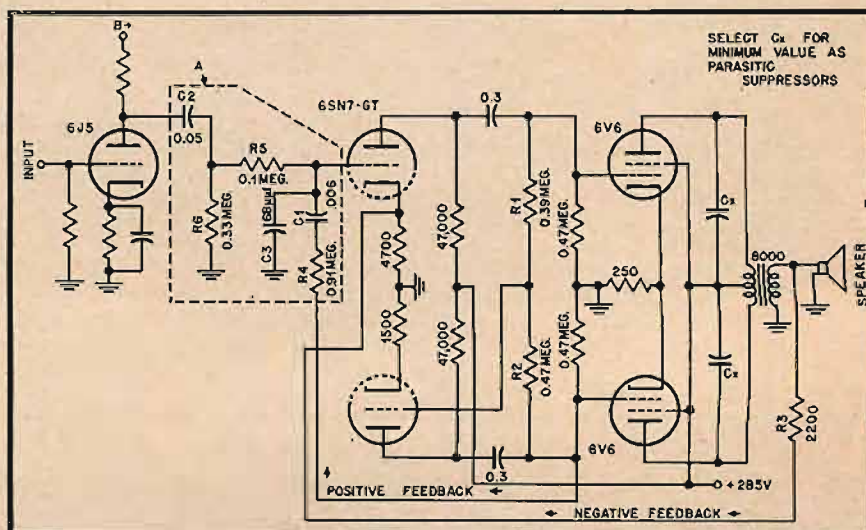


Fig. 1.

NO OTHER RECORD CHANGER CAN MATCH THESE FEATURES

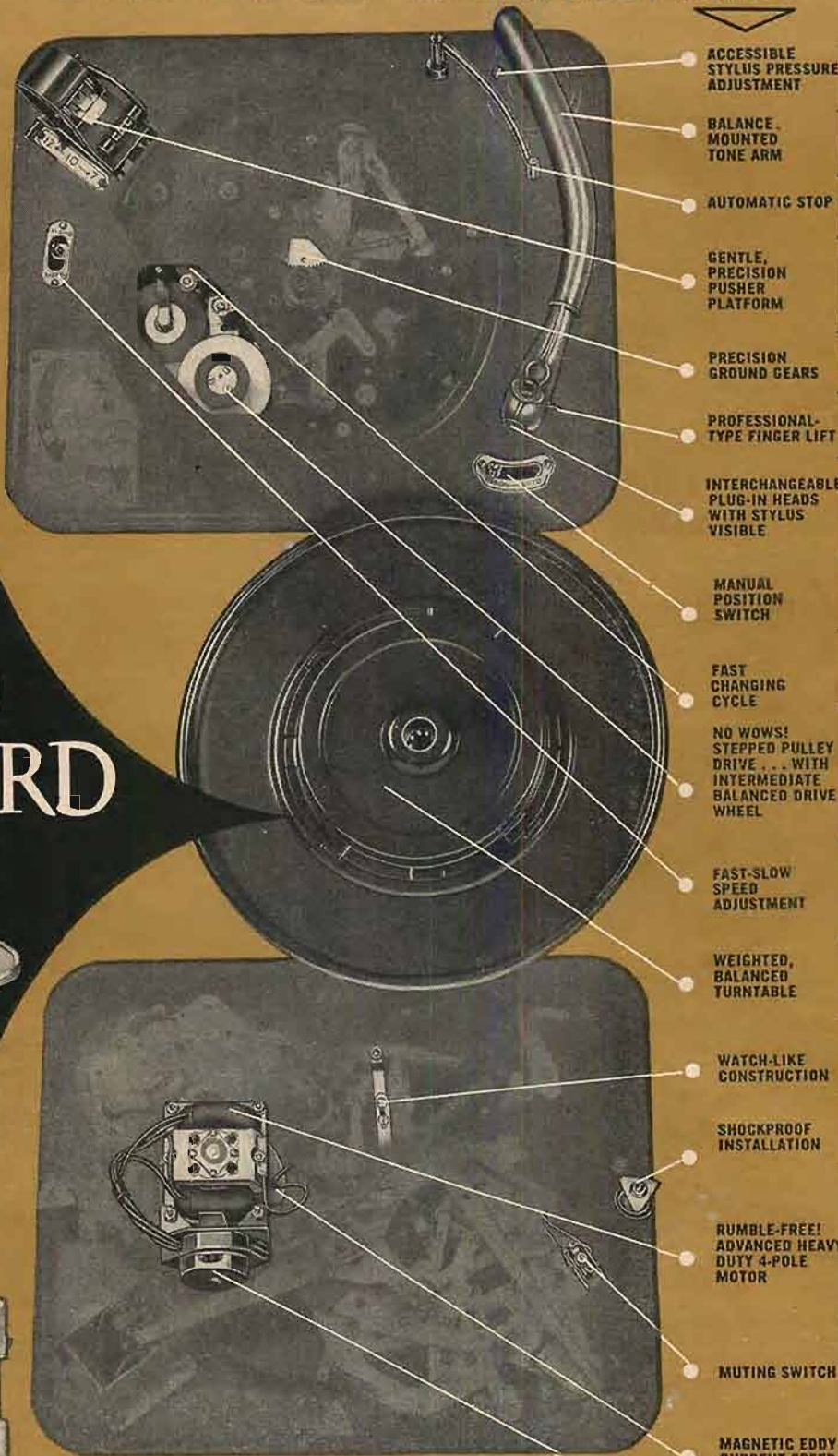
Here's what they mean to you



Why the "CROWN" MODEL RC90 GARRARD



is the World's Finest Record Changer



- ACCESSIBLE STYLUS PRESSURE ADJUSTMENT** Prolongs life of records by enabling you to keep correct weight of stylus upon delicate grooves.
- BALANCE MOUNTED TONE ARM** Guarantees true tangent tracking, eliminating disturbing resonances.
- AUTOMATIC STOP** For your convenience, insures positive and unfailing action at end of any type record.
- GENTLE, PRECISION PUSHER PLATFORM** The only device that insures gentle handling of records with standard center holes. No overhead bridge to damage or dislodge records accidentally.
- PRECISION GROUND GEARS** Perfectly meshed to insure constant, smooth action and years of service.
- PROFESSIONAL-TYPE FINGER LIFT** Permits safe lifting and setting down of pick-up arm when playing records manually.
- INTERCHANGEABLE PLUG-IN HEADS WITH STYLUS VISIBLE** Accommodates your personal choice of magnetic, ceramic or crystal cartridges, and protects record grooves, since stylus can be front-inspected for correct vertical position.
- MANUAL POSITION SWITCH** Gives you versatility... manual or automatic playing, as you prefer.
- FAST CHANGING CYCLE** The same, regardless of playing speeds; means less waiting between long playing records.
- NO WOWS! STEPPED PULLEY DRIVE... WITH INTERMEDIATE BALANCED DRIVE WHEEL** Cannot slip. Eliminates belts and guarantees smooth, even turntable speed, which you will enjoy as perfect musical pitch.
- FAST-SLOW SPEED ADJUSTMENT** All 3 speeds variable and adjustable. Guarantees perfect pitch; accurate speed settings. Compensates for current imperfections.
- WEIGHTED, BALANCED TURNTABLE** Means freedom from rumble, and constant turning speed through "flywheel" action.
- WATCH-LIKE CONSTRUCTION** All levers fully adjustable... easy, inexpensive to service. Bronze bearings at all moving points for longer life!
- SHOCKPROOF INSTALLATION** Unique spring suspension. Mounting holes are identical with former Garrard models, so that replacement is simple.
- RUMBLE-FREE! ADVANCED HEAVY DUTY 4-POLE MOTOR** Makes your RC90 the smoothest, most powerful, most silent record changer ever built! Weighted, balanced armature. No appreciable speed variation regardless of number of records on turntable; "hot" or "cold" operation, or variations in line voltage.
- MUTING SWITCH** Continuity of your music undisturbed by extraneous noises between records. No sound while arm is in changing cycle.
- MAGNETIC EDDY CURRENT SPEED CONTROL** A great high-fidelity achievement! Speed controlled by varying the field of a pair of permanent magnets... eliminating old-fashioned mechanical or electrical braking.
- CONDENSOR-RESISTOR NETWORK** Eliminates startling "plop" noise when changer shuts off at end of last record.

Engineered for the future; under rigid quality control

INTERCHANGEABLE SPINDLES
Fit all records, all sizes, as they were designed to be played. Most important, Garrard spindles are removable, so that records need not be ripped upwards over metallic spindle projections after playing, as on ordinary changers. Each with chrome clip for handy storage in your cabinet.

A complete stock of replacement parts readily available at all times to Garrard owners, in any part of the United States.

GARRARD World's Finest Record Changers and Record Players

Model RC90—3 speed "Crown" Super Changer • Model RC80—3 speed "Triumph" Automatic Changer
Model T—3 speed "Crest" Manual Player • Model 301 Transcription Turntable

Garrard Sales Corporation,  164 Duane Street, New York 13, N. Y.

- FOR 78 RPM, 33 1/3 RPM RECORDS WITH NORMAL CENTER HOLES:
 - a. Exclusive "Single play" spindle
 - b. Exclusive "automatic" bent spindle
- FOR 45 RPM RECORDS WITH WIDE CENTER HOLES:
 - c. Exclusive "automatic" spindle
 - d. "Single play" adaptor

WRITE FOR A COMPLIMENTARY COPY OF "SOUND CRAFTSMANSHIP"

16 pages illustrating and describing Britain's finest music reproducing equipment... the Garrard Crown Model RC90 Record Changer and the other products of the British Industries Group. Here, in concise, useful form, are facts you'll want for planning improvements and additions to your own high fidelity set.

Garrard Sales Corp., Dept. AE-12, 164 Duane St., New York 13, N. Y.
Send my copy of Sound Craftsmanship.

Name _____
Address _____
City _____ Zone _____ State _____



Which
Magnecorder
best fits
your needs?

the PROFESSIONAL TAPE RECORDER

Voyager

The first one-case professional recorder for remotes — rugged, light, reliable. Complete with line level amplifier, \$499.50. Other units available with 10 watts of audio from \$590.00.

Standard Magnecorder

PT63-AH recorder includes a 3-head assembly for monitoring directly from the tape. PT7-P amplifier provides high level mixing of three channels. \$850 complete.

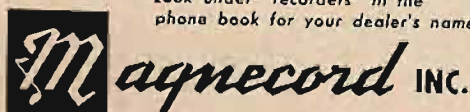
MagneCordette

A professional Magnecorder enclosed in smart blond, mahogany, or black lacquer cabinet, \$425.00. Also offered as the new Portable MagneCordette — a complete record-playback-P.A. system in a single carrying case, \$499.50.

New Magnecord M-80

Watch for the brilliant new Magnecord M-80 at your dealer's — the finest tape recorder ever built for the price. Features push-button controls, slot loading, 15 kc response at 7½ ips!

Look under "recorders" in the phone book for your dealer's name



225 WEST OHIO ST., CHICAGO 10, ILL., DEPT. AE-12



gins at the output of the conventional 6J5 voltage amplifier) includes the 6SN7-GT phase splitter and a 6V6 output stage. According to the tube manual the output rating can be conservatively set at a little over 10 watts, with home music system high-quality standards in mind. The 6J5 plate signal, after passing through a network A (of which more later) is fed to the "self-balancing" phase splitter. The grid of the lower 6SN7 triode obtains its signal from voltage divider R_1-R_2 across the push-pull splitter output. The output stage is conventional, the value of the cathode resistor having been supplied by the writer. All other values are given by the inventor.

The negative feedback loop is a standard type, from the secondary of the output transformer to the first cathode of the phase splitter. R_1 and the tube's cathode impedance form a voltage divider which determines the negative feedback factor.

The positive feedback loop is an internal one, from the grid of the lower output tube back to the first phase-splitter grid. The positive feedback is fixed, for mid-range frequencies, by the voltage divider R_1-R_2 (and, of course, to some extent by the admittance of the 6SN7 triode and the plate resistance of the 6J5 in parallel with R_1 and R_2). It is adjusted to a point where there exists a condition of critical regeneration in the amplifier with the negative feedback loop disconnected. When the negative loop is connected the over-all gain is reduced well below the point of amplifier instability. However, the high positive feedback has created an amplifier of high gain without incurring the penalty of steep boundary-frequency phase shifts which would come with the employment of several stages, and, of course, at a cheaper price. The critical regeneration can easily be maintained over the entire range of useful—that is, audible—frequencies.

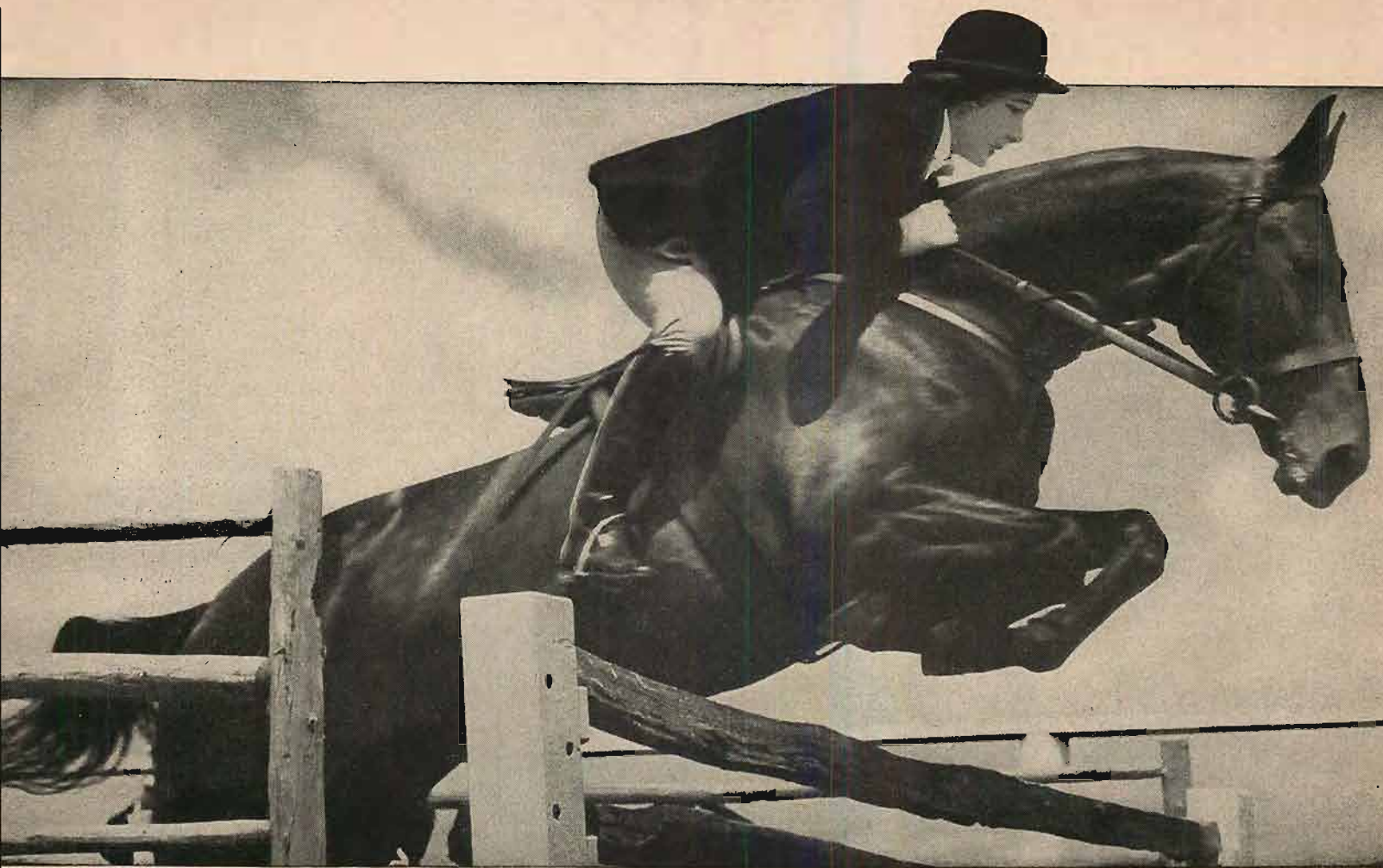
The low inherent phase shift of the amplifier permits the use of a low priced output transformer even though it is in the negative feedback loop. The over-all gain is primarily an inverse function of the feedback factor of the negative loop. Ordinary feedback theory shows that under this circumstance harmonic distortion and intermodulation are negligible up to any signal level at which there is sufficient overloading to disable one of the feedback loops.

Oscillation Prevention

So far, the scheme is apparently not new, at least in theory. But the theory has always been very difficult to realize practically because at frequencies outside the useful range the sense of the negative feedback changes and it becomes positive, causing oscillation. There are some common solutions. One is to design all the coupling elements in the amplifier so that frequency slope is no greater than 10 db per octave within the range for which negative-feedback loop gain is unity or greater. That costs money, especially where the output transformer is concerned. Another method is to introduce compensatory networks in the negative loop to apply reverse phase shifts. That is expensive, too, and risky.

The inventor's solution is to leave the negative loop alone and deal with the positive feedback loop. Change in positive feedback phase is not a danger, of course, since it could only tend to reduce amplifier gain and reduce chance of oscillation. In the diagram the job is done by the network A.

At mid-range frequencies, we have said that loop transmission is controlled by R_1 and R_2 . At low audio frequencies transmission depends on the ratio of capacitors



jumps are for Horses
... NOT *for magnetic tape*

That's why you need SOUNDCRAFT Micro-Polished Tape.
No Raised Spots! No Roughness! No Jumps!
It's S m o o t h right from the start!*

Under the microscope, magnetic tape may look like a steeplechase—replete with all the “jumps.” As you record, these jumps—minute raised spots characteristic of all coating processes—momentarily separate large enough areas of the tape from the recording head to appreciably interrupt high-frequency response. On some equipment, they may even cause signal dropouts.

The Answer Is Micro-Polish

But Reeves SOUNDCRAFT eliminates the “jumps” with its exclusive Micro-Polish process, assuring the most complete head contact possible right from the start. That's because Micro-Polish smooths off the microscopic nodules by

subjecting the ferrous oxide coating to high-precision polishing. It leaves the surface mirror-smooth, and preconditioned for immediate, stable, high-frequency response.

Breaking in tape by running it through the recorder, with accompanying head wear and waste of time, is a thing of the past.

Other SOUNDCRAFT Advantages

In addition, SOUNDCRAFT Recording Tapes are pre-coated with a special formulation to give utmost oxide adhesion, and prevent curling and cupping.

All tape is dry-lubricated to eliminate squeals and carries a splice-free guarantee on all 1200- and 2500-foot reels.

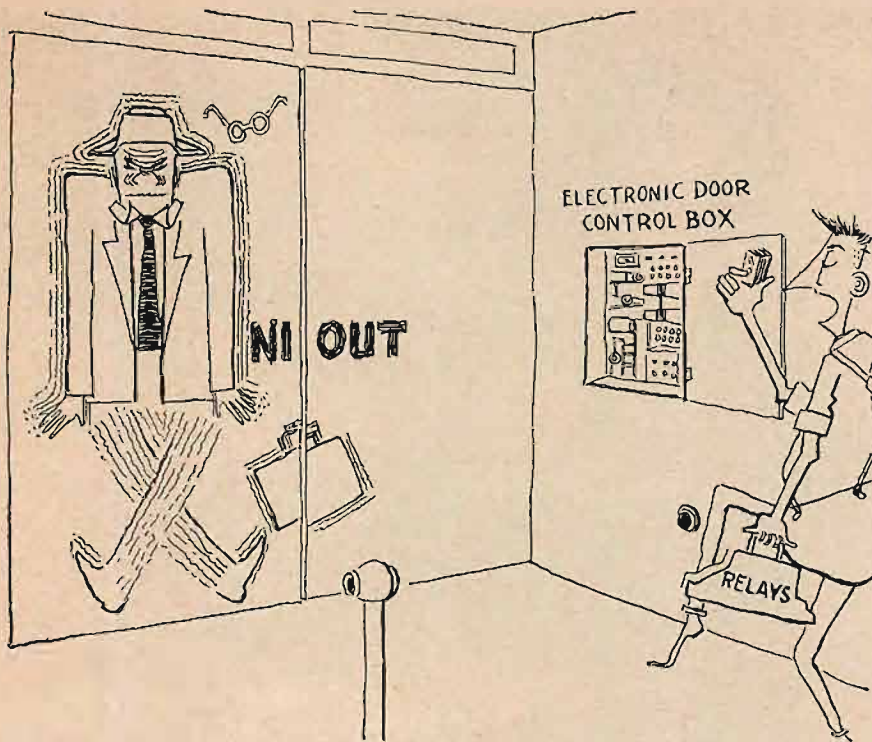


REEVES

SOUNDCRAFT
CORP.

**10 East 52nd Street, Dept. B
New York 22, N. Y.**

*Pat. Applied For.



DESIGNING ELECTRONIC EQUIPMENT WITHOUT RELAYS

Overwhelming evidence is accumulating to the effect that relays are the weak link in Electronic Equipment. They are expensive, unreliable, unprocurable, and, worst of all, *mechanical*. In short, fashionable designs no longer contain relays.*

It's really perfectly simple. Assuming the usual block diagram to contain sensing, amplification, and power device, it shouldn't be hard to get the power from amplification in a form to run the power device directly. It's easy — no relays needed.

Of course, just as a device gets into production it may develop irritating idiosyncracies such as non-operation or some such minor defect. It's probably only a case of the moving coil of the perfistron being melted by high-Mu splurges from the totemotor.

It'll take a Sigma relay to protect the thing because that's the only gadget that will fit into the unavailable space and respond to the conspicuous absence of signal power. Besides, you can console yourself with the fact that it's only just barely a relay.

**In 1940 we asked a propeller manufacturer who was trying our relays in his pitch-control mechanism why he didn't scout around for something better than propellers. His answer was classic: "How do you know we're not?"*



Type 4F. Good for fixing "no-relay" gadgets. 75 or 50 mw. in — 250 watts out. In large quantities, commercial specs, priced as low as \$1.00.

SIGMA

SIGMA INSTRUMENTS, INC.

95 PEARL ST., SO. BRAINTREE, BOSTON 85, MASS.

C_1 and C_2 which then have appreciable reactance. They are designed to have about the same capacitance ratio as the resistance ratio of R_1 and R_2 .

At the very low frequencies (where the negative feedback begins to shift phase and become dangerous) the reactance of C_1 becomes high with respect to the resistance of R_2 . C_1-R_2 then becomes a phase-shift and high-pass-filter network, reducing the positive feedback in the very low audio and the subaudio ranges and shifting its phase so that as frequency gets lower the feedback becomes negative. This offsets the tendency in the low range of the negative feedback in the other loop to become positive due to the natural deficiencies of such circuits and the reasonable-quality transformer. The positive feedback begins to reverse at frequencies only slightly lower than the lowest desired useful frequency so that even if the transformer has rather sharp cutoff characteristics at this point the gain of the amplifier is reduced sufficiently to prevent oscillation. Increase of distortion due to loss of feedback does not matter—nobody can hear it.

At high frequencies, capacitor C_2 (and the input capacitance of the 6SN7) acts with R_1 as a phase-shift and low-pass-filter network. Just slightly above the audible range the positive feedback is reduced and starts to become negative, reducing amplifier gain so that the cutoff of the transformer just above audibility cannot cause oscillation due to phase shift in the negative feedback loop.

It is obvious, therefore, that extension of the range of the amplifier and the transformer to the usual ultrasonic range is not necessary with this circuit. At some frequencies well above and below audibility, phase conditions in the feedback loops may make them both positive, but at these frequencies the loop gains have been made deliberately too small to permit oscillation.

Thus we have an amplifier which is cheap because (a) it can give sufficient gain with only two stages and (b) the output transformer can be standard—no \$30-plus quality and no tertiary or split windings. Yet it can (or so it seems) give all the quality which the art makes possible today. The writer would like to hear from anyone who tries the circuit.

There is not much more detail in the patent specification but you can get a copy for 25¢ from The Commissioner of Patents, Washington 25, D. C.

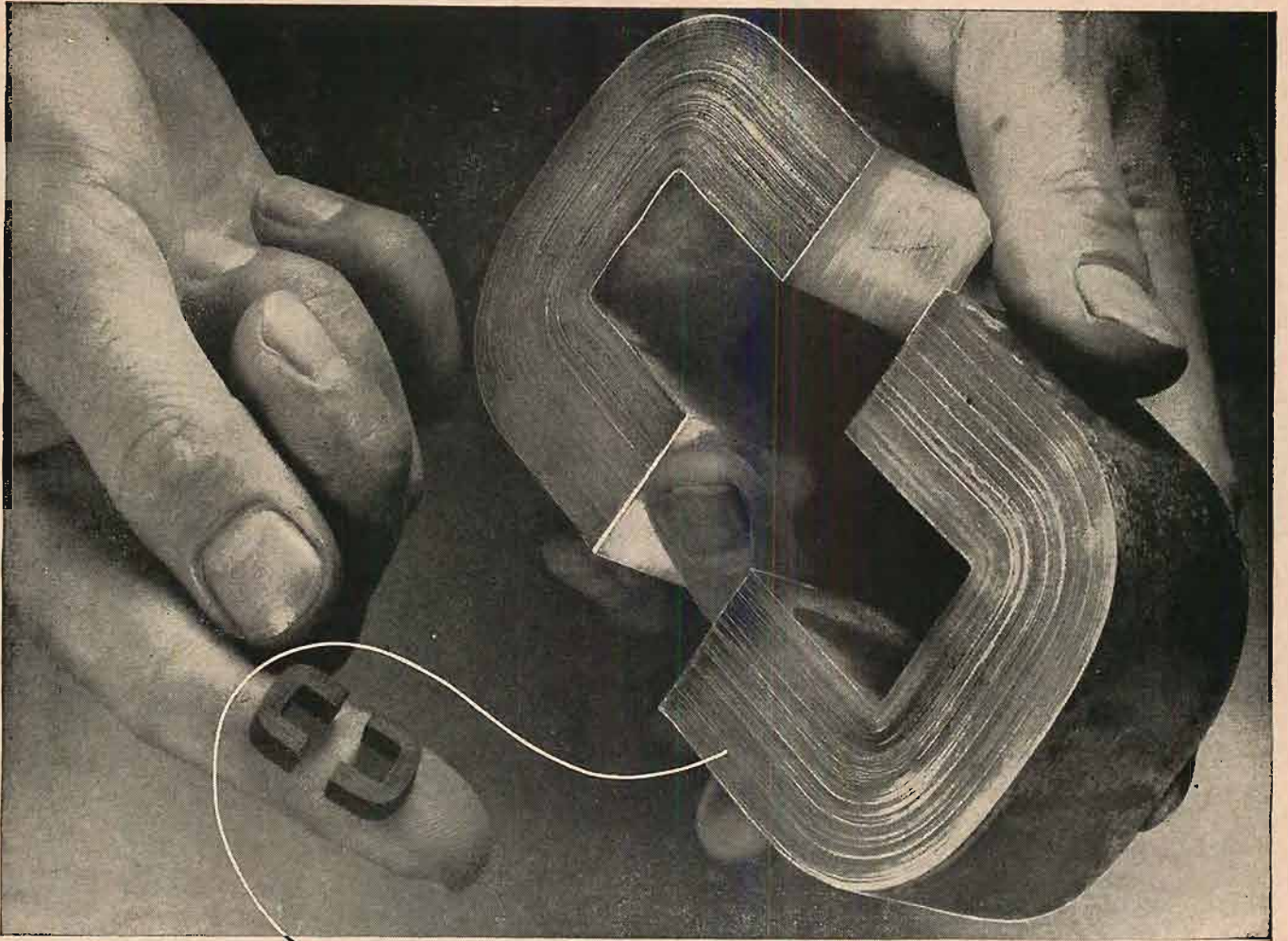
BOOK REVIEW

CIRCUIT THEORY OF ELECTRON DEVICES, by E. Milton Boon. 483 pages, \$8.50. New York: John Wiley and Sons, Inc., 1953.

This is a book primarily intended for electrical engineering students. It analyzes basic circuit operation, deriving expressions relating to gain, source impedance, the effect of feedback, etc. The use of equivalent circuits, and the mathematical derivations are presented especially clearly, both in concept and in format. (The latter is never forbidding.) The treatment of an amplifier as a four-terminal network makes the analysis a general one, applicable to all electron devices. Both tube and transistor circuit theory are discussed.

The clarity of the presentation recommends this book to general technical readers as well as to students.

—EMV



SILECTRON C-CORES... **BIG** or LITTLE

...any quantity and any size

*Wound from
precision rolled
oriented silicon
steel strip as thin
as .00025"*

For users operating on government schedules, Arnold is now producing C-Cores wound from 1/4, 1/2, 1, 2, 4 and 12-mil Silectron strip. The ultra-thin oriented silicon steel strip is rolled to exacting tolerances in our own plant on precision cold-reducing equipment of the most modern type. Winding of cores, processing of butt joints, etc. are carefully controlled, assuring the lowest possible core losses, and freedom from short-circuiting of the laminations.

We can offer prompt delivery in production quantities—and size is no object, from a fraction of an ounce to C-Cores of 200 pounds or more. Rigid standard tests—and special electrical tests where required—give you assurance of the highest quality in all gauges. • *Your inquiries are invited.*

THE ARNOLD ENGINEERING COMPANY

SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION

General Office & Plant: Marengo, Illinois

DISTRICT SALES OFFICES . . . New York: 350 Fifth Ave.

Los Angeles: 3450 Wilshire Blvd.

Boston: 200 Berkeley St.



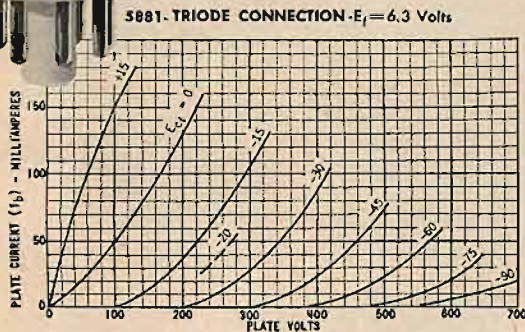
W&D 4363

for Hi-Fi



Want a really Super performance tube for your "Williamson" or "Ultra-Linear" amplifier?

Check these ratings of the Tung-Sol 5881



CLASS AB₁ PUSH-PULL AMPLIFIER — TRIODE CONNECTION
Grid #2 connected to Plate Values are for two tubes

Heater Voltage	6.3	Volts
Heater Current	0.9	Amp.
Plate Voltage	400	Volts
Grid Voltage	-45	Volts
Peak AF Grid to Grid Voltage	90	Volts
Zero-Signal Plate Current	65	Ma.
Maximum Signal Plate Current	130	Ma.
Load Resistance	4000	Ohms
Total Harmonic Distortion	4.4	Percent
Power Output	13.3	Watts

RATINGS (Interpreted According to RMA Standard MB-210)

Heater Voltage	6.3	Volts
Maximum Heater-Cathode Voltage	200	Volts
Maximum Plate Voltage	400	Volts
Maximum Grid #2 Voltage	400	Volts
Maximum Plate Voltage (Triode Connection)	400	Volts
Maximum Plate Dissipation	23	Watts
Maximum Grid #2 Dissipation	3	Watts
Maximum Plate Dissipation (Triode Connection)	26	Watts
Maximum Grid Resistance (Fixed Bias)	0.1	Megohm
Maximum Grid Resistance (Self Bias)	0.5	Megohm

In creating the 5881, Tung-Sol engineers have made fullest use of design and production techniques which have proved themselves over the past 15 years. Pure barium getter to effectively absorb gas for the life of the tube—gold-plated wire to minimize grid emission—are among the major design improvements in the 5881. This tube is directly interchangeable with the 6L6.

Tung-Sol produces the 5881 under laboratory conditions to insure peak efficiency and maximum uniformity. Order it from your regular supplier.

TUNG-SOL ELECTRIC INC., Newark 4, N. J.

Sales Offices: Atlanta, Chicago, Culver City (Los Angeles), Dallas, Denver, Detroit, Newark, Seattle

TUNG-SOL makes: All-Glass Sealed Beam Lamps, Miniature Lamps, Signal-Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

LETTERS

Comments on "The Piano"

SIR:

It is good to see in *Æ* such interesting and instructive articles as the two of Mr. Preisman's on "The Piano." Unfortunately the music trades magazines seldom carry articles of technical scope and merit on the science of musical tone production, and you are to be commended on these because we—your readers—are all interested in musical tone production as well as reproduction.

Especially since 1930, when my own research activities were transferred from reproduction to production of musical tones, especially through electronics, I have been much concerned with piano-tone production. Except for some sixty patents in this field, I have published very little on the results of these researches, but Mr. Preisman's articles leave a few interesting gaps which can be filled in.

For example, it does not appear to be generally known that the bridge and the soundboard respond to modulations of string tension, and since these are bicyclic, except at very high vibration amplitude, there is a strong frequency-doubling action. This occurs for all of the orbital rotational planes of the string vibration, and can be easily demonstrated with a small desk-type postal scale and a yard length of cord. Stretch the cord between fixed supports over the scale pan with the scale near one end and with an angle or "bearing" of, say, 30 deg. between this "string" and the "hitch pin" close by. If now the string's long section by displaced up, down, and to either side, the scale will in each case indicate a larger pressure and deflection. Since the scale pan, representing a piano bridge and soundboard, moves downward for a downward deflection of the string, and again downward for an upward or sideward deflection, there are two complete cycles of bridge motion for one cycle of string motion.

Force-displacement measurements of the bridge and soundboard show considerable non-linearity and this accounts for the appearance of a fundamental vibration component of the string in the soundboard motion.

The frequency characteristic of the soundboard varies from bass to treble along the bridge from about 90 cps to about 500 cps and these values change in different pianos. Poor fundamental response of a 30- to 60-cps string through a 90- to 100-cps soundboard is therefore to be expected. Likewise, in the treble end, a 3000- to 4000-cps string fundamental is beset by a 400- to 500-cps soundboard.

The high and low registers therefore suffer from poorly matched impedances and only the middle register—particularly the low middle range—has proper impedance matching, and it is here where the output tone is at its best.

The orientation of a grand piano soundboard is, of course, extremely bad. Acting as its own baffle, both top and bottom sides are about in the plane of a listener's ears, so there is strong cancellation of the low-frequency components of the lower tone registers. Upright pianos are much better in this respect, but the low-frequency performance of both types can be much improved by absorption of the radiation of one side or, as in some commercial loudspeaker enclosures, by reversing the phase of the radiation of one side through a folded horn, for example.

The better tone resulting from multiple unison strings is due not to the increased sound output so much as to the chorus effects among slightly detuned overtones. If these unisons are tuned to one beat in three seconds, for example—a value which is about as good on the average as a tuner can do—the higher numbered partials will have higher beating rates so that the 10th, say, will be ten times as fast or three per second. The vibration planes and orbits of the three unisons will also have random and changing phases so that the soundboard motion and output tones undergo a continuous change in quality as the tone decays.

Another element of piano-tone quality, as Baldwin's Knobloch has pointed out, is due to longitudinal vibration of the string. This varies according to the piano string scale design. In my six-foot Steinway "A" it is generally about four octaves above the fundamental frequency and only by rare chance is it harmonically related. We hear this as the ringing tone of the lower register strings. It has a full Fourier series of partials, all but the fundamental being well up into the high-frequency end of the audio spectrum.

QUALITY IN MINIATURE!

Langevin PLUG-IN

AMPLIFIERS and POWER SUPPLIES

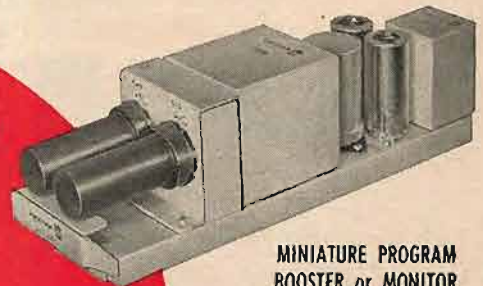


MINIATURE PLUG-IN
PRE-AMPLIFIER OR BOOSTER
AMPLIFIER TYPE 5116

Miniature plug-in two stage, low noise pre-amplifier or booster amplifier. The smallest high performance amplifier of its type that exceeds FCC requirements. Small size, excellent design and plug-in features make type 5116 ideal for installation in consoles and equipment racks. Push button metering facilities and gold plated plugs are standard at no extra cost.

Langevin-engineered to
IMPROVE PERFORMANCE!

Miniature-designed to
SAVE PANEL SPACE!

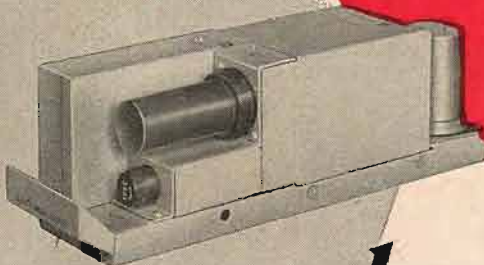


MINIATURE PROGRAM
BOOSTER or MONITOR
AMPLIFIER TYPE 5117

A plug-in two stage, push-pull, fixed gain audio amplifier. The most compact amplifier available for this service. Outstanding quality recommends type 5117 for applications requiring outstanding performance and maximum availability. Push button metering facilities and gold plated plugs are standard at no extra cost.

-for Radio and
Television Broadcast,
Recording Studios
and Sound Systems

AVAILABLE
IMMEDIATELY
FROM STOCK



PLUG-IN POWER
SUPPLY TYPE 5208

A miniaturized power supply of extremely compact design. Built of highest quality component parts throughout, type 5208 is designed for continuous service. Capable of supplying power for 10 Type 5116 pre-amplifiers or lesser combinations of types 5116 and 5117. Overall length 10 3/4"; width 2 5/8"; height 3".



PLUG-IN POWER
SUPPLY TYPE 5206

Designed for use with Langevin Miniature Amplifiers. Provides AC for amplifier filaments and well filtered DC for amplifier plate. One unit provides adequate power to operate up to 22 Type 5116 Amplifiers or lesser combinations of Types 5116 and 5117 with separately fused filament and plate supplies.

Langevin

-the name synonymous with quality in
audio equipment and components since 1923

NEW! File Catalog for broadcast engineers and sound technicians available without obligation. Request your copy today—just call or write, on company letterhead, to:

LANGEVIN MANUFACTURING CORPORATION
37 WEST 65th STREET, NEW YORK 23, N. Y.



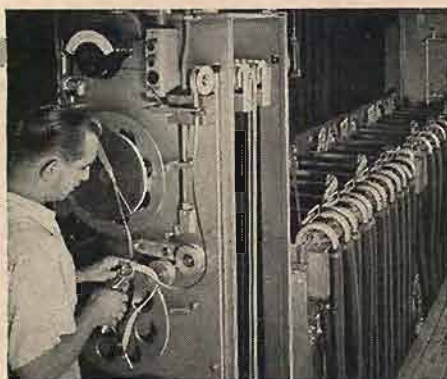
EXPORT DISTRIBUTORS: INTERNATIONAL STANDARD ELECTRIC CORPORATION, 50 CHURCH ST., NEW YORK CITY

Precision Prints

**YOUR PRODUCTIONS
BEST REPRESENTATIVE**

CLOSE CHECK ON PROCESSING

Picture and sound results are held to the closest limits by automatic temperature regulation, spray development, electronically filtered and humidity controlled air in the drying cabinets, circulating filtered baths, Thymatrol motor drive, film waxing and others. The exacting requirements of sound track development are met in PRECISION'S special developing machinery.



YOUR ASSURANCE OF BETTER 16mm PRINTS

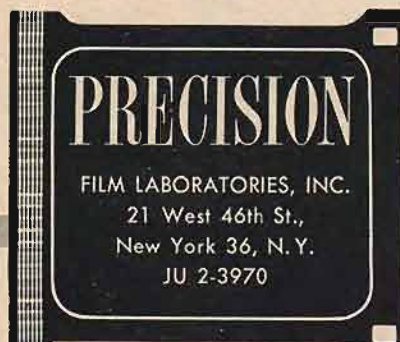
16 Years Research and Specialization in every phase of 16mm processing, visual and aural. So organized and equipped that all Precision jobs are of the highest quality.

Individual Attention is given each film, each reel, each scene, each frame — through every phase of the complex business of processing — assuring you of the very best results.

Our Advanced Methods and our constant checking and adoption of up-to-the-minute techniques, plus new engineering principles and special machinery enable us to offer service unequalled anywhere!

Newest Facilities in the 16mm field are available to customers of Precision, including the most modern applications of electronics, chemistry, physics, optics, sensitometry and densitometry — including exclusive Maurer-designed equipment — your guarantee that only the *best* is yours at Precision!

Precision Film Laboratories — a division of J. A. Maurer, Inc., has 16 years of specialization in the 16mm field, consistently meets the latest demands for higher quality and speed.



The piano-tone production system is really very complex and much still remains to be learned. My few remarks cover only a small part of this generally unknown area. Piano designing and building is hardly an exact science, insofar as tone production is concerned, and this is a challenging field of research.

B. F. MIESSNER,
Van Beuren Road, RFD 2,
Morristown, N. J.

SIR:

Mr. Preisman's discussion of the practice of mistuning the octaves at the extreme ends of a piano in accordance with the "inharmonic" of its overtones was read with great interest. In my opinion, this practice is ill-advised. Its theoretical usage seems to be dictated by the Pythagorean comma, a disparity existing between the pitch of octave unisons produced by a circle of perfect fifths, and those resulting from harmonics. However, the beats between the octaves of a piano "stretched" in this fashion are much more annoying to me than the "dead and lifeless" sound of a piano in which the octaves are precisely in tune. I am sure that a piano with octaves tuned to the interval of a diminished ninth would sound quite brilliant, but not necessarily pleasant. After all, equal temperament is in itself a radical distortion of natural harmonic relationships, so why compound the felony by further tampering? There is a possible parallel here between people who prefer "Stretched" pianos and people who like their reproducing equipment to sound spectacular rather than natural.

Aside from these small matters, I have found Mr. Preisman's articles valuable and informative especially with their emphasis of the musical element which all too often tends to lose itself in this business. Incidentally, the Conn tuning device is called a *Strobocon*, and someone seems to have recatalogued Chopin's Etude Op. 25 as Op. 75 in the footnote on page 68.

DAVID HANCOCK,
4 West 93rd St.,
New York 25, N. Y.

Missing Decimals

SIR:

The article titled "Three-Element Bass Control" in the October issue appeared to be the best one I have ever seen. It is too bad that I can't build this control. You left off the decimal points and I can't tell if one resistor or another is required. For example, what is 01 or 047 or 005? Just where is the decimal point? And why does such a little thing get me so riled up I make all sorts of errors in typing this letter to you? (*He did, too.* Ed.)

H. A. ROLLINS,
2328 Proctor,
Garland, Texas.

(We're truly sorry for this condition, which has been reported by many readers. It appears that the photoengraving for the schematic was overetched, and the periods were all eaten off. However, because the circuit was of so much interest to readers, we remade the cut and a more legible schematic may be found on page 70. Ed.)

HAVE YOUR OWN COMPLETE HiFi SYSTEM

AT MODERATE COST

START NOW WITH THE

Crestwood 400's

At right—Model 401
(Recorder-Preamplifier) \$199.50*

Not shown—Model 402
(Power Amplifier-Speaker) \$100.00*

*Taxes not included. Prices slightly higher
in Mountain and West Coast States.



HERE'S HOW! The Crestwood 401 is an extremely stable tape recorder (wow and flutter less than 0.3%) with a full fidelity preamplifier (frequency response 30-13,000 cycles \pm 2db). It has separate inputs for microphone, radio-TV and phonograph, which are connected to a selector switch.

The Crestwood 402 is a high impedance input, 10 watt power amplifier (frequency response 20-20,000 cycles \pm 2db) with an 8" extended range dynamic speaker, specially housed to produce exceptional frequency response for a compact unit.

IT'S EASY! With Crestwood models 401 and 402, here's all you do to complete your HiFi system:

1. AM-FM tuner (of your choosing)** is plugged into radio-TV input.
2. Record changer (of your choosing)** is plugged into phono input.

Both may be permanent installations because of the selector switch, which allows choice of inputs or tape playback.

**Certain AM-FM tuners and magnetic pickups may require special handling. Information supplied on request.

YOUR HI-FI SYSTEM IS READY TO USE! By use of the selector switch you can listen to either radio or records. And, by merely pressing the Record button, whatever you're listening to will be instantly recorded on tape—accurately, faithfully, just as you're hearing it! The same selector switch controls microphone input, allowing your own program arrangement.

CAN BE USED WITH PRESENT SYSTEM, TOO! The Crestwood 401 is an excellent unit to fit into your present HiFi system. Full fidelity and complete dependability.

FEATURES INCLUDE

Full Fidelity • Two Speeds • Two-Track Recording
• Separate Monitor and Record Volume Controls •
Exceptionally Sharp Magic Eye Record Volume Indicator •
Simplicity of Operation • 10 Watt Power Amplifier •
Precision Engineering • Modern Styling

SEE YOUR DEALER

FOR FULL INFORMATION

OR

SEND COUPON TODAY

Crestwood
BY DAYSTROM

TAPE RECORDERS

Open a Brand New
World of Recorded Sound

Crestwood Div. of Daystrom Electric Corp.
Dept. AE-12, Poughkeepsie, N. Y.

Please send complete information on the new
Crestwoods.

Am interested in setting-up my own HiFi
system.

Am interested in HiFi tape recorder only.

Name

Address

City.....Zone.....State.....

Awarded MEDAL OF MERIT for: Excellence of Product, Quality of Engineering,
Beauty of Design—by International Sight and Sound Exposition, Chicago, 1953.

AVAILABLE NOW!

tervals ranging from one to many weeks depending upon the power output, circuit design, and extent of use.

A modern hearing-aid tube suitable for front-end amplifier use has a filament power requirement of only 10 milliwatts; with usage of 15 hours daily, this can be provided for almost a month by a tiny "A" cell costing only 75 cents, or ten dollars per year. Even so, total battery costs may run fifty dollars or more per year with instruments using tubes throughout.

Transistors

Battery costs may be materially reduced through use of a transistor in the output stage, and further power economy is possible if transistors are used throughout. But replacement of tubes by transistors is more than a simple substitution, particularly if widely variable tone control is to be provided. Full use of transistor potentialities in hearing aids is contingent upon the development of suitably reliable related components at reasonable cost, as well as improvement in the transistors themselves. Novelty value alone can be expected to become ever less, but power economy and miniaturization are permanent issues in which transistors have inherent advantage.

Transistors have been at some disadvantage from standpoint of circuit noise, and with present costs of subminiature capacitors or transformers suitable for tone control and for interstage coupling of low impedance circuits. Thus manufacturers tend to have active interest both in transistors and in improved subminiature tubes. One instrument maker fulfills opposing requirements with a transistor in the output stage and tubes in two earlier stages. But as a useful tool in hearing aid design, the transistor is undoubtedly already here to stay, and has changed the whole outlook on instrument planning.

COMING EVENTS

February 4-6—Audio Fair—Los Angeles, Alexandria Hotel, Los Angeles, Calif.

March 22-25—National convention of The Institute of Radio Engineers, Kingsbridge Armory and Waldorf-Astoria Hotel, New York City.

May 17-20—Electronic Parts Show, Conrad Hilton Hotel, Chicago, Ill.

May 23-29—NARTB Annual Convention, Palmer House, Chicago, Ill.

June 15-17—RETMA Annual Convention, Palmer House, Chicago, Ill.

September 30-October 3—High Fidelity Show, Palmer House, Chicago.

October 13-16—The Audio Fair, Hotel New Yorker, New York City.

Compare

Collaro

FULLY AUTOMATIC
3-SPEED RECORD CHANGERS

for 7, 10 and 12 inch Records

WITH ANY RECORD
CHANGERS IN THE FIELD
REGARDLESS OF PRICE

for RUMBLE
FLUTTER
and WOW

These are the tests of high fidelity . . . not claims, not boasts. That's why Collaro, confident of the results, invites you to compare.

Collaro has developed an entirely new turntable drive mechanism, and thus has succeeded in achieving performance considered impossible in earlier record changer designs. Rumble, wow, and flutter are virtually eliminated. Mechanical operation is smooth . . . gentle to the record and to the delicate stylus.

And while you are comparing these, look at the construction. Note that there are no intermediate drive wheels employed and no belts to slip or to replace. Rotate the turntable and observe how freely it spins. This is the combined result of dynamic balance and ball-bearing suspension. Now lift the turntable. It's heavy . . . intentionally weighted to give flywheel action for constant, steady rotation. You'll notice that the turntable is rubber covered. Important . . . because unlike other materials in use this surface does not shed; and dust and grit particles cannot become imbedded. On the underside is a 4-pole motor with self-aligning oilite bearings for silent steady power.

You will also discover that the Collaro changers are absolutely jam-proof; that they automatically shut off at the end of the last record; that the tone arm is ball-bearing mounted, and tracks accurately with as little as 3 gram stylus pressure.

Remember these features . . . look for them, compare them . . . and you will agree that Collaro really makes high fidelity record changers for high fidelity record reproduction.



	LIST PRICE
Model 3/532 Intermixes 10 and 12 inch records	\$65.00
Model 3/531 Non-intermix	54.50
Model 3/534 Single record player	33.60

Available at Radio Parts Jobbers,
Distributors, and Hi-Fi Dealers.

Write for complete details to:

ROCKBAR CORPORATION
215 EAST 37th STREET, NEW YORK 16, N. Y.

EDITOR'S REPORT

WIDER COVERAGE

MORE AND MORE people are becoming interested in high-quality sound reproduction in the home—a fact which must be apparent to any of *Æ*'s readers who also see other magazines and newspapers. Some months ago, *Life* acknowledged the existence of the hi-fi fad with an article which seemed to explore the ultra-fanatic type of hobbyist to the exclusion of the serious music listener who has found in hi-fi the solution to his desire for music as it should be heard. Most of the big home magazines are taking notice at least once a year of the existence of equipment which would provide better sound, and they have dressed up their presentations in a manner which would be expected from the "slicks." They are to be congratulated for their interest and the manner in which they present the material.

We are inclined to "view with alarm" the tendency exhibited by the *New York Times* which recently carried a 14-page hi-fi section in a Sunday edition. In this section appeared the advertising of manufacturers and distributors of audio equipment, with which we have no quarrel, but in the same section there also appeared two articles which ridiculed the hi-fi hobbyist and the entire hi-fi idea as a whole. How *The Times* can take advertising for a certain type of product and then ridicule the users of that product is beyond our comprehension.

Be that as it may, we are acutely aware that the newcomers to the hi-fi field are not all hobbyists in the sense that they build some of their equipment and are constantly experimenting with it in the search for perfection. Most of the newcomers just want good equipment which will give them good reproduction, and they want it with a minimum of bother and effort. Then there are others who want information on how to assemble the factory-built components into a workman-like and attractive combination which give them the desired results.

For some time *Æ* has been widening its coverage in that direction, yet without reducing the technical articles which the audio hobbyists have come to expect.

In the February issue, therefore, you may expect to find still more material for the non-technical music lover, and with that issue a new department—as such—will be inaugurated. Just a word of caution—don't be confused by the facelifting job on the February issue, for a change is coming. After all, we haven't changed the appearance of the magazine appreciably since March, 1949. (We planned the change for the January issue, but time goes too fast and we didn't make it.)

AUDIO FAIR—LOS ANGELES

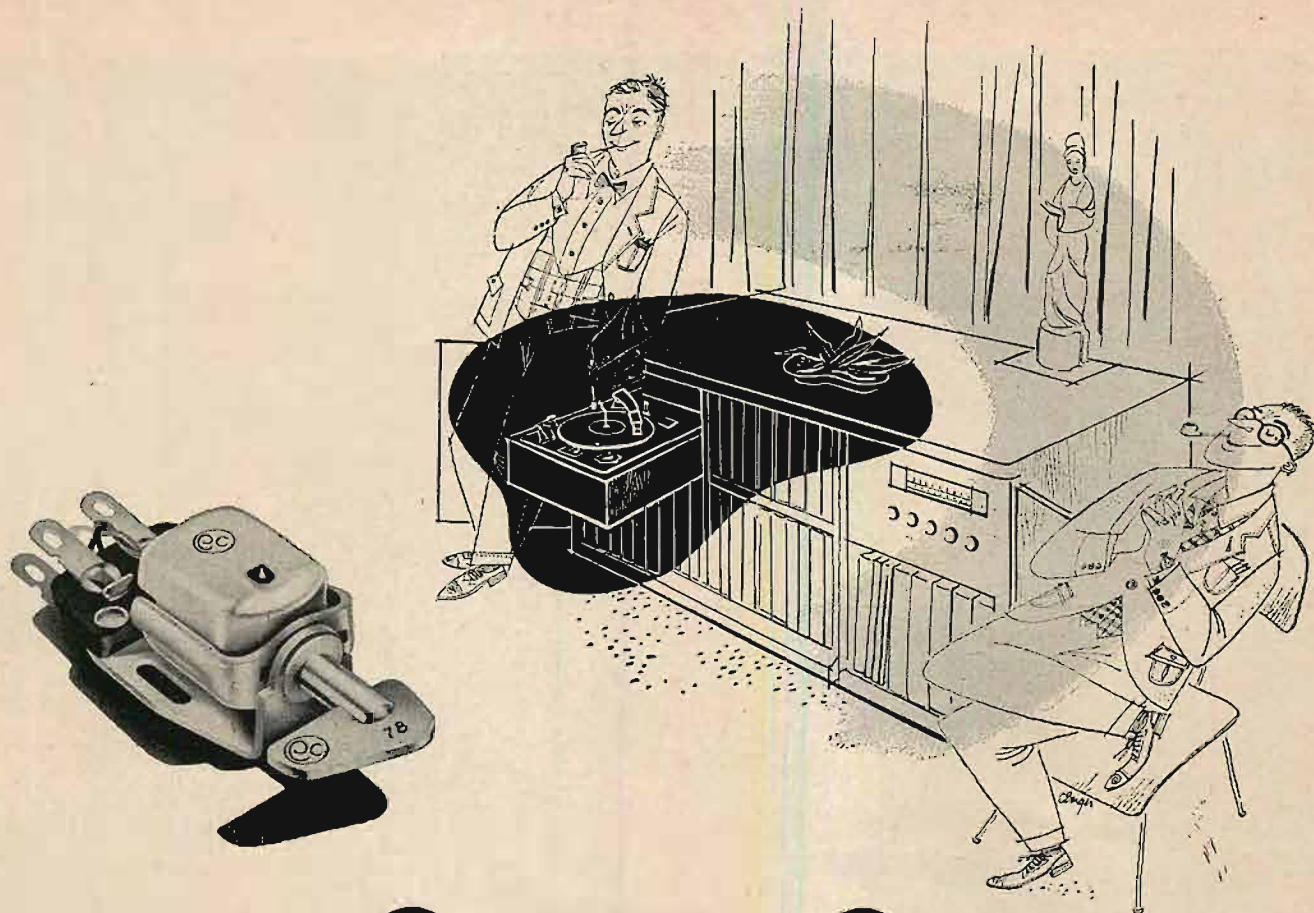
Heralded as the "Audio Fiesta—A Festival of Sound," the second Audio Fair—Los Angeles opens on February 4 at the Alexandria Hotel in the City of the Angels. This is the big audio event of the year on the West Coast, and we wonder how big the attendance will be. Last year, the figure was around 17,000, and was topped only by the recent Audio Fair in New York, which racked up an attendance of over 25,000. This may be the new East-West contest of the year. In any case, don't fail to be there if it is at all possible. If you've never seen an Audio Fair, you've missed something; if you ever have attended one, the chances are that you'll be there again.

APOLOGY

Everyone makes a mistake occasionally, and we're no better than the average, it seems. One of the photos used in the article "It Can be Attractive" was wrongly credited. Naturally when an organization does a good job on putting in a music system, it likes to receive credit for it—and particularly does it not want credit given to someone who had nothing whatever to do with the work. At the top of page 31 in the November issue is shown an attractive installation which was actually made by Shrader Manufacturing Company, Inc., of Washington, D. C., and we take this opportunity of apologizing to Bill Shrader—who has often contributed to *Æ*'s pages, and who will be back again soon—and to give the credit where it is due.

Merry Christmas & Happy New Year

from all of us to all of you



“I’m glad I waited...”

Here’s how I solved a problem that bothered me . . . and may be bothering you.

Many of my favorite recordings happen to be 78’s. They mean as much to me as any of my newer LP’s or 45’s. Changing pickups was often a real nuisance—and yet I wasn’t willing to give up the superior quality of my two Pickering cartridges.

Last fall my dealer offered a suggestion. “Wait a little longer,” he said. “You’ll be glad you did.”

He was right. I now have Pickering’s new turn-over cartridge. A simple flip of the handy lever and I’m ready to play any favorite that fits my mood—whether it’s standard or microgroove. More than that, I’d swear my recordings sound better than ever.

I’m glad I waited . . . but you won’t have to.

Ask your dealer to show you this convenient new turn-over cartridge. Have him demonstrate it. See if you, too, don’t hear the difference!

PICKERING and company incorporated • Oceanside, L. I., New York

PICKERING PROFESSIONAL AUDIO COMPONENTS

“For those who can hear the difference”

... Demonstrated and sold by Leading Radio Parts Distributors everywhere.
For the one nearest you and for detailed literature, write Dept. A-3



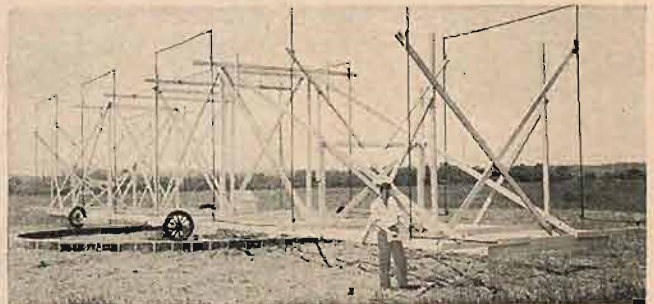


How silent is the night?

Watching the serenity of Christmas skies, we are conscious of deep silence. Yet the stars are talking to us all the while—talking in radio waves that are full of meaning to scientists probing the depths of space.

The important discovery that some stars produce radio waves was made by a Bell Laboratories scientist while exploring atmospheric disturbances which might interfere with transoceanic telephone service.

His discovery marked the birth of the fast-growing science of radio astronomy. It is telling us of mysterious lightless stars that broadcast radio waves, and it promises new and exciting revelations about the vast regions of space concealed by clouds of cosmic dust.



Directional radio antenna used by Karl G. Jansky, in the discovery of stellar radio signals at the Holmdel, New Jersey, branch of Bell Telephone Laboratories. In 1932 he detected waves of 14.6 meters coming from the direction of Sagittarius in the Milky Way.

It is another example of how Bell Telephone Laboratories scientists make broad and important discoveries as they seek ways to make your telephone serve you better.



BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

Magnetic Transfer of Stainless Steel Recording Wire

SAMUEL STORCHHEIM*

Wire recording is still employed in many useful applications, and the effects of signal transfer between adjacent turns may become troublesome. The author reports the results of a number of tests made to determine the optimum working conditions for various recording wires.

ONE OF THE phenomena accompanying magnetic wire recording is that of magnetic transfer. This condition involves the magnetization of unrecorded turns of wire by adjacent turns of recorded wire, the wire usually being made of 18/8 stainless steel. Transfer is popularly referred to as "crosstalk" and is particularly noted when quietly recorded passages of wire follow or precede heavily recorded portions of wire. An illustration of what this sounds like would be the hearing of two radio stations on the same setting, one station coming in normally, the other annoyingly clear, though at a lower volume than the desired program.

In order to investigate transfer, a study was made of the effect magnetic properties such as remanence, B_r , and coercive force, H_c , had upon transfer when wires were magnetized with increasing recording currents.

Procedure

The magnetic parameters of remanence and coercive force were measured directly from hysteresis loops projected upon a previously calibrated cathode-ray oscilloscope screen. The hysteresis loop tester used to make these measurements was specially designed¹ and constructed, and was capable of accepting wires of a maximum of $\frac{1}{8}$ in. diameter.

* Engineer-in-Charge, Atomic Energy Division, Sylvania Electric Products Corp., Bayside, L. I., N. Y.

¹ W. W. Wetzel, "Review of the present status of magnetic recording theory, Part 1," AUDIO ENGINEERING, Nov. 1947.

The accuracy obtained using this unit was ± 2.5 per cent for the H_c values and ± 5 per cent for the B_r values. Several strands, generally six, of fine wire, .004 in. or .0036 in., had to be tested in order to obtain accurate B_r readings. The larger the area of wire used, the more lines of flux were available for measurement, i.e., the hysteresis loops were longer and B_r measurements were more readily made. The value of coercive force was dependent upon the applied field. Once the field was established, the H_c remained constant regardless of how many strands of wire were used.

The testing procedure followed was to take a spool of 7500 ft. of fine diam. wire and record a 1000-cps signal from an audio oscillator through a 4.5-to-1 step down transformer upon the first 100 ft. The signal was placed on the wire using a Shure recording and playback head and a 50-kc bias at 75 ma. The recording currents used for this purpose ranged from 0.47 to 85.0 milliamperes. Once the 100-ft length of wire was magnetized it was rewound upon its unrecorded balance. After this was done, the wire was played back through the Shure head and an amplifying and filter system so the output of the recorded and unrecorded parts could be measured. These determinations were made in db using a Ballentine voltmeter with an arbitrarily chosen zero point. It was found that the output of the wires directly recorded upon ranged from +30 to +32 db at a noise level of -26 db, while the output of transfer signals ranged from a high of +16 db to a low of -25.5 db. (The negative values exist

because of the arbitrarily chosen zero point on the indicating voltmeter.)

The transfer of the wires was observed to occur immediately after the original signal on the recorded portion of wire dropped off as indicated by the voltmeter. Transfer was shown to be not a uniformly recorded signal along the length of wire but rather a series of "bursts" of magnetized portions along the wire. It was noted that the transfer signal gradually diminished in output as the distance between the recorded and unrecorded portions of wire increased. A very effective visual demonstration of the actual transfer phenomena was observed by placing a cathode ray oscilloscope in the system. Transfer could then be seen as a succession of "flashing" sine waves corresponding to the original signal but of lesser amplitude. These flashes decreased in amplitude with increased distance between the recorded and unrecorded passages of wire until eventually no trace of transfer could be observed.

Results

The data obtained during these studies are tabulated in Table 1. Curves plotted from these data, Figs. 1 to 6, indicate the following:

Figure 1, plots of transfer vs. recording current for .004-in. diameter wires of various H_c and B_r values, show that transfer first increases to a maximum value, levels off and then declines as the recording current is increased. There appears to be a trend as to the effect the actual values of H_c and B_r have on the maximum transfer value of the curve and where this maximum value lies along the recording current abscissa. Figure 2 is a plot of maximum transfer value for a particular wire versus the remanence of the wire. The curve shows that as the remanence increases the maximum transfer value also increases.

Figure 3 shows the curve obtained when the recording current for maximum transfer value for a specimen is graphed vs. the coercive force of the specimen. The trend is for increasing recording current with increasing coercive force; i.e., the peak of the curves in Fig. 1 move to the right as the coercive force increases. This means a lower rate of increase in transfer at the lower recording currents, which would be of practical advantage. Thus, Figs. 2 and 3

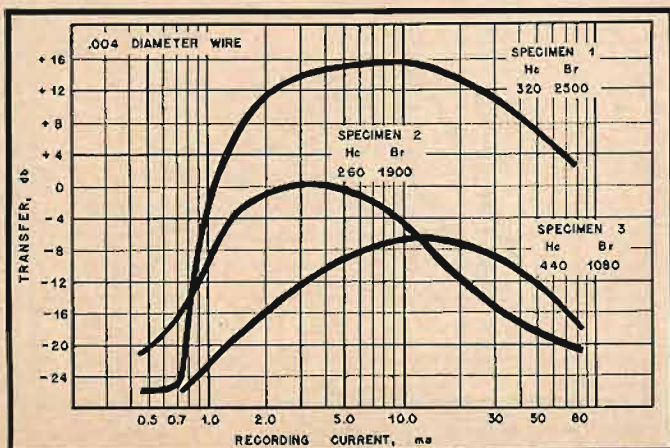


Fig. 1. Transfer vs. recording current for three specimens of .004-in. wire.

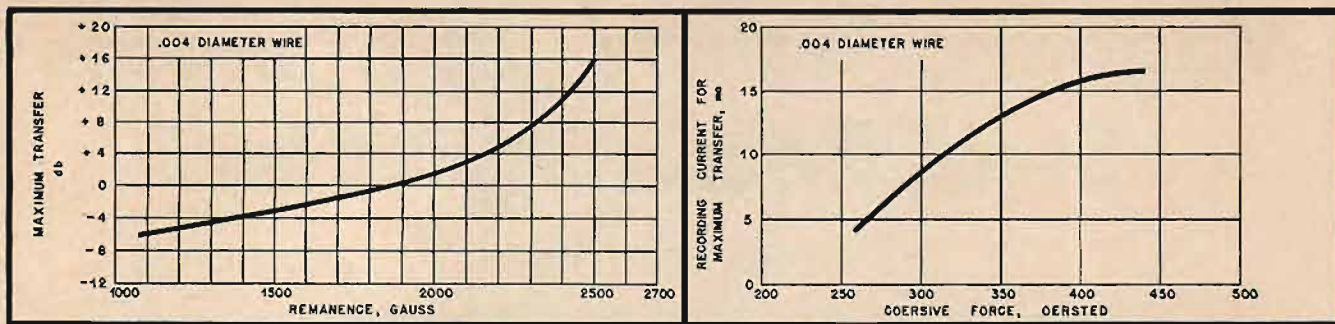


Fig. 2 (left). Transfer vs. remanence for one of the specimens of Fig. 1. Fig. 3 (right). Recording current for maximum transfer vs. coersive force in oersts, for one specimen of .004-in. wire.

indicate that transfer can be minimized by decreasing the remanence and increasing the coersive force. Lowering the remanence in turn lowers the output of a recording wire and there is, therefore, a limit to how low a value of B_r can be tolerated. Too high an increase in coersive force, which increases the difficulty of erasure of a recorded wire is, therefore, also limited.

Figure 4 is a plot similar to that of Fig. 1. The specimens used in this case were .004-in. diameter wires obtained from another source. Here it is seen that the same general trends occur; i.e., the curves rise, level off and then decline. The maximum transfer values also show up as increasing as the remanences increase. The effect of coersive force is not as clear as in Figs. 1 and 3; however, both H_c values are rather close and the indication is that the currents for maximum transfer for both curves are about the same.

Figure 5 represents the transfer values vs. recording current for finer wire, namely, .0036 in. rather than .004 in. Again the curves repeat the now familiar pattern of rise, level, and decline. Also, the higher remanence values cause higher maximum transfer values. The higher coersive force also moves the peak transfer value toward higher recording currents. In addition, as with .004-in. wire, the higher coersive force seems to cause the slope of the rising part of the curve to be less steep.

Finally, Fig. 6 shows a comparison between the effect the diameter of the wires involved has upon the curves of transfer vs. recording current. Here it is

seen that the general appearances of the two curves are similar, however, the peak value for transfer for the .004-in. wire is higher than that of the .0036-in. wire, both wires having almost the same B_r values. As with the curves representing .004-in. wire, the higher value of the H_c appeared to move the peak of the curve representing .004-in. wire to higher recording currents. Interestingly, the slope of the lower H_c curve, .0036-in. wire, was steeper than that of the higher H_c curve. This seems to be a reversal of what was found regarding the effect of H_c on .004-in. and .0036-in. wire when compared to other .004-in. and .0036-in. wire, respectively.

Thus, a smaller diameter wire would appear to minimize transfer and so a finer wire is more desirable. There is a limit to this however, for as the diameter of the wire in fine sizes is decreased,

wire drawing costs rise very rapidly. Another limiting factor is that the wire in finer sizes would snap if the recording unit started or stopped too suddenly; i.e., the wire although having a greater tensile strength as measured in pounds per square inch in the finer sizes would actually allow only for a lesser breaking load as measured in pounds.

Discussion

A possible explanation of why the magnetic transfer phenomenon behaves as it does has been considered and is as follows:

Magnetic transfer is simply the physical or very near physical contact of a magnetized permanent magnet, a turn of wire, inducing a contacted non-magnetized permanent magnet to a partial

(Continued on page 56)

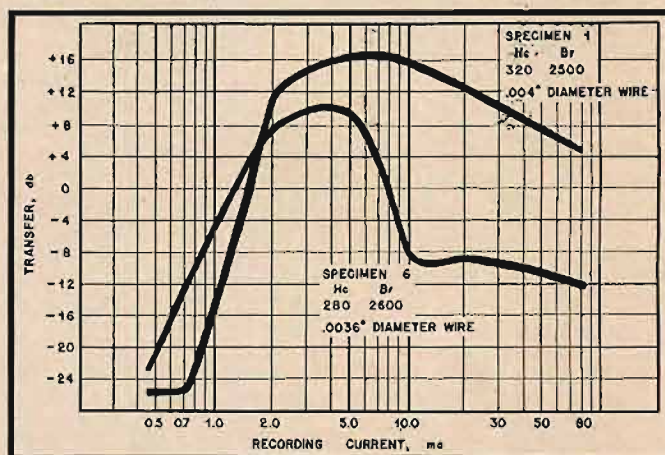


Fig. 6. Comparison of transfer vs. recording current for two wires of different diameters.

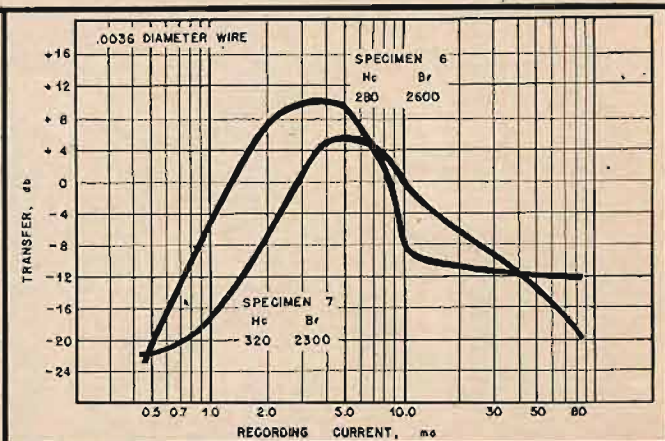
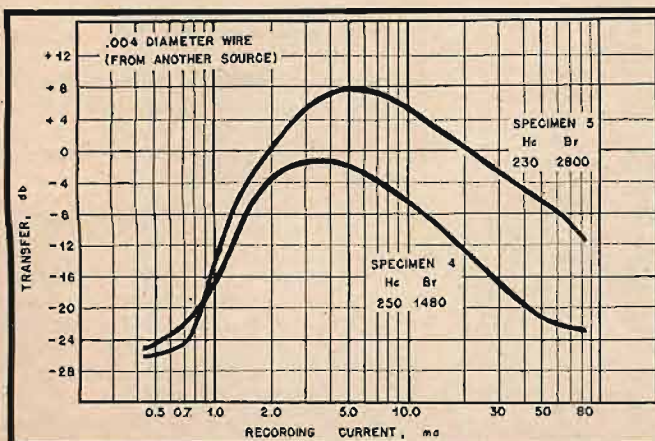


Fig. 4 (left). Transfer vs. recording current for two specimens of .004-in. wire from a different source than those of Fig. 1. Fig. 5 (right). Transfer vs. recording current for two samples of .0036-in. wire.

An Automatic Disc Recorder

CURTISS R. SCHAFER*

Time-saving is money-saving—in recording studios as well as elsewhere. The author describes a system whereby considerable time and attention is saved by making an operation partially automatic instead of entirely manual.

THE EQUIPMENT to be described was developed to meet the needs of the recording studio with a great deal of tape-to-disc dubbing work to do. Once the tape playback machine has been started, and the cutter head lowered onto the disc, the operation is almost completely automatic; that is, the program material will be dubbed to the disc with the proper spacing between selections, and both the disc and tape machines are stopped at the end of the program. Control of the disc cutter from the tape is accomplished through small pieces of Scotch tape which have aluminum foil on the outer side. These are stuck in place on the tape by the operator when he edits the tape, and act as miniature shorting bars which operate the appropriate relay on the recorder panel.

The automatic disc recorder is shown in Fig. 1. It is built around a Fairchild 539-G recorder which has been modified as follows:

1. A spiralling motor and overrunning clutch have been added.
2. A dual Micro-switch has been mounted on the left lead screw support so that when the cutter has finished the center spiral it strikes the switch actuator and a relay shuts off the turntable motor, stylus heat, and spiralling motor.
3. Other additions to the Fairchild unit are a suction pump and tube, a

* Consultant to The Dubbings Company
41-10 45th St., Long Island City, New York.

Fig. 1. The control panel mounted adjacent to the disc recorder provides convenient operation.



microscope, and spiralling and micro-groove attachments.

Figure 2 is a diagram of the audio section of the panel. The program material leaves the tape (on an Ampex "400") via a 500-ohm line, goes into the T-pad, through the passive equalizer, to give the proper high-frequency characteristic for microgroove (LP) or standard (78-r.p.m.) recording, and out into a high-quality 30-watt power amplifier¹. From the output of this amplifier,

which is loaded with a 10-db isolation pad, it comes back to the panel and into the meter switch which sets the recording level at 20 dbm for microgroove and at 26 dbm for standard recordings when the meter indicates 0 VU. This switch also monitors the voltage (approximately 6 volts at 0 VU) across the heater coil in the thermostylus unit. From the switch and VU meter, the signal goes into the 500-cps crossover network (for bass equalization) and the cutter head.

Figure 3 is a wiring diagram of the automatic control section. The indicator lights, PL, are numbered 1, 2, 3, and 4 from right to left when looking at the front of the panel, and are associated with the switches just below them on the panel and correspondingly numbered on the diagram. Terminals AA lead to the heater coil in the thermostylus unit and terminals BB lead to the microscope light. The relays indicated are of the latching type. The 30-watt amplifier, suction pump, turntable motor, and spiralling motor are plugged into the twist-lock receptacles mounted on the rear of the chassis. Sw₁ is a push-button switch for manual control of stylus heat. Another push-button switch is used for manual control of separating spiralling if desired. On the octal socket at the left of the diagram, terminals 3 and 7 go to the section of the dual Micro-

¹ Curtiss R. Schafer, "30-watt high-fidelity audio amplifier", *AUDIO ENGINEERING*, July 1948, p. 21.

(Continued on page 51)

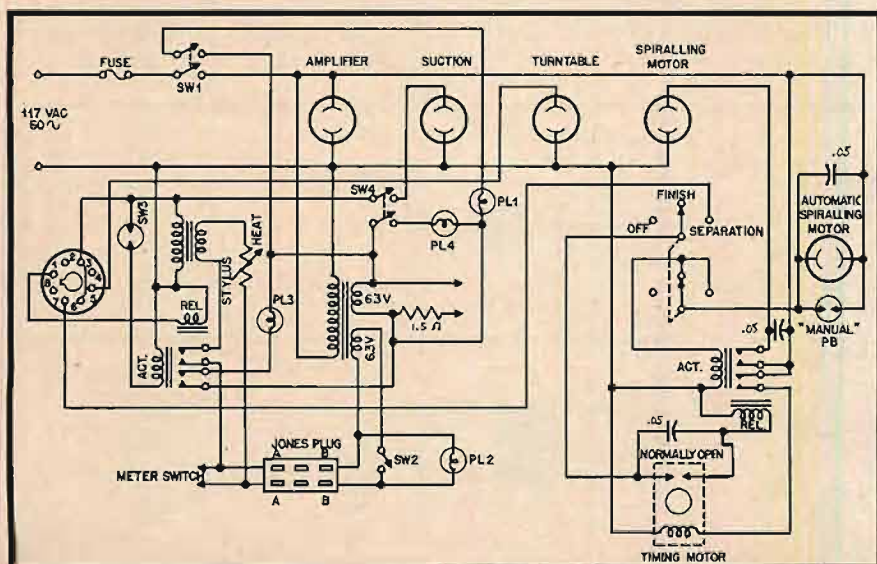


Fig. 3. Complete schematic of the power and signal circuits for operation of the disc recorder and its accessories.

A New Wide-Range Phonograph Cartridge

JOHN F. WOOD*

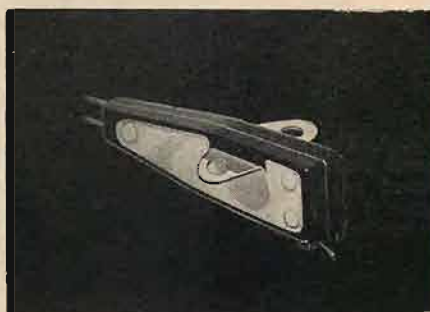
A description of the newest contender in the field of hi-fi reproduction. The principles of operation of the barium-titanate cartridge are outlined, and the economies of such a device are discussed.

FOR MANY YEARS the magnetic phonograph cartridge has been accepted as the standard of the industry and used in practically all professional and high quality reproducing systems. With specialized associated equipment, excellent response can be obtained over the major portion of the audio spectrum. While ideally suited for the constant velocity recording characteristic, there are definite disadvantages to the use of a velocity type of pickup on modern records. Until recently there has been little else available and the use of the magnetic cartridge has been accompanied with equalizing circuits and preamplifiers of increasing complexity.

With the development of the barium titanate piezoelectric element a new medium was available to the cartridge designer. Experience had been accumulated with the design and production of various ceramic cartridges for conventional phonograph use where high output and low cost were primary considerations. Accordingly, it was logical to pursue the development of a cartridge in which the full potentialities of the ceramic could be realized.

As the outgrowth of this program, the Electro-Voice Model 84 Ultra-Linear ceramic cartridge is presented to the music listener and professional as a cartridge eminently suited to the reproduction of modern records.

*Senior Engineer, Electro-Voice, Inc., Buchanan, Michigan.



The new Electro-Voice Ultra-Linear ceramic pickup cartridge.

Amplitude and Velocity

Unfortunately, a number of misconceptions have existed regarding cartridges and recording methods. In view of these misconceptions, a brief review of recording characteristics is desirable and follows in the paragraphs below.

Figures 1 and 2 are shown to clarify the relation between velocity and amplitude. The waveform is that of the record groove with frequency increasing toward the right. The frequency scale has been reduced because of limited space. According to the equation:

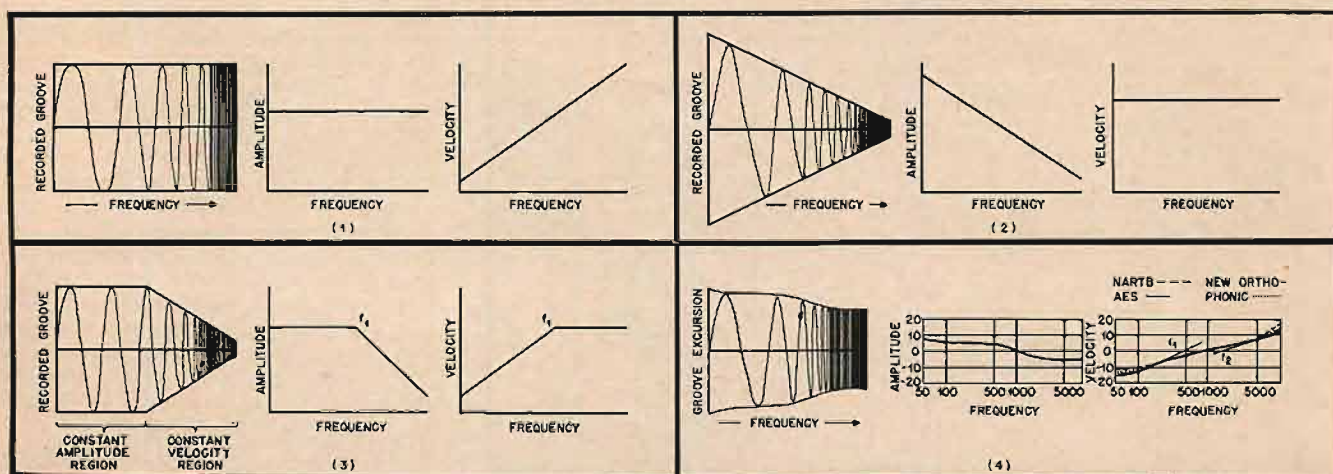
$$V = 2\pi fA$$

where V = velocity of a stylus moving laterally with the longitudinal motion of the groove,
 f = frequency
 A = amplitude of groove excursion,

velocity will increase with frequency for a given amplitude at the rate of 6 db per octave. Conversely, amplitude will decrease with frequency for a given velocity at the rate of 6 db per octave. The statement is often made that a cartridge or system is "flat." To be accurate it is necessary to indicate the reference to constant amplitude, constant velocity, or some recording characteristic such as the New Orthophonic or National Association of Radio and Television Broadcasters recommended curves. For example, a velocity-flat cartridge would not reproduce a modern music record with an Orthophonic characteristic without considerable equalization.

Origin of Recording Characteristics

The origin of constant-velocity recording goes far back into the history of sound recording. The old acoustic recording method, with elaborate horns and strong voiced artists, utilized essentially a velocity characteristic. The first electric cutters were of the magnetic type and recorded with a 6 db per octave descending slope on an amplitude basis. When played back with a magnetic pickup with the inherently inverse characteristic, the result was a flat reproduction of the original sound. Since the amplitude of the groove can become quite large at the lower frequencies, a reduction in level below some arbitrary crossover point was necessary to prevent the overcutting of one groove into the



Figs. 1 to 4. (1) Constant amplitude operation. (2) Constant velocity operation. (3) Standard frequency test record characteristic. (4) Modern recording characteristics.



(Left) Production testing of compliance, using a magnetically driven vibrating reed which is loaded by the stiffness of the cartridge. The change in amplitude of vibration is read from the meter which is calibrated directly in compliance—the reciprocal of stiffness. A high value of compliance is necessary to prevent distortion and actual damage to the record groove. (Right) Production testing of output voltage and frequency response. Voltage output at 1000 cps is indicated on the meter while playing a test record, and frequency response is checked within a 2.5 db envelope on the face of the oscilloscope over the range from 50 to 10,000 cps. The source for this test is a sweep-frequency record.

next. At this crossover point the transition was made electrically from constant velocity to constant amplitude. This characteristic is shown in Fig. 3 and is still used for a number of standard frequency test records.

When interest was aroused in the more natural reproduction of sound, it was found that the signal-to-noise ratio was very poor. This was true because of the small groove amplitude at the higher frequencies. Consequently, high-frequency equalization was provided for the cutters in various degrees until, today, records are cut with very nearly a constant-amplitude characteristic. Variations from this characteristic exist for several reasons. The first reason is to facilitate design of equalizing networks. Another involves improvement in needle tracking at the high frequencies. Variations are often made by the recording engineer to compensate for acoustic deficiencies and to produce special effects.

The NARTB, AES and New Orthophonic characteristics are shown in Fig. 4. The crossover points still exist but do not have the significance of the old transition point. The lower point is shown at 500 cps (f_1) and the upper point at 2120 cps (f_2). Because of the gradual transition, the crossover can be defined as the intersection of the asymptote or tangent of the curve with the 1000 cps level.

Obviously, the correct reproduction of these curves requires compensation of any magnetic cartridge, whether it be variable reluctance, moving coil dynamic, or other. These cartridges operate in accordance with Faraday's Law:

$$e.m.f. = \frac{d\phi}{dt}$$

where $e.m.f.$ = the generated electromotive force,
 N = the number of conductors in the field,

$\frac{d\phi}{dt}$ = the time rate of change of magnetic flux.

For this reason this class of cartridges is referred to as the velocity type.

For the magnetic cartridges, equalization is usually accomplished by a rising gain in the preamplifier of about 6 db per octave below the lower crossover point. As the magnetic cartridge is inductive, high-frequency equalization can be accomplished by shunting with a load resistance of the proper value, as is done in some preamplifiers. In others this is done in other sections of the circuit.

The effects of this extensive reshaping of the response curve can now be considered. As mentioned above, the cartridge is inductive and is therefore susceptible to hum pickup from stray magnetic fields. These fields are produced by phonograph motors, transformers, and other electrical equipment. At 30-cps, the output of this cartridge is 18 db below the 1000-cps level, or from 1.25 mv to 5 mv in an average cartridge. Amplification of this low-level signal will increase the hum along with the signal. Furthermore, there is the consideration of tube and circuit noise which is always a problem in low level amplifier design.

The Barium Titanate Transducer

Barium titanate is a true ceramic material, similar to the material used in an ordinary tea cup. However, barium titanate possesses the unique ability to generate an electric charge when subjected to mechanical stress. This phenomenon is known as the piezoelectric effect. In such an element the generated e.m.f. is proportional to the mechanical strain in the material. Because of this phenomenon, pickups utilizing the piezoelectric effect are referred to as amplitude or displacement devices.

A typical element consists of two

slabs of barium titanate separated by an electrode surface which may be a metal strip or a deposit of silver. (See Fig. 5.) Electrodes are deposited on the outside surfaces and the entire assembly is charged by the application of a high voltage, just under the breakdown potential. This "charge" accomplishes an orientation of the molecular structure and produces piezoelectric sensitivity. A bending force applied to the element will stress one side in tension and the other in compression. The generated voltages of the two slabs are usually added in series to provide maximum output.

While the piezoelectric effect has been widely used in cartridges with Rochelle Salt or ammonium di-hydrogen phosphate (ADP) generating elements, certain characteristics limited their use for the conventional home phonograph. The higher output voltage of the Rochelle Salt element is offset by its susceptibility to damage by excess humidity and its dehydration by exposure to extreme dryness. Furthermore it dissolves in its water of crystallization at 130° F. ADP is better in these respects but has a much lower dielectric constant. On the other hand, the barium titanate element is completely resistant to moisture, is unaffected by temperatures up to and above 212° F., is relatively strong, and has a very high dielectric

(Continued on page 52)

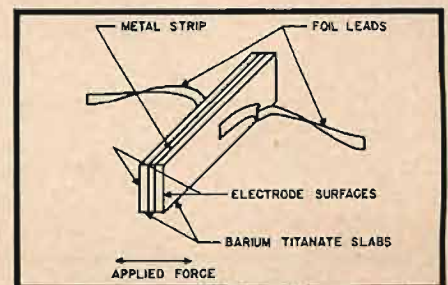


Fig. 5. A barium-titanate element.

How to Brace a Speaker Cabinet—

Vibration Reduction in Loudspeaker Enclosures

G. B. HOUCK*

Presenting the reasons for bracing a bass-reflex loudspeaker cabinet, and showing how to do it with the assurance of improved performance when the job is completed.

BENJAMIN FRANKLIN once observed that "Empty barrels make the loudest noise." In this case he was referring obliquely to the common phenomenon of uninformed vociferation, not describing the performance of a loudspeaker enclosure. G. A. Briggs, in the second chapter of "Sound Reproduction," was commenting on the latter when he wrote: "The indications are that the effect of cabinet resonance has been underestimated in the past." He observed that the tone-quality of reproduced sound was greatly improved when the loudspeaker cabinet was constructed of materials having a high density. In a paper presented before the IRE PGA¹, Frank McIntosh pointed out that "boomy" sounds are caused by acoustic radiation due to decaying vibration of the panels in a poorly braced cabinet.

Briggs offers one solution to this problem—make the panels massive and they won't vibrate. The principle involved is that of relative momenta. Consider the effect of a moving mass of air striking a panel. Referring to Fig. 1, if a unit volume of air having a mass M_1 , and an instantaneous maximum velocity V_1 strikes a unit volume of panel having a mass M_2 , initially at rest, both masses will have a resulting velocity V_2 . This relationship may be written:

$$M_1 V_1^2 - M_2 O^2 = (M_1 + M_2) V_2^2 \quad (1)$$

Note that for the optimum condition, V_2 approaching zero (panel does not move) it is necessary to have the ratio of M_2/M_1 as large as possible. Since M_1 ,

* General Precision Laboratory, 63 Bedford Road, Pleasantville, N. Y.

¹ IRE Professional Group on Audio, No. 10, September, 1952.

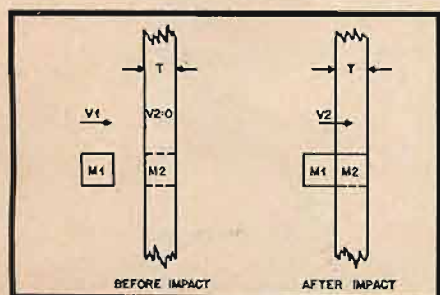


Fig. 1. Kinetic energy effect of Unit Volume of air M_1 , impinging on Unit Area of panel, M_2 .

Material	Mass lbs./ft. ³	Thick. In.	M_2 lbs./ft. ²	M_2/M_1	V_1/V_2
Dry packed sand	105	1	8.75	114	10.7
Brick	125	3	31.2	406	20.2
Concrete	150	3	37.5	488	22.1
Plaster	—	1	8.0	104	10.2
White Pine	26	7/8	1.9	24.7	4.9
White Oak	46	7/8	3.36	43.8	6.6
2-7/8 wood panels with 1" sand between	—	—	12.55	163.5	12.8

the mass of air is fixed at roughly 1/13 lb./cu. ft., M_2 remains the only variable. By varying M_2 , it is possible to obtain the ratios shown in Table I for several different materials. It appears obvious from a glance at this table that a small improvement in V_2 (hence a reduction in vibration) may be had only at the expense of a large increase in weight. For example, a panel made of concrete would tend to vibrate (other things such as the modulus of elasticity being equal) 1/4.5 times as much as one made of wood, but would weigh 20 times as much. Thus a typical bass reflex cabinet weighing 50 pounds constructed of wood, would weigh 1000 made of concrete—probably too much for the average living room floor to support. Even if this were permissible, such an enclosure would be virtually immovable and would present the baffling (no pun intended) problem mentioned in a recent editorial.²

Fortunately for the cabinet designer there is another solution to the problem of reducing panel vibration. Instead of relying on weight alone to accomplish the desired results, he can make the panels stiff, and join them rigidly together.

Stiffness of Panels

Several factors determine the stiffness of a panel. The chief factor of course is the geometry of the panel. In most cases it is very difficult to analyze the behavior of a vibrating plate, especially if one attempts to relate various design parameters to a resulting acoustic output. It is entirely beyond the scope of this discussion to examine these theoretical considerations in minute detail. Fur-

² EDITOR'S REPORT, AUDIO ENGINEERING, March, 1953.

thermore, it can be shown that a much simpler method of analysis provides the essential information necessary to make very substantial improvements in cabinet construction.

For all practical purposes it is reasonably sufficient to consider a panel as made up of an infinite number of small beams arranged side by side as shown in Fig. 2. Notice that in this type of analysis, the beams are represented as extending across the shorter dimension of the panel. Assuming the edges of the panel are supported, it is logical to suppose that the beam exhibiting the most severe deflection when subject to a load, will be one near the center of the panel such as beam A. Now, without attempting to determine an exact coefficient for the stiffness factor, it can be shown that the maximum deflection of beam A is dependent on a few easily determined variables. Actually, since the beams are integral parts of a homogeneous plate, the deflection will be somewhat less than that of a single unattached beam.

The equation for the deflection of a rigidly supported, uniformly loaded beam may be written as

$$Z = \frac{W L^3}{384 E I} \quad (2)$$

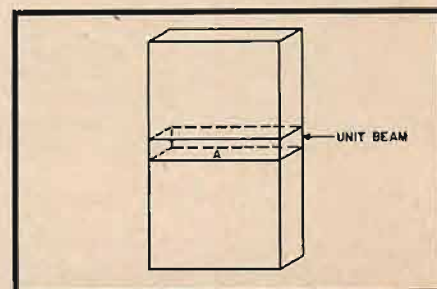


Fig. 2. Typical panel as used in the discussion.

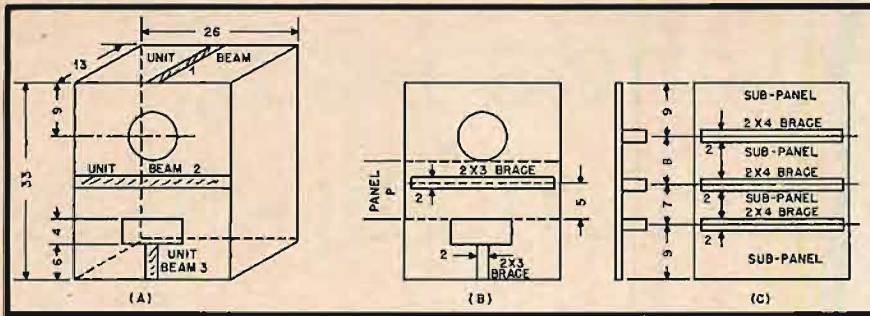


Fig. 3. Typical bass-reflex enclosure, with dimensions as used in the sample problem. All stiffening beams are mounted so that their maximum cross-section dimension is perpendicular to the plane of the panel.

in which Z equals the maximum deflection, W equals the load on the beam (maximum instantaneous value), and I equals the moment of inertia of the cross-section of the beam. If this equation is compared with that for a non-rigidly supported beam, in which case

$$Z = \frac{5 W L^3}{384 E I} \quad (3)$$

it will be observed that the deflection is five times the magnitude of the former. Of course in actual practice these extremes are almost never encountered; no panel however loosely secured would exhibit a vibration five times as severe as one firmly attached to an immovable support. Nevertheless, this simple comparison emphasizes the need for rigid support of the panels.

The maximum deflection of such a beam may also be reduced by decreasing its length as far as is practicable. On the other hand, little benefit is derived from attempting to vary the value of E ; reference to appropriate tables reveals that the modulus of elasticity of commonly used lumber varies from about 1.00×10^6 to 1.6×10^6 .

The moment of inertia of these beams equals $bd^3/12$, where b is the width of the beam and d is its thickness. (See Table II) It is interesting to note here that doubling the thickness of a panel (and hence the thickness of a unit-width beam) reduces the deflection by a factor of eight; tripling the thickness reduces deflection by a factor of 27; and so on. Before demonstrating a typical solution to a cabinet design problem, it will be found helpful to introduce one further beam equation into the discussion. In the case where a panel contains an opening (speaker mounting hole or reflex port), the beams which have one termination at an opening are classified as cantilevers. The deflection for this type of beam is written as:

$$Z = \frac{W L^3}{8 E I} \quad (4)$$

For convenience, the terms in the equations which remain more-or-less constant in any one design, are W and E , and they may be lumped into one constant, K . The equations are then rewritten as:

Simple beam—no end supports

$$Z = \frac{5 K L^3}{384 I} \quad (5)$$

Simple beam—fixed end supports

$$Z = \frac{K L^3}{384 I} \quad (6)$$

Cantilever

$$Z = \frac{K L^3}{8 I} \quad (7)$$

Figure 3 and the sample problem show the suggested method of analysis

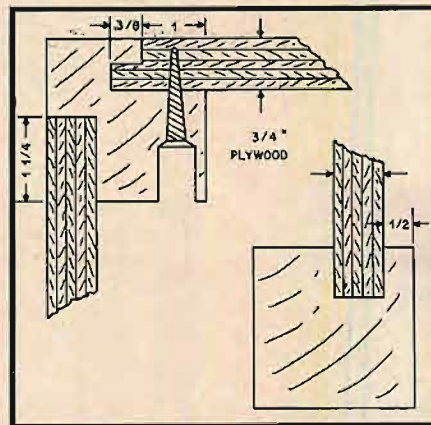


Fig. 4. Examples of cornerpost construction.

as applied to a typical cabinet. Cabinets of different shapes will present stiffness problems somewhat different from the sample illustrated. In this case, the analysis is used to determine the size, shape, and number of braces required to improve the performance of a cabinet originally constructed without full consideration of the factors just discussed. Naturally the need for extensive bracing is reduced if the enclosure is properly designed from the start.

Construction

There is more to the problem of designing a rigid speaker cabinet than mere choice of adequate panel thickness and arrangement of bracing, however. As was observed from the discussion of the beam equations, above, the method

of supporting the panels is highly important. Since most panels are made of plywood, it is necessary to insure that all joints are constructed to achieve the maximum possible rigidity. A simple but effective method for accomplishing this is to use corner posts to which the panels are securely anchored. A few typical joints of this type are illustrated in Fig. 4. It will be found that such methods also contribute to the over-all appearance of the finished structure.

At first glance, the prospective builder may be somewhat dismayed by the suggestion that special tools are needed to prepare the joints for assembly. This type of work is best done using a joiner or router, although the patient craftsman may use a plane with very good results. In many instances the whole problem can be greatly simplified by having a local mill cut each piece to size and prepare the joining surfaces from drawings furnished by the designer. The task, then, is merely one of assembling the finished parts.

During this assembly operation it is best to screw and glue all joints together so that the finished cabinet will be tight and solid. The front panel of the enclosure can also be permanently anchored if the loudspeaker is mounted as shown in Fig. 5. It is fairly well recognized that speaker performance is greatly improved by mounting the speaker in this manner. As illustrated, an alternate method using two superimposed panels obviates the necessity for special routing. In either case captive nuts attached to the back of the panel receive the speaker mounting bolts from the front. Many loudspeaker manufacturers will, upon request, supply suitable gaskets for this type of mounting.

Conclusion

It has been the purpose of this discussion to analyze the problem of spurious acoustic output caused by excessive panel vibrations in a loudspeaker enclosure, and to suggest an approach which will result in a definite reduction in the effect and a vast improvement in the over-all performance. As might be

(Continued on page 54)

TABLE 2

Moment of Inertia about the Center of Gravity for Common Lumber Sizes (max. Value)

Nominal Size In.	Dressed or Finished Size In.	Moment of Inertia In. ⁴
1 x 1	7/8 x 7/8	.049
1 x 2	7/8 x 1 5/8	.31
1 x 3	7/8 x 2 5/8	1.32
2 x 3	1 5/8 x 2 5/8	2.45
1 x 4	7/8 x 3 5/8	3.44
2 x 4	1 5/8 x 3 5/8	6.45

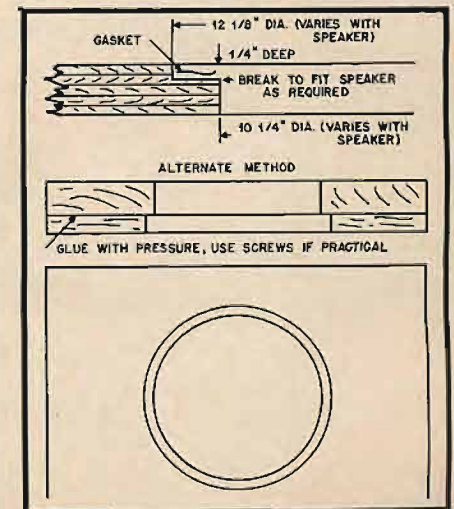


Fig. 5. Loudspeaker mounting details.

Tired Business Man's Radio Cabinet and Speaker

C. G. Fraser*

Music-time means relaxation for many—but when there is no cabinet available which provides the convenience demanded by the t.b.m. at the end of a hard day's work, the solution is best arrived at by a cut-and-try building operation—as described here.

THE ACCOMPANYING PHOTOGRAPHS represent the culmination of some seven or eight years of interesting and satisfying work in the hobby of sound reproduction. *Figure 1* shows a radio, turntable, and amplifier cabinet recently completed, the design of which incorporates a few interesting features. The height of the cabinet has been selected to stand even with the arm of a chair in such a manner as to be of maximum convenience to the operation of either the radio or the turntable. The chair which normally stands beside the cabinet has been removed for photographic purposes. A considerable amount of thought has gone into this design in an attempt to overcome what we regard as disadvantages that appear in nearly all other designs of cabinets. Most cabinet designs fall in two general categories: (1), Controls positioned for operators who prefer to lie on the floor; and (2), Controls positioned for people who prefer to stand facing a blank wall. The design shown has all controls at finger tip reach while sitting comfortably in a chair. The cover to the turntable rolls back at finger tip touch. A detail of this operation is shown in *Fig. 2*.

The equipment used consists of a Meissner AM-FM tuner, Rek-O-Kut turntable, Clarkstan tone arm, Pickering pickup and record compensator, and preamplifier.

*7516 N. Boyd Way, Fox Point II, Wisc.

The turntable is mounted partly beneath the tuner so as to shorten the cabinet as much as possible from front to back. Since all controls are still readily accessible, nothing is lost by this overlap. The record compensator is offset by means of flexible couplings. The purpose here is to be able to cluster the control knobs within easy reach on the front panel. A neon glow lamp over the compensator dial indicates when the turntable is in operation. Small lamps placed on the two front corners of the turntable compartment turn on when the cover is rolled back. The top of the tuner compartment has a hinged cover to facilitate tube replacement.

The 15-watt amplifier used in this equipment was built from a UTC design and incorporates a UTC tone control which has been permanently fixed to give 10 db of bass boost and 5 db of treble boost. This tone control as sold has a low-frequency peak at 50 cps and a high-frequency peak at 8,000 cps. This was unsatisfactory for best operation of the speaker system so the unit was taken apart and capacitor values changed to give a low-frequency peak of 27 cps and a high-frequency peak of 14,000 cps. A little work on a Saturday afternoon and a can of hot oil will do it.

THE LOUDSPEAKER

The development of the speaker system has taken place in parallel with the other equipment which confirms the statements so frequently heard that perfection of one component uncovers the failings of another component. *Figure 3* illustrates what was once a Stephens bass-reflex cabinet. In this connection the number of articles which have been written dealing with ways and means for improving the operation of a bass reflex cabinet might be taken as an indication that certain people are dissatisfied with this type of reproducer. That, at least, was the writer's experience. The original speaker used in this cabinet was an Altec 603. As perfection of various components was achieved, it became increasingly evident that the speaker-cabinet combination could stand some attention.

At about this time an opportunity occurred to witness the performance of a folded horn installation. After studying various literature which is available from the library on sound in general and folded horns in particular, it seemed that it was worth a try to remodel a good bass reflex cabinet in hopes of improving the performance with a homemade and rather poorly engineered exponential horn. After a considerable amount of doodling on graph paper, it was possible to design a horn 56 in. long and with a 19-in. flare within the dimensions of the original cabinet. Next came the problem of using the present speaker if possible,

Fig. 1. Combining simplicity of construction and ease of access, this "home-made" cabinet houses the turntable, phono preamp and controls, radio tuner, and the power amplifier.





With the controls for the radio tuner at arm level when the user is seated, as indicated in Fig. 2 above, listening can be a pleasure uninterrupted by the need for jumping up and down to change stations or records. The loudspeaker, shown in Fig. 3 below, is located across the room. The cabinet was modified from a standard model.

and perhaps this illustrates to perfection the adage, "Fools rush in where angels fear to tread." The high-frequency horn of the 603 speaker was removed. It probably was fortunate at the same time that some damage occurred to the voice coil, so for something like \$13.00 a new copper voice coil and cone to convert the speaker to a standard Altec woofer was installed. The change was simple but it appeared as though the 57-cps resonant frequency of this speaker should be lowered if possible. After obtaining as much advice as possible the periphery of the cone was sanded and a large portion of the voice-coil diaphragm was cut out. This was a step by step operation, each one a little bolder than the one before, until it was possible to get the resonant frequency down to 32 cps. It might be added however, that the paper cone by this time had been sanded so thin that it was transparent. An application of rubber cement closed the pores and made it substantially air tight. It was necessary also to close the center of the cone and to open up relief ports in back of the diaphragm. This entire venture would make Mr. Hilliard feel bad but there seem to be some advantages in not having test instruments because if the quality of the tone of this speaker has been adversely affected, it is not apparent to the ear.

The next problem was the selection of a high-frequency unit. Note that this folded horn does not have the "Queen Mary super structure" that is common with this type of enclosure. The high-frequency unit is here but it is not in sight. The actual installation was made by the selection of a University cobra unit. The horn is mounted permanently within the convolutions of the low-frequency cabinet. The driver, however, can be reached from the back of the cabinet and removed by unscrewing if necessary. This particu-

lar tweeter was selected for two reasons: The cross-section of the horn is small enough that it can be placed within the larger horn with a minimum of interference, and the driver can be removed without the use of a screw driver. Obviously this driver is far inside the cabinet where no tools can be used. The standard crossover frequency for the University tweeter is 600 cps. This was a matter of some concern because all literature on the subject indicates that a cut-off of 400 or 500 cps is necessary for this type of cabinet. Probably it is again fortunate that no instruments have been put on the cabinet or probably it is because of the 6 db of attenuation in the cross-over frequency, but any missing notes in the 500-600 cps zone simply cannot be detected. As a further safeguard towards a break in response the folded horn was constructed of $\frac{5}{8}$ -in. Weldwood, which is an all birch plywood, then finished with hard enamel.

If there is any conclusion that can be drawn from this type of progress, it is that the man without technical knowledge must be satisfied to make his progress slowly. He must also anticipate a mistake now and then, and most of all he must be satisfied to imitate the work of others. There probably is not a good original idea in this entire paper. Anything that might be classed as purely original would probably be also classed by the technical boys as undesirable.

The performance of the unit, at least so far as the ear is concerned, is good. It appears to reproduce 32-cps fundamental tones well, although the only available source of this material is an FM broadcast of live pipe organ music.

(Continued on page 59)



The 1953 Audio Fair in Review

HARRIE K. RICHARDSON*

AFTER PREMISING a number of these annual observations on the growth of Audio as an industry, it is somewhat relieving to discover that the path of this year's wordage leads directly to evaluation of Audio as a market.

In Fairs gone by—even as recent as last year—there has been present the lagging indication of two disturbing situations.

(1) Audio manufacturers, with few notable exceptions, were not on a common ground of understanding with the prospective buyers of their equipment. Too often they placed themselves in the position of selling 'scope traces and printed specifications, overlooking the inability of their audience to interpret technical demonstrations in terms of living-room performance.

(2) Buyers of home music systems as a whole had not equipped themselves with the basic knowledge necessary for intelligent selection of the system's various components. There was far too much of

the "I-don't-know-from-nothing, technically-speaking" attitude.

On the one hand, you had the engineering brethren describing their audio progenies in a vocabulary which was virtually meaningless to their listeners. On the other hand the listeners, not to be outdone, blossomed forth like a mass migration of Deems Taylors with an effect which was equally bewildering.

The 1953 Fair witnessed the meeting of the twain. One could take his choice and use *low-frequency boost* or *basso fortissimo* with reasonable assurance of conveying the desired connotation to whomever he was speaking, be it music lover or engineer.

In essence, the 1953 Fair marked the moment in audio history when the professional engineer and the embryonic hobbyist met each other half way. Engineers deserted their slipstick terminology and spoke in terms of musical values, while music lovers met the challenge

by tossing around such words as *frequency response*, *distortion*, and *equalization* with full knowledge of their meanings.

Credit without limit is due both groups. Because, within the space of a single year they have solidified a basis of mutual understanding which has long been needed.

Clearly evidenced by the scope of the 1953 Fair was the fact that the audio industry has at last become a major commercial entity. No longer is it accorded the paternal pat of condescension by major manufacturers, nor is it accepted with resignation as a necessary evil by the larger recording companies. If there be clearer proof that audio has passed twenty-one, this reporter remains to be so enlightened.

Herewith the observations which stand uppermost as relief at the passing of the 1953 Fair gives way to anticipation of the one scheduled for 1954.

"An audio engineer's dream" could well be the title of the display presented by Acro Products Company. Acrosound transformers, Ultra-Linear amplifiers, and a host of other precision audio devices made up an exhibit which was easy to take and hard to leave.

Featured in the exhibit of Alpha Wire Corporation was the release of the company's new catalog 153-S, which is concerned exclusively with wires and cables for use in sound equipment. This catalog dramatizes the extent to which Alpha has gone in keeping pace with the audio industry. Also on hand was a complete display of Alpha products.

The major portion of the Altec Lansing Corporation exhibit was devoted to stressing the purely home atmosphere of high fidelity. Five tastefully arranged groupings of typical living room furniture successfully dispelled the idea that special cabinetry is needed for a high-quality home music sys-



tem. The remainder of the Altec display consisted of a miniature anechoic chamber with transparent sides, in which an Altec Duplex speaker was put through tests to show the basis of its unconditional guarantee of frequency response from 30 to 22,000 cps.

* Associate Editor, *Audio Engineering*

Genuine stereophonic sound—the kind reproduced with three or more recording channels—was the highlight of Ampex Corporation's showing of the Model 350-3 stereophonic recorder. Housed in three portable cases, the 350-3 is perfectly suited for location recording in the production of 3D motion pictures with dimensional sound. So realistic were the recordings used



to put the equipment through its paces, that only the difference in acoustical surroundings prevented virtual duplication of the live performance. Of more realistic interest to Fair visitors were the new Ampex Model 350 recorder console and the Model 450 continuous tape reproducer.

Newspaper and magazine correspondents, as well as radio and TV commentators that covered the Fair—and many they were—migrated quite naturally to the suite occupied by Amplifier Corp. of America. Here they were treated to an outstanding display of a device which is rapidly becoming a

staple tool of their profession—the miniature, portable tape recorder. Of the many models of Amplifier Corp.'s Magnemite recorder exhibited, interest was centered on the new battery-operated-motor unit which affords every recording facility within a small case and weighs but eight pounds.

Known principally for the excellent motion picture equipment the company has manufactured for many years, Ampro Corporation has successfully transferred its enviable reputation to the audio field with a new line of tape recorders. Available in a number of models, the new Ampro recorders are exceptionally fine performers within their various price ranges.

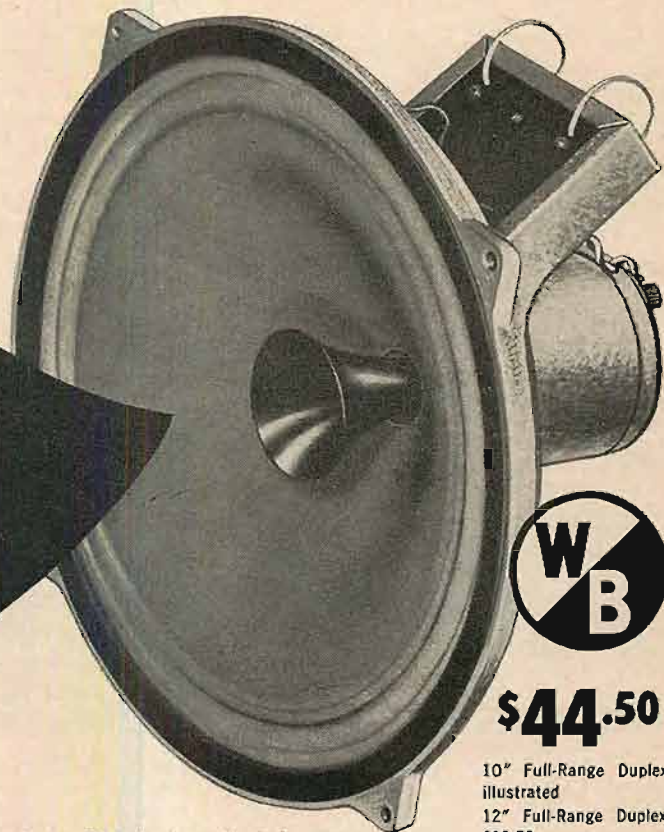
One would have to travel far and wide to discover more appealing examples of audio cabinetry than that shown by Angle Genesee Corporation. Custom-built, well-constructed, and acoustically-correct, the enclosures on display were the subject of many complimentary observations.

Imagine, if you can, a competent concert pianist playing the well-known Chopin Polonaise; suddenly her fingers leave the keyboard, yet the music continues without noticeable change. This was the dramatic means chosen by Audak Company to demonstrate the realistic performance of the Audak Polyphase Chromatic reproducer. Unchallenged was the opinion of audio engineers and fans alike that the Audak pick-up passed this most trying of tests with flying colors.

The dominant theme of the Audio & Video Products Corporation exhibit was based on the completeness of the products handled by the company for radio stations and professional recording studios, with primary emphasis being placed on tape recording equipment and accessories. Among the well-known trade names in evidence were: Ampex, Altec, Electro-Voice, McIntosh, Cinema, Tapak, and Telefunken. Also of great interest was the display of

New **Beam W/B**
STENTORIAN®*
Golden Tone
SPEAKER LINE

to Audition is
to Acclaim it



\$44.50

10" Full-Range Duplex, illustrated
12" Full-Range Duplex, \$99.50

Specifications, 12" Duplex Model

Frequency Response, 20-20,000 cps. • Bass Resonance, 35 cps. • Built-In Cross-over Network • Graduated "Fibre-tone" L.F. Cone • Phase Matched H.F. Drive • Power Capacity Conservatively Rated 15 Watts • "Alcomax 3" Magnets • Die-Cast Chassis • Crackle Gold Finish • Weight, 16 lbs., 4 oz. • Both Duplex models have twin concentric voice coil drives.

Here is a new speaker line which will become one of the great names in the American hi-fi field. Built on a revolutionary new principle, these speakers are priced remarkably low for instruments of such outstanding quality.

Beam W/B Stentorian speakers, British-made by the world-famous Whiteley Electrical Radio Company, complement to the fullest extent the most modern achievements in hi-fi recording and in amplifier design—provide vivid realism, high sensitivity, and a degree of musically satisfying *balance* never before attained in a speaker.

The wonderfully smooth performance of Stentorians over an extended range is made possible by W/B Beam's new "Fibre-tone" diaphragm and cone process... and by the patented, brilliantly-designed twin concentric drives (duplex). And Stentorians are made entirely by *one organization*; every component, without exception, is manufactured under one roof, to strict quality specifications. *Compare price and performance*, and you'll want to own one of these remarkable speakers.

BEAM STENTORIAN W/B

BEAM INSTRUMENTS CORPORATION
350 FIFTH AVENUE NEW YORK, N. Y.

*Leaders in Loudspeaker Manufacture for over 30 years.



**W/B STENTORIAN
HIGH FIDELITY DIRECT
RADIATOR SERIES**

6", 8", 9", 10", 12".
Extended bass and smooth highs. Balanced response without coloration, from 35-14,000 cps. Incorporates the

exclusive new cambric "Fibre-tone" cone. Voice coil impedance, 15 ohms. Die-cast chassis. Crackle gold finish. Priced from \$6.95 (6") to \$39.50 (12").



**W/B STENTORIAN
HF TWEETERS
T 12 Specifications**

Ideal with any cone speaker. Response, 2,000 to 20,000 cps. Coil impedance, 15 ohms. Power handling, 15 watts. Rigid construction. Prices: T 10 (5 watts), \$17.95; T 12, \$45.00

Crossover unit, 15 ohms, matches all Stentorian tweeters, H.F. speakers and woofers, \$7.25.

Also 18" woofer...and the revolutionary 18" "Quadruplex" full-range unit having four independent drives on a single axis.

Audition These Beam Stentorian Speakers at Your Audio Dealer's. Descriptive literature on request.

pre-recorded music-on-tape shown by the A-V Tape Libraries division. No doubt about it, this rapidly growing library of recorded tape offers a challenge to the disc companies which now occupy the major portion of the home music market.

The thoroughness with which Audio Devices, Inc., penetrates the field of recording materials was well evidenced by an attractive exhibit which included the entire line of Audiodiscs and Audiotape. Stressed in the display was a large wall board devoted to the theme,—"Of the 30 best selling records of 1952, 29 used Audiodiscs for the master recording." The black sheep, incidentally, was a London record made abroad.

Packaged high-fidelity equipment of unsurpassed appeal to both eye and ear was shown by the Appliance and Electronics Division of Avco Manufacturing Corporation. Spotlighted was the Crosley "Enrico Caruso" FM-AM radio-phonograph. This unit is housed in two matching cabinets, one for record changer, tuner, and amplifier; the other is an acoustically-engineered speaker enclosure. Although the Avco display was essentially high fidelity in character, a small portion was devoted to the complete line of Crosley Coloradios, portables, and a new portable clock-radio-phonograph.

A relative newcomer to the high-quality audio industry is Beam Instruments Company, American distributor for England's famous Acoustical QUAD amplifier, first shown in this country at the 1951 Audio Fair, and the Stentorian line of high-fidel-



ity speakers, also manufactured in England. Especially interesting was the Stentorian "Quadruplex," an 18-in multispeaker which has four independent voice coils and diaphragms matched to a built-in crossover input; power rating is 30 watts. All Stentorian speakers are constructed with a cambric cone and surround, and as a result have remarkably low fundamental cone resonance. Also shown was a group of striking enclosures manufactured by Beam for housing the various types of speakers.

The Fair offered no more complete showing of high-fidelity amplifiers than that of Bell Sound Systems. Beginning with the low-power Model 2122B and continuing through the higher powered remote-control Model 2145A, Bell presented an amplifier for every home music requirement. Sharing honors with conventional amplifiers was the new Bell binaural amplifier which was demonstrated with remarkable effectiveness. Also displayed were tape and disc recorders, and two high-fidelity transcription-playing units.

You can always count on Berlant Associates for equipment displays which are both entertaining and informative. This year's showing was no exception, featuring as it did four Concertone high-quality tape recorders which cover the needs of both professional recordists and advanced audio hobbyists. As in previous years, gracious Bert Berlant, company president, was on hand to explain the whys and wherefores of the fine recorders his firm manufactures.

There's no better example of growth in the field of high fidelity than David Bogen Company, whose exhibit was one of the Fair's more pretentious. So complete is the Bogen line of tuners and amplifiers that it satisfies everyone from the budget-minded to the connoisseur whose only criterion is perfection. The highlight of the Bogen exhibit, at least to this observer's way of thinking, was the "decorators' corner"—an assembly of tasteful furnishings which proved beyond doubt that a home music system must not necessarily be an eyesore.

The expanding diversity of the company's line of high quality speakers was emphasized in the display of R. T. Bozak Company. In addition to speakers themselves, Bozak is now merchandising an assortment of enclosures which are impressive in performance and stunning in appearance. Outstanding is the model which houses two matching speaker systems, and which may be used with equal effectiveness for either stereophonic or monaural reproduction.

Personalities were the order of the day in the exhibit of British Industries Corporation, with G. A. Briggs and Harold Leak, both noted audio authorities from across the water, on hand to demonstrate and discuss the equipment with which they are most closely identified. Mr. Briggs who, in addition to having written many books on sound reproduction, designs Wharfedale



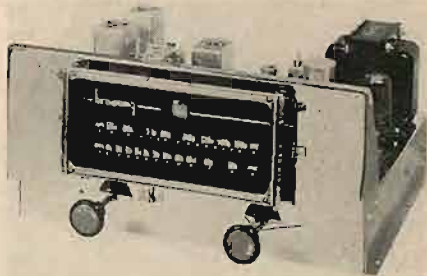
speakers, thrilled visitors with a three-way speaker system mounted in a corner cabinet whose hollow walls were filled with sand. Mr. Leak, as might be supposed, had paternal interest in the amplifier which was used in the demonstration. Mr. Briggs, in his first appearance at an Audio Fair, found a deep spot of affection in the hearts of his American contemporaries—while Mr. Leak, an Audio Fair veteran, was received with the welcome of an old and respected friend.

One of the real pioneers in the audio industry, Victor Brociner, president of Brociner Electronics Laboratory, presided over his company's display of a magnificent-sounding new speaker system, a new power amplifier, and the well-known Brociner audio control system. Of particular interest was the Model 4W wall horn, designed for use in rooms where a corner speaker is not feasible. Powered by a twin-cone driver unit, the 4W has in effect a "built-in" corner, and provides performance equal to that of the original Brociner Model 4 corner horn, without requiring corner placement. Styling of the enclosure is both conservative and graceful.

Sticking to a tradition which was established with the first Brook amplifier, Brook Electronics features the use of low-mu triodes throughout in the new Model 22A, which resembles in appearance the Brook

Model 7 preamp and is but little larger. Attractively finished in gold and brown, the 22A is the first completely enclosed amplifier Brook has built. Output power is 10 watts and controls include input-selector switch, variable record equalization, bass boost, treble cut, and compensated volume control.

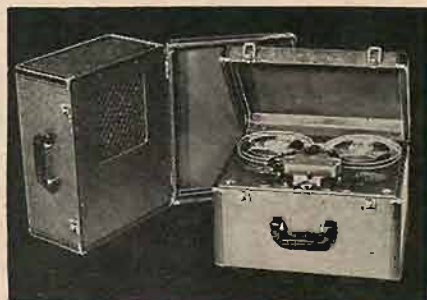
Along with exceptional tuners, there was displayed a high-quality amplifier in the exhibit of Browning Laboratories. Featured was the new RJ-42 AM-FM tuner, a new precision-built unit which offers wide-range reception and is virtually free of annoying



drift. Although precision-built, the RJ-42 is designed for operation by the non-technically-inclined music lover, having only two control knobs—one for tuning both bands, the other for channel selection, AFC control, and switching on and off. A screw-driver adjustment on the rear of the chassis is used for setting the tuner's output level to match that of other input devices.

The Columbia "360", first of the two-speaker high-fidelity table-model phonographs, together with the matching XD speaker for stereophonic effect, was featured in the exhibit of Columbia Records, Inc. GRI deserves a special pat for the courtesy and attention which were accorded visitors by genial Bill O'Boyle, national sales manager of the phonograph division.

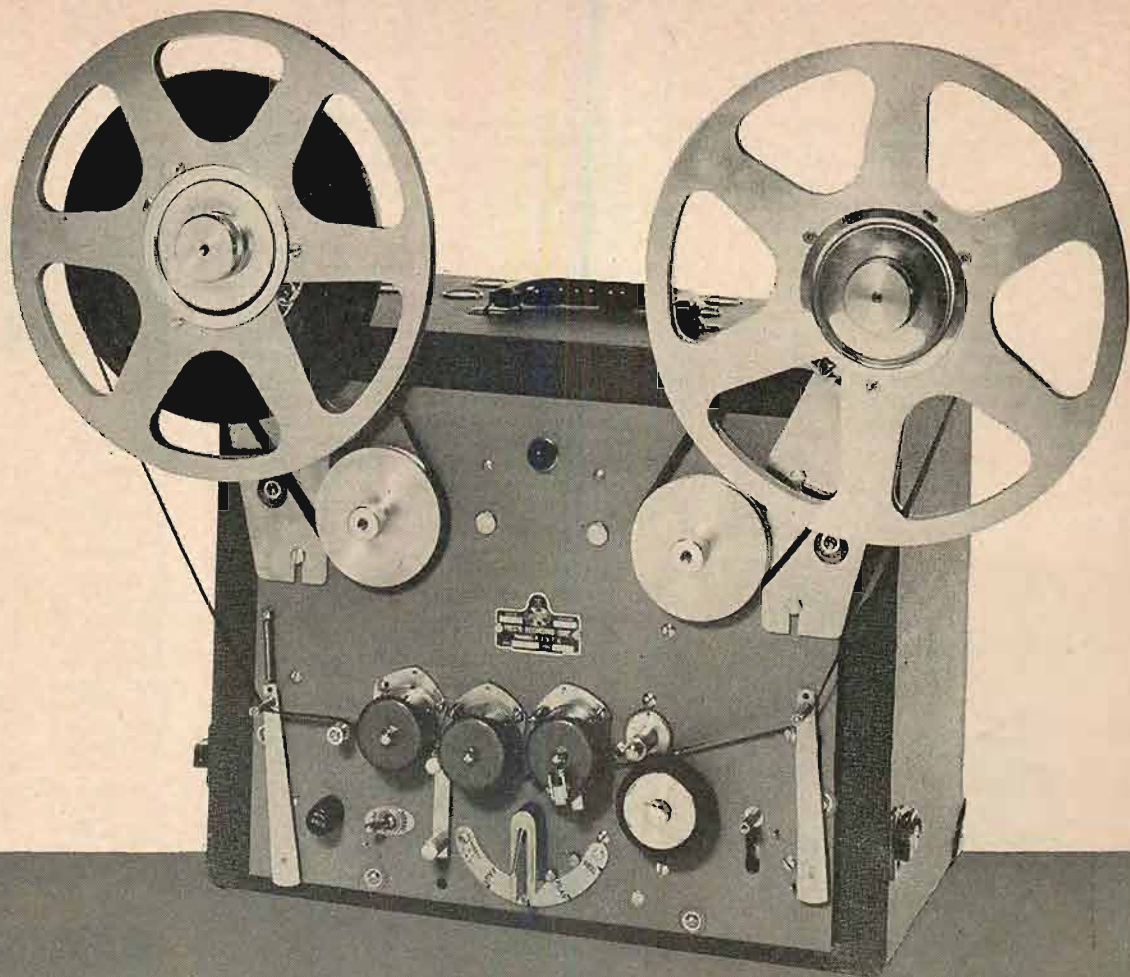
Indicative of the tremendous expansion which is taking place in the tape-recorder field were the new Crestwood recorders displayed by Daystrom Electric Corporation. Designed essentially for home use, the



Crestwood 401 approaches professional standards in many respects. It is a low-level-output recorder for which Crestwood manufactures a companion power amplifier. The two units are supplied in handsome luggage-type carrying cases for portability.

Officials of Conrac, Inc., travelled all the way from California to present the Fleetwood line of television receivers which are specially designed with high-quality audio output for feeding high-fidelity music systems. Particular attention was accorded Models 600 and 700, both of which are equipped with a remote-control unit which may be located as much as 100 feet from the picture chassis.

**you
don't
buy
one of
these
every
day!**



PRESTO RC-7 with RA-1 reel adapter

Compare these RC-7 features:

- Instantaneous speed accuracy
- Dynamic range better than 50 db. at 3% distortion
- Three-motor drive
- No friction clutch or friction brakes
- Heavy duty construction throughout
- Separate-erase-recording-playback heads
- Twin speed: 7 1/2" /sec. or 15" /sec.
- Frequency response to 15,000 cps.
- Reel size: to 10 1/2" (with RA-1 adapter)

Purchase of a tape recorder is a major investment. And, with so many unproven brands on the market, it simply does not pay to select anything but a recognized, precision built and proven recorder.

The PRESTO RC-7 is just such a unit. Designed and manufactured by the world's foremost producer of precision recording equipment, the RC-7 with RA-1 reel adapter is today's No. 1 buy in fine tape recorders. Here is a unit that is fully portable for field recording, yet with the rugged construction and precision operation characteristic of the finest studio equipment.

If you're planning to replace an existing unit or add an additional tape recorder, your selection of a PRESTO RC-7 will pay long term dividends in faultless service, ease of operation and the genuine satisfaction of owning the best.

Do you own a Presto RC-7? The RA-1 adapter will allow you to use reels up to 10 1/2" diameter. Write for full details and price.



PRESTO RECORDING CORPORATION
PARAMUS, NEW JERSEY

Export Division:
Canadian Division:

25 Warren Street, New York 7, N. Y.
Walter P. Downs, Ltd., Dominion Square Bldg., Montreal

WORLD'S LARGEST MANUFACTURER OF PRECISION RECORDING EQUIPMENT AND DISCS

It seems to be a pleasant habit of Cook Laboratories, Inc., to present each Audio Fair with a fabulous example of recorded sound. This year was no exception. Using a battery of 20 specially-designed speakers fed from one of his company's binaural recordings of a large pipe organ, Emory Cook, president, thrilled thousands of visitors with startling reproduction of a 16-cycle note—fundamental, that is. Those who could remove their attention from the remarkable demonstration of sound were treated to a preview of the first working model of a new changer arm which mounts two pickups for binaural records.

DuKane Corporation rigged up a 'scope to illustrate the recording and playback frequency response of the new Tru-Fidelity tape recorder. Clearly shown was the



unit's ability to handle 20 to 12,000 cps at 7½ ips. Available in both panel-mounting and portable models, the Tru-Fidelity recorder operates at 3¾ and 7½ ips, and is a masterpiece of industrial design.

Long known principally for the excellence of the jewelled styli manufactured by the company, Duotone chose its Fair exhibit to announce that it is now handling American distribution for the Holland-made Philips line of loudspeakers. As in previous Fairs, the focal point of the Duotone suite was an excellent display which dramatized the superiority of the diamond over other stylus materials for hi-fi music systems.

Espey Manufacturing Co., Inc., a first-time participant in the Audio Fair, displayed a greatly expanded line of tuners and amplifiers, including a new binaural unit which was featured in demonstration. Of particular interest to dealers who were present was an Espey-designed demonstration stand, which contains one each of the various Espey models and incorporates a switching arrangement for playing any desired tuner and/or amplifier.

As in years gone by, Electro-Voice, Inc., came through with one of the Fair's truly outstanding exhibits of fine audio equipment. Sharing honors with the handsome Georgian 4-way speaker system were E-V's new ultra-linear ceramic cartridge and Model 15-TRX triaxial reproducer. Repeating another aspect of former E-V exhibits, program material used for demonstration was exceedingly well chosen.

Fairchild Recording Equipment Corporation, which has long been among the leaders in the manufacture of professional disc and tape recorders, used its Fair exhibit to emphasize its penetration into the consumer market for high-quality audio equipment. Along with the Model 215 magnetic pickup which was first shown publicly at the 1952 Fair, the exhibit featured two

new Fairchild developments—a plug-in tone arm which accepts all standard cartridges, and a preamplifier-equalizer which is exceptional both in appearance and performance. Both of these items are certain to create a stir when they strike the audio market place; first deliveries to dealers are scheduled for around December 30.

A new ribbon-type pickup, designed by D. T. N. Williamson of Williamson amplifier fame, was given its first American showing by Ferranti Electric, Inc. Known as the Ferranti pickup, the new unit features an integrated design of arm and head, with an extremely low mass movement, and exceptional compliance. The unit was demonstrated tracking perfectly a 20-ke cut on lacquer at 1-inch concentricity at 78 rpm. Response is uniform from 20 to 20,000 cps.

Avery Fisher and James Parks, president and sales manager, respectively, of Fisher Radio Corporation were on hand to give official sanction to the first public introduction of several new Fisher entries in the high-fidelity market place. Particularly out-



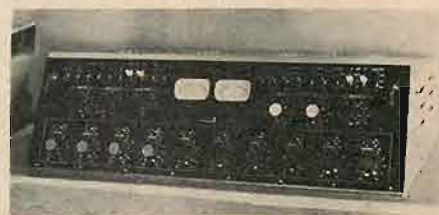
standing was the new Model 70-RT AM-FM tuner, which includes built-in preamplifier, with tone controls. Beyond all question, the 70-RT satisfies the need for a precision tuner which includes within a single chassis all the control facilities required for a high quality music system.

A deluxe addition to the well-known Garrard line of record changers and single players was given its first public showing by Garrard Sales Corporation. The new RC-90 changer permits variable speed control at all operating speeds, along with a number of other features including a manual play position and easy adjustment of tone arm pressure. A noise suppressor across the a.c. switch eliminates the "clunk" which is usually heard in the speaker when a changer is shut off. Shown with the new RC-90 was the standard RC-80 changer upon which Garrard has built its enviable reputation.

Visitors to the exhibit of Gately Development Laboratory were treated to the first public showing of the "Purest," a newly-developed folded-horn enclosure which does not require corner location. Performance of the Purest, also of the original Gately Super-Horn corner-type enclosure, was entirely satisfying.

General Electric Company, whose development of the GE magnetic cartridge played no small part in bringing the country's music lovers face-to-face with the wonders of high fidelity, has broadened its coverage of the industry to include a new remote-control amplifier, a wide-range coaxial speaker, and a record compensator. The latter item, for connection between pickup and amplifier input, is designed to bring up-to-date existing music systems which are not equipped with record equalization.

Strictly professional in character, the Gates Radio Company display presented the firm's new CCI master control console



which represents many innovations in technical design. Flexibility of control afforded by the CCI is creating wide acceptance for the unit throughout the broadcast and recording industries.

Dictating equipment shared honors with transcription arms, equalizers, and a host of other audio components in the exhibit of Gray Research & Development Company. Although the bulk of its activity these days is devoted to the manufacture of studio equipment for TV stations, Gray is still deeply involved in audio as was evidenced by a display which was thoroughly entertaining.

Among the more impressive complete high-fidelity music systems shown at the Fair was the Model 1621 console introduced by The Hallicrafters Company. Enclosed in a handsomely-styled cabinet, the



unit comprises a Hallicrafters AM-FM tuner and matching amplifier, Garrard three-speed record changer, two Jensen speakers, and the Hallicrafters studio record adjuster. Especially noticeable was the fact that ample cabinet space has been allowed for speaker housing.

H. A. Hartley, president of the English company bearing his name, in his third Audio Fair appearance found his time equally divided between acknowledging the welcome of his many American friends, and demonstrating his firm's new 20-watt amplifier, together with a new tape recorder produced by his company in collaboration with another English firm, Wright and Weaire, Ltd. It goes without saying, however, that the Hartley Model 215 speaker and Baffle were his primary interest. According to Mr. Hartley, "The particular object of our exhibit this year was to show that in pinning our faith to the single-unit speaker to cover all frequencies we could still provide really impressive bass in large rooms."

Harvey-Wells Electronics, Inc., long known for the manufacture of communications equipment, made an auspicious

(Continued on page 63)

the
unique

Regency



KLIPSCH LICENSED FOLDED HORN ENCLOSURE
with complementary speaker systems

Provides "built-in" corner; can be used in corner or against flat wall

Designed for 15" coaxial speakers, or separate 2-way and 3-way systems . . . without need for modification

One full octave of added bass guaranteed over any commercially available bass reflex enclosure

10 to 15 db more efficient than conventional enclosures; laboratory flatness ± 5 db to 30 cps



Dimensions:
high
33½" wide
19" deep

REGENCY ENCLOSURE ONLY

Mahogany. List \$200.00; Audiophile Net, \$120.00

Blonde. List \$215.00; Audiophile Net, \$129.00

COMPLETE REPRODUCER SYSTEMS

REGENCY II. Includes E-V Model 114-A 2-way system in Regency enclosure.

Mahogany. List \$517.00; Audiophile Net, \$310.20

Blonde. List \$532.00; Audiophile Net, \$319.20

REGENCY III. Includes E-V Model 114-B 3-way system in Regency enclosure

Mahogany. List \$592.00; Audiophile Net, \$355.20

Blonde. List \$607.00; Audiophile Net, \$364.20



Superlatively styled in low-boy motif, gracefully accented by a solid antique brushed brass grille, the Regency is appealing as a design of excellence and enduring beauty. Adaptable to the living room, study or den, the exquisite veneers are hand-rubbed to a mirror finish on every exposed surface. The Regency is available in rich mahogany or smart lustrous Korina blonde.

A Klipsch-licensed folded corner horn with integrally built-in "corner," the Regency can be employed in the corner for augmented bass response or against the wall of the room away from the corner for flat response (± 5 db to 30 cps). In the Regency, the vital cavity behind the cone baffle exploits the unique, patented Klipsch feature of resonating the back-load with the frontal air load to increase bass efficiency through a broad 4-octave pass-band acoustic circuit.

Send for Bulletin 185

Electro-Voice

Handbook of Sound Reproduction

EDGAR M. VILLCHUR*

Chapter 15, Part 1. Power Supplies, Hum and Noise

AN AUDIO AMPLIFIER must control an independent source of energy in order to amplify, and for its operative needs must also use up power that does not get passed on. The a.c. power receptacle is the most common source of this energy, but the electric power supplied commercially must be changed in form before it can be used. The circuit that performs the necessary conversions is called the power supply.

The alternations of the a.c. line make power transmission and distribution more convenient, and make it possible to employ step-up and step-down transformers in the amplifier. The common value of 117 volts (in the U.S.) is, similarly, a convenient one. However the alternations have no direct use in the vacuum-tube circuit itself, and the voltages required by the amplifier stages differ in value from 117 volts. The power supply must therefore step the voltage down for tube heaters, and perform the operations of voltage step-up, rectification, and filtering for the plates and screen grids.

Unfortunately the alternations always get into the signal channel to a greater or lesser degree, creating hum output at the fundamental and harmonic line frequencies. In addition the power supply intrudes its own characteristics into the picture, limiting the amount of power that can be drawn by the load, disturbing the essentially constant-voltage nature of the line source, or serving as an inadvertent path for low-frequency

positive feedback between stages. A properly designed power supply reduces all of these effects to such proportions that there is no significant effect on amplifier operation.

Power Supply Design

A typical audio amplifier power supply is illustrated in Fig. 15—1, labelled with voltages common to such application. The dual diode tube acts as a full-wave rectifier, conducting during both halves of the power cycle. Since each plate is alternately positive for each half-cycle, electrons can flow from the cathode to one or the other of the plates during both cycle halves, as illustrated in Fig. 15—2.

The resultant rectified voltage has a fundamental frequency double that of the input—a 60-cps a.c. line produces a rectified output of 120-cps pulsating d.c.—and this fact works to our advantage by making the task of smoothing out the pulsations easier. The shunt capacitive reactances of the filter capacitors are halved, and the series inductive reactance of the choke is doubled for the same values of capacitance and inductance, which gives us a more effective filter or, for the same effectiveness, a smaller one. Where the size and weight of the power supply components are critical, as in aircraft equipment, a primary supply frequency of 400 cps or higher is used in order to reduce the requirements imposed on the filter.

The power amplifier stage uses the major part of the total B current, and is relatively insensitive to ripple. It is fed from the supply point indicated in

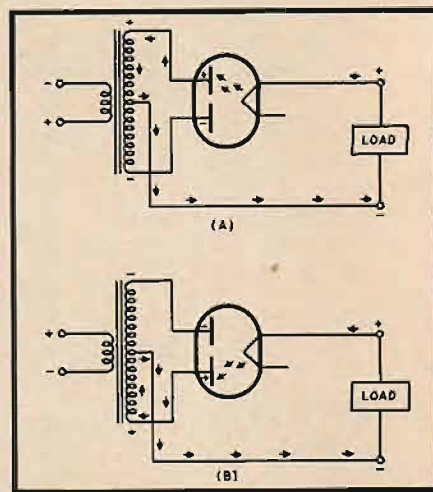


Fig. 15—2. Operation of a full-wave rectifier. Each half of the tube conducts alternately.

Fig. 15—1, because the low d.c. resistance of the choke enables this component to carry a large amount of current without introducing too great a voltage drop, and because the power amplifier does not need the added filtering of the R-C sections. (In some cases the screen grids may require added filtering.) A comparable number of milliamperes flowing in the filter series resistors, besides requiring resistors of high wattage, would introduce a totally unreasonable voltage drop. It is thus desirable to use a choke with the lowest possible d.c. resistance; any changes in load current associated with signal variations will not then involve a significant change of d.c. voltage drop across the choke, and hence will have little effect on the B+ voltage.

Voltage Regulation

The voltage regulation of the B power supply refers to its constancy of voltage under changing load. A straight Class A amplifier draws the same amount of current at all times, but class AB amplifiers draw more current at large signal amplitudes. If the B supply voltage goes down significantly on signal peaks the amplifying characteristics of the tubes will be instantaneously changed and distortion introduced. This is particularly true of Class B amplifiers, and in some cases gas-filled voltage regulator tubes have been employed to keep the voltage constant despite changes of either load current or line voltage. It is possible to

* Contributing Editor, AUDIO ENGINEERING.

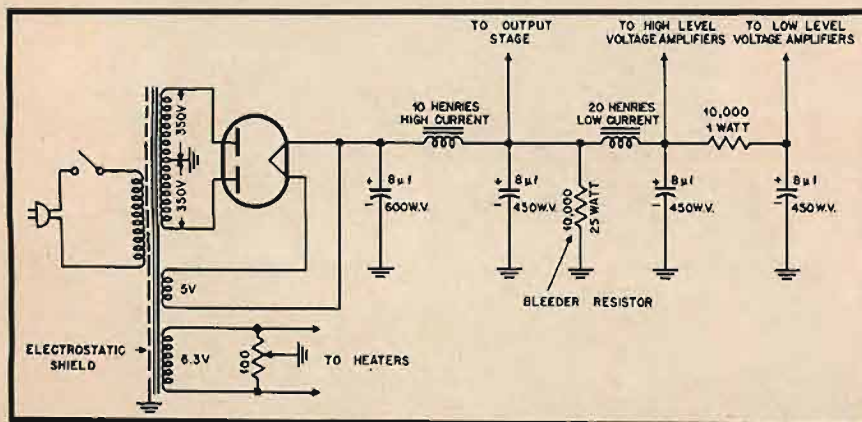


Fig. 15—1. Typical power supply for an audio amplifier. The high voltage winding of the transformer is rated as 700 v. c.t., or as 350-0-350. The bleeder resistor is not required if the output stage is in Class A.

SPECIALIZATION MAKES THE DIFFERENCE

Specialization may be defined as the concentration of all effort to a special or specific course of action

Even a mechanical device concerned with the function of record reproduction should possess all the advantages of such specialization.

Most units undertake to do much more. They change records, mix records, flip records, reject records, and assume a multitude of other functions. This is 'generalization' as distinguished from 'specialization'.

The REK-O-KUT turntable, on the other hand, is devoted entirely to playing records. And every design feature, every fragment of engineering know-how has been devoted and restricted to the all-important job of playing records . . . to provide the constant, steady, unwavering record motion necessary for the faithful reproduction of records free of mechanical distortion.

Specialization makes that difference. And all of the efforts and facilities of the manufacturer shall continue to be intensively devoted to that one objective . . . that one aim: *To make the finest turntables in the world.*

There is a REK-O-KUT Turntable for your specific discriminating requirement. Seven models are available at prices ranging from \$59.50. At Leading Radio Parts Distributors and at Sound and Music Dealers.

Write for Descriptive Literature



REK-O-KUT TURNTABLES

REK-O-KUT COMPANY, 38-03M Queens Boulevard, Long Island City 1, New York
Export Division: 458 Broadway, New York 13, U. S. A. Cables—Morhanex
In Canada: Atlas Radio Corp., Ltd., 560 King Street, W., Toronto 2B

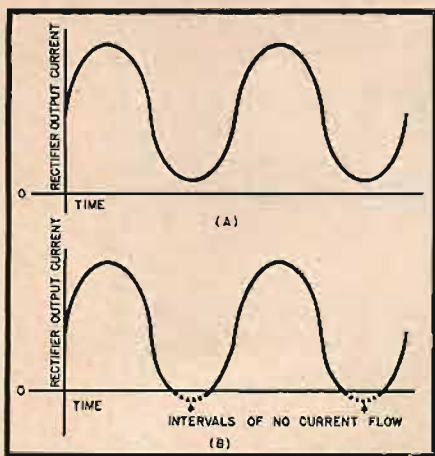


Fig. 15-3. (A) Full-wave rectifier output current. (B) Rectifier current with insufficient load. The discontinuities create an increase in output voltage. This can be avoided by the use of a bleeder resistor, which increases the minimum value of the current.

secure sufficiently good regulation without going to such lengths, however, and voltage regulators are in general reserved for other, more critical applications. The use of a well-regulated power transformer conservatively rated as to current capability, of a rectifier tube with good regulation, and of a low-resistance choke is normally sufficient.

Rectifier tubes present a resistance in series with the line which causes the output voltage to vary inversely with the amount of current drawn. Where regulation is important because of anticipated changes of current flow, the regulation characteristics of the rectifier tube, as described by tube manuals, should be taken into consideration. The voltage vs. load characteristics of several rectifier tubes are listed in Table 15-1.

The filter shown in Fig. 15-1 is of the capacitor-input type. When the first capacitor is eliminated the circuit becomes a choke-input filter. The latter has lower output voltage (the voltage of the capacitor input filter is usually at some value between the r.m.s. and peak values of the input a.c. voltage to the rectifier) and greatly reduced effectiveness as a filter, but better voltage regulation. It is not usually considered necessary to accept the first two results as payment for the last.

The "bleeder" resistor across the B supply line is for the purpose of improving regulation when there is a danger of load current dropping to low values. It has only a minor effect on the total percentage of current change, but it prevents the current from dropping below a certain minimum point. This minimum is that value of d.c. load current which falls below the negative peak of the variable component. If the d.c. flow did fall below this point discontinuities would be introduced into the wave form, as illustrated in Fig. 15-3. Such a discontinuity represents a sudden break in the rate of change of the current, and is like introducing an addi-

tional voltage in series with the choke,¹ causing the total voltage output of the filter to increase. A power supply serving a variable load usually has a bleeder resistor connected as shown, of a value equal to about 1100 ohms per henry of choke inductance.

Ratings of Power Supply Components

Components of power supplies are rated for given voltages and specified maximum load currents. If these ratings do not meet the requirements of the amplifier the results may be improper operation, failure in service, or both.

Filter capacitors must have a working voltage rating with a comfortable margin of safety over the voltage at the rectifier cathode. Current is not drawn from the rectifier until the cathodes of the working tubes have warmed up. Since the latter are usually indirectly heated they are only beginning to draw current when the directly-heated rectifier has already become operative. The voltage across the filter capacitors (and especially across the first one) is thus reduced very little by voltage drops in the power transformer or the rectifier tube, and may be significantly higher than normal during the warm-up period.

Transformers and chokes that are made to carry more current than they are designed for exhibit several effects: they overheat and in time may fail, and they cause the available voltage to vary unduly with change of load. Furthermore the inductance rating of a choke is in terms of a maximum current flow, and if this maximum current is exceeded the electrical inductance is correspondingly reduced due to core saturation.

Power Supply Filtering and De-coupling

As the amount of amplification ahead of a stage is increased the percentage of ripple that can be tolerated in the B supply is reduced. It is a lot simpler and cheaper to improve the filtering for such low-level stages separately, rather than to filter the entire B supply so well that the point from which the output stage derives its power is also suitable for the rest of the amplifier. But there is another factor, over and above considerations of hum, that makes separate filter

¹ L. B. Arguimbau, "Vacuum-Tube Circuits." New York: John Wiley and Sons, Inc., 1948, p. 40.

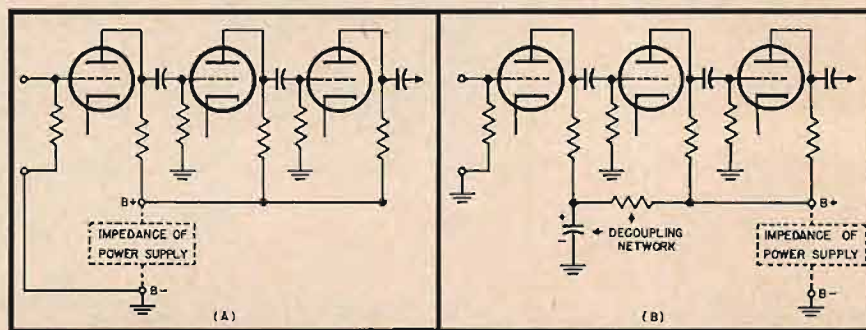


Fig. 15-4. (A) Feedback between stages due to common power supply impedance. (B) Avoidance of regenerative feedback through the power supply, by the insertion of a de-coupling network.

sections necessary in any case. This is the danger of regenerative interstage coupling through the power supply.

TABLE 15-1
VOLTAGE REGULATION CHARACTERISTICS OF COMMON RECTIFIER TUBES

Tube Type	Approximate change in output voltage associated with change from half-load to full-load current ^a	
	Capacitor-input filter	Choke-input filter
5T4	50 v	15 v
5U4	80 v	20 v
5V4	40 v	10 v
5Y3	40 v	25 v

^a At specified input voltage

Consider the three cascaded amplifier stages in (A) of Fig. 15-4. The output signal voltage coupled from one stage to the next is that between plate and ground. While this voltage is almost equal to the voltage across the plate resistor at signal frequencies (B+ being considered as signal ground due to the effective short of the high capacitance filters), the reactance of the filter capacitors becomes large enough to be significant at very low frequencies, and the above is no longer true. The impedance between B+ and B- then forms part of the load impedance of each of the stages, and this added element of load impedance is common to all three. Part of the output voltage of the second and third stages is thus coupled back to previous points in the signal channel.

For any two adjacent stages the feedback is negative—a fraction of the output signal of the higher level stage is effectively fed back to its own input, where the signal, ignoring phase shift, is exactly opposite in phase. But the feedback between the first and third stages is positive. The input signal to the first stage has suffered two phase reversals, and the output of the third stage has the same phase as the output of the first stage. When the amount of feedback is great enough, which is to say when the frequency is low enough for the filter reactance to have become sufficiently high, regeneration and self-sustaining oscillation occur. The subsonic frequency of this type of oscillation has given it the name of motorboating, and

[Continued on page 57]

1 The industry's biggest, heaviest and finest magnet, 10½ pounds of Alnico V metal, providing the highest possible fidelity and efficiency.

2 Center pole piece, a special alloy of low-carbon dynamo steel; makes the fullest use of the power of the magnet.

3 Phasing plug—indispensable for improving high-frequency response.

4 The pressure-type high-frequency tweeter is mounted coaxially through the woofer pole piece.

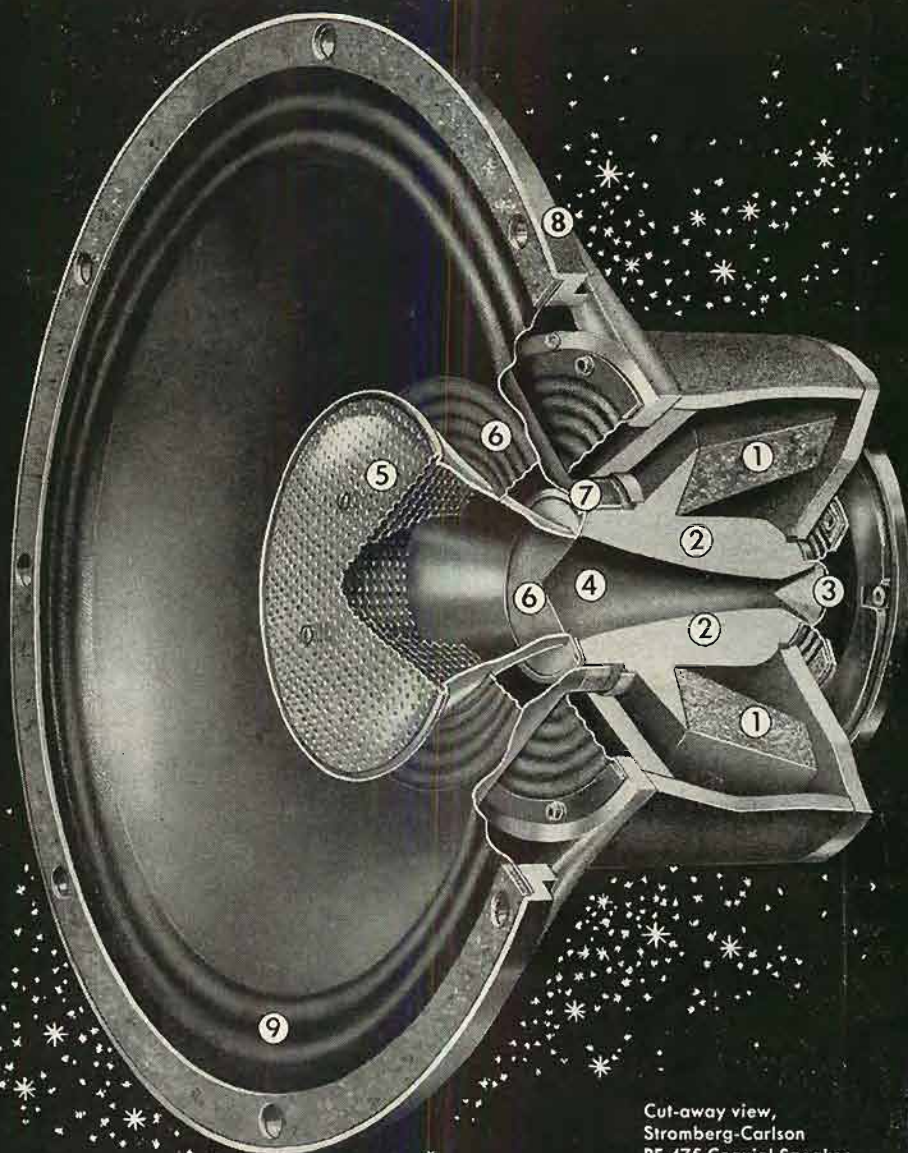
5 10-element acoustic lens of non-resonant plastic material. Enables the speaker to transmit the highs with a 90° angle of coverage in all planes.

6 Plasticized dust screens—far more protective and efficient than felt or similar materials.

7 The 3" voice coil is mounted on aluminum for high heat dissipation and better handling of more power. Unaffected by temperature or humidity.

8 High-strength, cast aluminum frame (basket), with the rigidity necessary to hold the extra-heavy magnet.

9 The double-rolled edge is treated with Geon vinyl plastic for smoothest frequency response with minimum distortion. "Fatigue" cracks are completely eliminated, and the double edge allows increased cone travel.



Cut-away view,
Stromberg-Carlson
RF-475 Coaxial Speaker.



learn the inside story of...

the World's Finest coaxial speaker

If you were a highly skilled combination of toolmaker, machinist and jeweler, you could build yourself no finer coaxial speaker than this 15-inch masterpiece.

Built to jewel-like tolerances, it is, at the same time, so rugged that extreme overload conditions and even mishandling are all in the day's work.

Do see it and *hear* it, at any Stromberg-Carlson Hi-Fi dealer's. Until you do, here's an audiophile's eye view of the features which make it superb.

Complete specifications—in bulletin SED 3.40—will be sent on request.

Stromberg-Carlson

SOUND DIVISION • 1219 CLIFFORD AVE.
ROCHESTER 21, NEW YORK

Audio

ETC

EDWARD TATNALL CANBY*

NO, IT WASN'T *directly* my idea, the new title of this newly severed section of what for all these years (since May, 1947) has been part of the *RECORD REVUE*; but I'll admit that I've long had a secret yen to make use of those initials of mine in some "practical" way! Best idea previous to this—a license plate for my car. (Connecticut, where initials may be used.) Haven't been able to swing that one yet and I'm still an anonymous YV-493. So the editor's brilliant brainstorm, quite independent of me, is welcomed and you can send in all the cat-calls you want, we don't care. That "ETC" is going to have to cover a lot, as has the old title in the past. But no more, perhaps, than our own favorite HI-FI, which is pretty soon going to cover *everything* as far as I can see.

* * *

Herewith an experimental report on a fine collection of gadget equipment for phonophiles that has been sitting about my place, waiting to be noticed. I'd better say quick-like that this new department, while it will surely comment now and then on equipment of one sort or another, is not and cannot set itself up as an official Equipment Report. That sort of thing will be handled elsewhere and in a wholly different manner. What I can contribute here, occasionally, is the Amateur's Reaction—the sort of thing that happens to a non-engineer phonophile when the gadgets designed for him actually turn up in his home and are put hopefully to work. I haven't got a reputation as Audio's Number One Amateur for nothing. When I get going, I have a heavy hand. If any machine is subject to breakage, mis-use, wrong connections and the like, I find it remarkably easy to oblige with the man power. If instructions are, as Li'l Abner says, confoosin', I'm ready to get confused to the point of utter confoundedness. I qualify very nicely, I think, as Audio's Road Test, or as an audiomatic General Motors Proving Ground.

The difference between me and a million other lethally equipped amateurs, however, is that I have a strange way of stopping afterwards and analyzing. Now why did that happen? Also, I write my ideas down and publish 'em, which I am, fortunately in a position to do. And so, I venture to suggest, my reactions to the stuff may just possibly be *constructive* in the end, if *destructive* at the beginning!

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

Gadget Collection

It's with that spirit in mind that I tackle today's batch of home gadgets. And I'll add this. Most new gadgets that get to the market are designed, by some enterprising person, to Fill a Need, to Rectify a Situation, to Do Something Better that hasn't been done very well. There's always a minus value in the background, somewhere.

Most gadgets are thus brave attempts to solve basically insoluble problems-of-the-moment. Few of them are perfection; there wouldn't be any need for them if perfection were possible. And so very few gadgets go all the way; almost all of them have disadvantages. Don't be surprised, then, if I mention the disadvantages. They're inherent in the breed, and let's praise those who defy the drawbacks and go right ahead with their gadgets anyhow for what they're honestly worth, the plus with the minus—the following included.

* * *

My collection is as follows—and the batch of them are cousins, inter-related. *Discs*: The Dubblings company's two test LP's, D-100 and D-101; Audax's Stylus-Disc, for testing stylus wear. *Measurements*: A neat little 50-power Japanese "Vista" microscope, to complement the Audax disc; the Weathers Stylus Pressure Gauge; the Dubblings D-503 Test Level Indicator. *Record Treatment*: Duotone Electro-Wipe Magic Record Cloth; the Walco Foam-Disc turntable covers. Let's take a look at these latter first.

Record Savers

The Foam-Disc, distributed by Walco, of Walco stylus and Stati-Clean fame, is a turntable mat made of poured foam rubber (not ordinary foam), dressed up in nice colors, in manual table models covered with smooth suede. About an eighth of an inch thick and very good looking, especially in bright red and green.

To tell the truth I was a bit baffled by these, since normally I don't go for bright decoration, for its own sake. But Walco claims utility—a soft base for dropping records and for accidental pickup falls, a firm adhesion with minimum grittiness (much better than grit-collecting flock, I agree) and in particular a magnetic separation between steel turntables and magnetic cartridges that reduces objectionable magnetic "pull." Sounds reasonable and I like the squishy feeling of the stuff. The suede

model, incidentally, is excellent for disc-jockey style slipping (allowing table to spin while holding a record on cue), a major interest of mine in radio program making. DJ's note, if you've had trouble with rubber covered tables.

I'd expect a changer's capacity record load to be reduced by two or three discs by the foam mat. Not overly important, in view of the above advantages.

The Duotone Magic Record Cloth is as magic as most gadgets using that over-worked term—i.e. not at all; but it works. Don't know what the impregnation is in the soft folds of felt-like cloth, but it's somewhat sticky and greasy to the feel and comes off rather too much, if your wiping away of the static is vigorous. The static goes, definitely, and so does dust and grit. But I wonder what happens (a) when the cloth becomes grit enfolded, even a bit and (b) when it is left out of the plastic casing, to dry? I haven't had it long enough to know—but I do find myself using it, and the job is simpler than with the assorted spray techniques for record treatment.

The Not-So-Eternal Stylus

Needles, needles! Now that our diamond-bearing friends have done such a fine job in publicizing the quick wear of metal and sapphire points, people are getting almost neurotic about their styli, and I among them. It's not so easy to tell just when a point is shot, especially when you get to listening for distortion so hard that you forget to hear the music.

I've tried a number of pocket magnifiers of one sort or another on stylus points with very little satisfaction, as far as judging the condition of a 1-mil point is concerned. It's either not magnified enough, or with a higher blow-up, the focusing problem is hopeless; nobody has steady enough hands. Only a real microscope, and that specially adapted, will ordinarily give those fine, jagged images of worn-down tips that we've all seen in the ads of late.

The "Vista" 50-power pocket glass from Japan, is the size of a saved-off pen light and as convenient, but its special feature is a brilliantly simple solution to the problem of focus. The business end of the tube is sliced off diagonally; the slanted ellipsee, with a hole in the middle for the objective, is slightly concave and chromed so that it is a reflector to spot light on the point of focus. Neat. In order to find that focus you merely rest the lower end on the surface to

[Continued on page 59]

the Jensen "DUETTE" WON

at the INTERNATIONAL SIGHT AND SOUND EXPOSITION

and the thousands who came to listen, said . . .

"I never dreamed you could get such a full range from such a small unit"

"They must do it with mirrors"

"Why, this bass sounds as good as our big, expensive setup"

"I'll bet it took real engineering to get that balance"

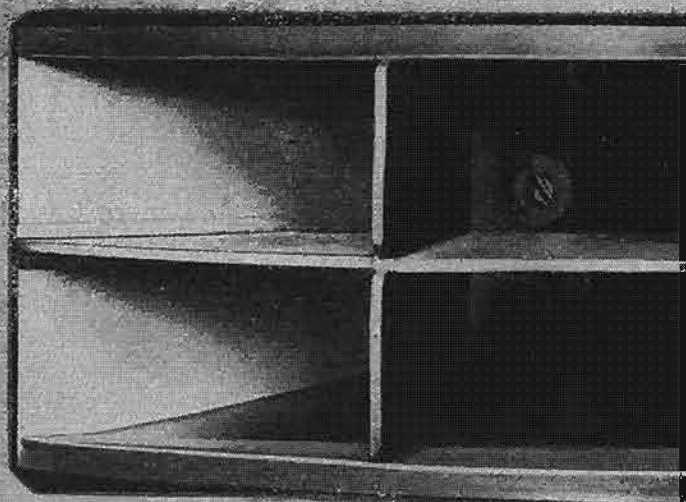
"If that's all the bigger it is, you can have it in the living room"

"Why doesn't our set sound like that when you turn the volume down?"

"I always thought two-way systems cost a fortune"

"I never thought you could get such clean highs, at such low cost."

"Notice how there isn't any boom in the bass!"



The Jensen "Duette" is a true two-way system that fulfills the high standards of *true* high fidelity . . . a skillfully balanced combination of a special 8-inch "woofer" for the lows and a multicell horn-loaded "tweeter" for the highs, plus crossover system in a new, acoustically coordinated very small enclosure.

Not since Jensen engineers developed the bass reflex principle has there been such a new departure in enclosure acoustics . . . a miniature cabinet that makes possible full low bass reproduction.

The "Duette" • In the smallest space (11" x 23¼" x 10" — one bookshelf or a small corner)

At the lowest cost (\$69.50)

has the most sought-after qualities in fidelity of reproduction . . . thrilling true definition, separation and realism of sound through the whole musical range.

With the "Duette," Jensen makes high fidelity a luxury everyone can afford now. You don't have to wait—use with your present TV, radio and phonograph, or build your high fidelity system around the "Duette" in less space and at lower cost than speaker systems that give you far less.

Duette

SHOWN ACTUAL SIZE

THE GOLD MEDAL



SPECIFICATIONS

MODEL DU-201 (as illustrated—available now—)

Dimensions: 11" x 23 $\frac{1}{4}$ " x 10"

Finish: Mahogany toned pigskin textured plastic case with contrasting front. Copper toned trim.

L-F Unit: Special 8-inch heavy-duty "woofer."

H-F Unit: Multicell horn-loaded compression driver unit "tweeter" (as used on Jensen H-222 and H-520 Coaxials).

Impedances: 4 and 8 ohms available on 3-terminal strip on back of case.

Power Rating: 20 watts speech and music.

Net Price: **\$69.50**

MODEL DU-202 PORTABLE

(available January 15)

Dimensions: 11" x 23 $\frac{1}{4}$ " x 11 $\frac{1}{4}$ "

Finish: Black plastic leatherette case with light gray front. Aluminum toned trim. (Acoustic and electrical specifications same as DU-201)

Handle on end of case. Snap locked removable front cover contains 25-foot cord and plug, plus storage for 2 7-in. (or 3 5-inch) boxes of tape with retaining strap.

Ideal for portable hi-fi record and tape reproduction, and sound reinforcement by lecturers, musicians, recording engineers and hi-fi enthusiasts.

Net Weight: 21 lbs., *Net Price:* **\$89.50**



**YOUR ELECTRONIC
EQUIPMENT**

Demands Highly Specialized

WIRE

THE MANUFACTURERS
AND SERVICE MEN
WHO SERVE BEST

Specify

Belden

WIREMAKER FOR INDUSTRY



EDWARD TATNALL CANBY*

MORE SPOKEN WORDS

Shakespeare: Romeo and Juliet. Old Vic Company. (Claire Bloom, Alan Badel).

RCA Victor LM 6110 (3)

Complementing the recent *Macbeth* from the Old Vic is this more imposing album, a further step in the modernization of Shakespeare and (strangely enough) the return, via records, to the dependence on imagination for scenery that actually characterized the original Shakespeare productions. The plain theatres of Shakespeare's day, the modern-dress (as of then) costumes, the elementary stage and sound effects, left virtually everything to the playwright and to his words, written for his speaking characters. The amazing versatility of the Elizabethan playwright in the straight use of words unadorned to build up a drama never came through more nicely than here, in *Romeo and Juliet*!

True, one must cope with and get used to the special and exaggerated Shakespearean way of acting, as it now exists in a tradition that is as rigid, outwardly, as that of our own fine soap dramas on the radio. For awhile, the unfamiliar grammar, the strange words, the mouthfilling phrases, will get you down. But the Old Vic knows its stuff. After awhile the conventions of this special and very great kind of drama begin to adjust themselves to you, so to speak, and the sense comes through. Conventions, mind you, that are now less rigid, no less artificial than those of soap opera, where every voice is a type, every sentence, every inflection is done just so, by actors who study and mimic until a hundred radio voices sound exactly like one another. Shakespeare has the same conventions—but of different sorts, and his, one begins to realize, allow for a lot bigger scope in the drama than the soap drama. Both (never forget), being drama are essentially artificial and utterly unlike nature—though the more dramatic for it.

And so Shakespeare's extraordinary preoccupation with death and dying is the more vividly and absorbingly clear here because of such unlikely and improbable monologues as those of Romeo and of Juliet, dying or about to die—and the plain fact that the Old Vic actors know this convention for what it is, and exploit it with the utmost finesse. Drama on records has never quite equalled this album before.

Hi-Fi, definitely, with the simplest of sound-effects, unobtrusive musical curtains, slight changes in liveness to indicate small or large places, the usual formalized "mob sounds" for parties, crowd scenes, discovery-of-the-dead-lovers, etc. It's extraordinary how little is needed to back Shakespeare up—as he intended it should be. Not even the slightest direct indication of who is whom or where is where—it all comes out, expertly devised by Shakespeare, in the course of the actual words. Better grab this album fast, and play it often.

Columbia Masterworks Literary Series. Prose readings by famous authors. Columbia SL-190 (12). (Special album, but probably available soon separately.)

Here is another revolution from Columbia—not so much in the mere mechanics of recording

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

a batch of voices, which is hardly revolutionary now with five years of tape already behind us, but rather in the new and exciting understanding of the LP medium itself that this shows.

The series is not yet focussed in intent. There seem to be two aims here, one, to record "documentary" readings of works by their own authors, to a length and continuity never before attempted, and, second, to record spoken stories—as stories. My impression is that the first aim is uppermost, the documentary; I am convinced that the second—wonderfully exploited in a few of the records—is by far the more important.

At this point I'm only halfway through the batch, having covered readings by Somerset Maugham, Steinbeck, Saroyan, Sir Osbert Sitwell and Edna Ferber. I still have Edith Sitwell (of the famous "Façade" recordings where she reads her own texts to Walton's music), Truman Capote, Aldous Huxley, John Collier, Sacheverell Sitwell (third sibling of the famous family), Katharine Anne Porter and Christopher Isherwood—phew! Each of them has an entire 12-inch LP, approaching a solid hour of reading. Enough to keep me and anyone else busy for a good month, without a single musical record. The non-story discs are interesting, no doubt, and instructive and documentary. But what gets me are the stories. For stories, just keep in mind, were originally and timelessly meant to be told—out loud. It's only us moderns who have the new-fangled idea that a story should be read.

And so—out of the batch, so far, I recommend as a great experience two discs, Edna Ferber reading and acting her long short story, "The Gay Dog," about a pathetic hen-pecked Chicago bachelor, and Somerset Maugham's two stories, "The Fat Women of Antibes"—which is absolutely superb entertainment—and a somewhat lesser value on the obverse, concerning a circus-act lady who dives into a six-foot tank of water flaming with gasoline, two shows every evening. (Nope, she doesn't miss—not in the story. Maugham's too clever for that.) John Steinbeck's two stories are both crackerjack ones, but he's no reader and you can follow them in suspense thanks to their own sheer power, not to his anticlimactic reading. Saroyan is unintelligible as he "tries" (so says the label) to read his own work. He insisted on using his own tape recorder and I'd hate to have to mention the brand; luckily I don't know. It stinks.

I'll report on the others when I get 'em played over. I've heard good things about the Truman Capote "Children on Their Birthdays"—two entire sides long. Might try it too. I'm all for more stories on records—complete and long—by real story tellers, of every sort. How about folk stories? They're always told out loud, except when people "collect" them for books.

Stravinsky: Oedipus Rex. Text written and spoken by Jean Cocteau. Cologne Radio Symphony and Chorus. Columbia ML 4644
Le Petit Monde de Don Camillo. (Sound track) Fernandel and others.

Decca DL 7024

Here are two records indicating among other things what vast new areas LP has been entering. A large number of musical works which in their original form included some species of speech—narrator, operatic dialogue, even straight drama to which had been added incidental music

—now suddenly can appear in unexpected wholeness via the new medium of LP; where formerly the speech parts were universally scrapped in recording as quite impractical, now we've discovered that speech adds mightily to the effectiveness of an LP, as well as allowing for a more complete presentation. Especially hi-fi speech, undistorted, with "presence" and life, and with lots of sibilants.

Oedipus Rex is an odd piece, composed to a synthetic Latin text that was translated—into Latin, not out of it—from a Cocteau original out of Sophocles. The narrator's role in the score is supposed to be spoken in the language of the audience, wherever the piece is done. In this case, however, Stravinsky has got the author himself of the original, and so the narration is done in Cocteau's own French, though the Latin parts are translations from Cocteau!

French, you'll find, is a remarkably effective language on records, undoubtedly because it is liquid, relatively unpercussive, depending on quantities—syllable lengths—instead of accent, which is very nearly equal in every syllable. Ideal for the mike, which objects to percussions and all sudden changes of dynamic level, as every radio speaker must learn.

Technical note: the performance of *Oedipus* was taped in Cologne, Germany, but Cocteau's voice was taped at a French performance some eight months later.

Le Petit Monde (The Little World of Don Camillo) is nothing more than the straight sound track (or excerpts?) of the film itself, in French, and the remarkable thing is its mere existence in this form—for Decca has released it without any adornment whatsoever, not even notes on the album cover, nor any translation, synopsis, blurb, or what have you. Even the labels, made in U.S.A., are in French. Obviously Decca must take for granted that any buyer of this record knows his French by heart, which only goes to show how "esoteric" an LP can be these days and still sport a big, popular label like Decca.

The original seems of high quality—could it have been taped, rather than made on sound film?

Beethoven: Music from Goethe's Egmont, op. 84. Wurttemberg State Orch., State Theatre Chorus(?) soloists, F. Leitner.

Decca DL 7540

Here's another—with words in German. Not, it is true, the entire drama, which would be somewhat impractical even with LP to put it mildly, but instead of the usual overture, so very familiar, we now have a group of eight musical numbers, instrumental and for tenor and contralto solos—and, at the end, a long and impassioned dramatic monologue by the hero himself who at its conclusion rushes forth to "die for freedom" against tyranny, in typical Beethoven (if not Goethe) style. The German is excellent and well recorded for this last band; again it gives a sense of realism and aliveness to the whole work.

Odd note: The Chorus, as mentioned in the label and also in the cover annotations, is not to be found; I haven't spotted it yet after a couple of playings. Maybe it got edited out by Decca's (right hand) engineers, without telling the production (left hand) department.

the **BIG** question ...

*When to change stylus -
finally answered by*

Audax **STYLUS-DISK**

PAT'S PEND.

- 1.** Gives visual indication (before your valuable records are ruined) of whether or not the stylus is in playable condition.
- 2.** Will test ANY type of stylus, in any type of pickup—in a jiffy.
- 3.** Neither the stylus nor the cartridge need be removed for the test. Nothing need be disturbed.
- 4.** The grooves may be used over and over again, until finally a worn or defective stylus scrapes the delicate groove-walls.
- 5.** Should last for years—ONLY costs \$3.90 net, at your dealers. (Add 25¢ if shipped from New York City.)

STYLUS-DISK is a MUST for any music system, for just as a fuse protects an electric circuit, the STYLUS-DISK protects your records against ruination by a worn stylus. You need no longer worry about the stylus. This remarkable device, the STYLUS-DISK, will give you the needed warning.

MUST features in a

high quality pickup

- 1.** Listening quality in music is everything. Only the Audax **CHROMATIC** magnetic pickup, satisfies this all important requirement.
- 2.** Replaceability of stylus at home. Highly important because a jewel point, be it diamond or sapphire, has only a limited playing life.
- 3.** Compliance near-infinite, both lateral and vertical.
- 4.** Needle-talk practically nil.
- 5.** Musical range, smooth, for full audible spectrum.
- 6.** Stylus must be in full view for the all important stylus-groove alignment.

The Audax CHROMATIC has every one of these MUSTS to a degree not equalled by any other pickup. To those who asked about it, the Audax is the highest quality magnetic pickup . . . it is neither a rochelle salt nor a ceramic crystal. It has no hangover or phase-lag, "the worst type of distortion."

Now, as in the past, pickups come and pickups go, but the Audax CHROMATIC is still by far, the finest performing instrument yet devised.

BUT, only YOU can tell what sounds best . . . therefore, see and HEAR the CHROMATIC, and YOU be the judge.

Write for FREE literature

AUDAX COMPANY

500 Fifth Avenue

42nd Floor

New York 36, N. Y.

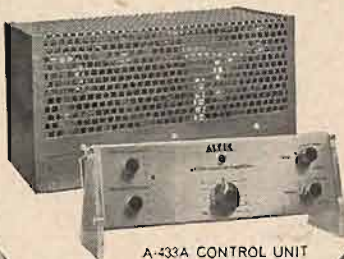
Creators of Fine Audio-Electronic Apparatus for over 25 years

"The Standard by Which Others Are Judged and Valued"



*striking
a new note
in tonal
brilliance!*

A-333A AMPLIFIER



A-333A CONTROL UNIT



The pleasure you derive from the magnificent fidelity of an Altec home music system is equaled only by the pride that comes with knowing you possess the finest. Altec fidelity is truly the highest fidelity assuring you unsurpassed performance.

Visit your Altec dealer soon and plan now to install in your home an Altec home music system for a lifetime of listening pleasure. Altec home music equipment is well worth waiting for because Altec fidelity is highest fidelity without compromise.



DUPLEX LOUDSPEAKER

A SOUND
REPUTATION
SECOND
TO NONE



9356 SANTA MONICA BLVD., BEVERLY HILLS, CALIF.
161 SIXTH AVENUE, NEW YORK 13, N.Y.

FI

(Since all Fi is Hi these days, we might as well save a couple of pieces of type now and then.)

Full Dimensional Sound—A Study in High Fidelity. Notes by Charles Fowler.

Capitol SAL 9020

Those who have attended recent Audio Fairs will know all about this album, which was distributed to practically every exhibitor and immediately put to use. (There was also a "trade" hi-fi record with announcer, but that one is not on public sale.) An excellent job and to my knowledge the first of its type from a major record company's catalogue. The material is predominantly classical music on one side, popular on the other, but the range is greater than this implies—and only goes to show, as a matter of fact, how Hi-Fi has levelled out the old differences between those arbitrary categories. From Glazounoff to Stan Kenton, Bloch to Foghorn Boogie, this disc illustrates most of the major points of Hi-Fi sound and its interest for addicts will be as great as it is transient—what with isolated single-movement excerpts—to the music lover, popular or classical. Try the Studies in Percussion, parts 1 and 2, first. Cowbells, gongs, drums, etc.

The surfaces are exceptionally quiet (and other Capitols have been relatively noisy at times). A significant innovation is the soft plastic envelope for the record, which has enough overlap to allow a fold that is dustproof. Not practical for standard records probably (it won't fit into an ordinary record sleeve), but a step in advance nevertheless. Enthusiastic notes, at length, by Charles Fowler. No vocal explanations on the disc itself.

Scriabin: Poem of Fire; Poem of Ecstasy. Mitropoulos, N. Y. Philharmonic.

Columbia ML 4731

Scriabin: Poem of Ecstasy. Loeffler: Pagan Poem. Paris Philharmonic, Rosenthal.

Capitol P-8188

An easily described comparison between these two versions of the Scriabin piece (which, musically, is a work that makes my insides crawl, so twisted and over-wrought and out of style and taste is its post-Wagnerianism)—the two rate as Hi-Fi, one of them Columbia's by now fairly uniform high standard, the other Capitol's Full Dimensional Sound, but they represent, to my ear, two opposing mike philosophies. The Capitol may or may not be a one-mike job but its tonal color is of that type, the complex of orchestral sounds, the hundreds of submerged solo instrumental passages typical of this music blended at a considerable distance. A mellow, good sound, but not too sharply highlighted in the monaural reproduction. Columbia's, on the other hand, is less literal, less "faithful," more artificial, but in the recorded medium seems to me to bring out more of the score, to achieve more presence and aliveness. In this version, presumably with more than one mike, the solos, notably the solo violin and trumpet, are sharp, steely, etched against the total sound; not the original concert hall intention in literal terms but a good equivalent of the binatural on-the-spot impression.

Note the markedly different equalization required. Columbia has considerably more pre-emphasis that Capitol, in the highs. Be sure to adjust when making comparisons.

Borodin: Polovetsian Dances. Moussorgsky, Night on Bald Mt. R.-Korsakoff: Cap. Espanol. Austrian Symphony, various conductors. **Remington R-199-130**

One of those discs of pot-pourri usually unreviewable because the title is too long (hence abbreviations) or the content is too conventional. As representative of Remington's current Musirama Three-Dimensional sound it warrants notice. With this sort of opportunistic publicity (please, I ask, show me some two-dimensional sound) I have no sympathy whatsoever. Will we ever get past the -rama craze? But the record remains to be judged for itself. This one, I hasten to add, is a good one for the price though I do not know what the Austrian Symphony may be, nor whether, as is possible, it exists on other labels under more familiar but already-contracted names. The playing is good, in the final part of the Borodin unusually warm and musical. No complaints!

The sound, whatever the dimensions, is good too, though not technically up to top Hi-Fi, nor entirely ideal acoustically. The mike setting is strangely Hollywoodish, a close-to, rather dry effect, the strings only feet away. Austria? Perfectly listenable, nevertheless. Pre-emphasis is moderate, less than Columbia, there are no appreciable highs over about 8000 or so but there are enough for any musical purpose—specifically, enough to bring through faint triangles and the breath of a flute. Plenty for anyone who is interested in the music.

Surfaces, in this low-priced line, are of course substandard and may be short-wearing. The hiss of earlier Remingtons is gone, the background crackle is not objectionable. But on the Borodin side there is an interesting effect that is significant as to Musirama three-dimensional merchandizing. An odd extraneous sound, like a faint tambourine being shaken, goes all the way through and on wide range equipment is distinctly disturbing. It disappears entirely, however, with a cut-off of about 7000 cps. It will not be heard on most machines on which this record will be played. A calculated risk, a shrewd appraisal of the present situation? Possible, but it might also have been an unavoidable accident.

Wagner: Preludes to Lohengrin, Meistersinger; Overtures to Tannhäuser; Ride of the Valkyries. Detroit Symphony, Paul Paray. Mercury MG 50021

A sample from the recent new branching out at Detroit of the "Living Presence" technique chez Mercury. Evidently this kind of presence is not the fairly fixed sound-style that we've found consistent in London's (for, in Columbia's (nameless) technique, in the New Orthophonic. This Detroit disc has a sharp, very close and dead sound, brilliantly recorded, tremendously effective but very unlike some of the earlier Living Presence one-mike jobs at Chicago and Minneapolis. Not unlike the Remington disc above, strangely enough, as far as acoustics go. Interesting. Very low distortion, good surfaces. Real Hi-Fi, no doubt.

Paray (he's 70 years old) is a strange conductor and rather intriguing to hear. His Wagner tends to be on the sprightly side, French-style, in contrast to the familiar heavy German manner, and the really flighty parts—mid-section of the Tannhäuser overture (Venusberg) for instance—are as electric as cat's fur. Excellent! The Valkyries' violinistic flames crackle as you've never heard them. On the other hand, Paray has the strangest way of bouncing anything that is march-like, as though he were hoping up an down with excitement on the podium! The Meistersinger Prelude is unforgivably bouncy and staccato—missing the majesty of it altogether; the Valkyrie ladies bounce up and down too, though to better advantage. A highly individual conductor and, all in all, an attractive and unaffected musical personality. I'll look forward to more of his quirks.

Franck: Symphony in D Minor. St. Louis Symphony, Golschmann. Capitol P-8221

Khachaturian: Gayne Ballet. Indianapolis Symphony, Sevitky. Capitol P-8223

Capitol, too, is busy in the middle West; here are samples from recent additions to the FDS catalogue. The somewhat close and dead sound of these records is evidently not at all a coincidence, for the two records (and the French Scriabin disc, above) are remarkably consistent in their tonal effect. This, I'd venture to guess, is an extension of a very honorable tradition often referred to as West Coast Sound, stemming both from the big film studio sound stages and from popular recording, in which area Capitol is of course a leader. Specially built stages are—or were—more or less inevitably very dead. Film music is scarcely in need of concert hall reverberation, for music or the speaking voice. The dead, close-up technique of popular music is enormously effective with brass, percussion, and piano; but when applied to the symphony orchestra it gets hold not of these powerful elements—which are at the rear—but the strings, which are in front. Hence the over-stringy sound of many a modern classical record using close-to techniques.

I'm not extra enthused over Capitol's somewhat padded sound, but then I don't like the ultralife one-mike sensations any better. In the recorded medium, it seems to me, concert hall or no, the ideal is always between the two, with a good, round, big liveness, but also with strong, sharp highlights for the individual sounds. Can be done with many mikes and also, given the right set-up, with one.

in stock at

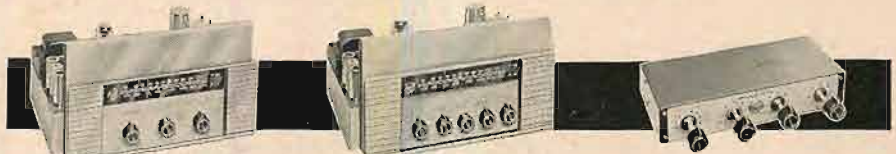
ALLIED

RCA INTERMATCHED HIGH FIDELITY COMPONENTS

AUTHORIZED



DISTRIBUTOR



ST-1 FM-AM Tuner

Precision-built for high sensitivity and stability. Overall sensitivity better than 5 mv. Response, ± 1 db. AFC on FM. Output 2 v. at less than 0.5% distortion. Designed for easy, attractive custom installation. Handsome chrome on satin gold finish panel. $6\frac{3}{4} \times 13\frac{1}{2} \times 8\frac{1}{2}$ " deep. Complete with tubes. Shpg. wt., 16 lbs. **98 SX 665. Net.....\$144.95**

SVT-1 Deluxe FM-AM Tuner

Deluxe features: separate wide-range bass and treble controls; AFC on FM; preamp and 4-position equalizer. Sensitivity 5 mv. Output 2 v. at less than 0.5% dist. Three inputs: for magnetic phono, tape recorder and aux. Handsome blue and maroon panel. $6\frac{3}{4} \times 13\frac{1}{2} \times 8\frac{1}{2}$ " deep. With tubes. Shpg. wt., 17 lbs. **98 SX 666. Net.....\$164.50**

SV-1 Deluxe Preamplifier

For use with RCA or other quality amplifiers. 4-position equalizer. 5 inputs: magnetic phono, radio, tape, TV, and aux. Output, 1.5 v. at less than 0.5% distortion. Obtains operating voltages from RCA amplifiers; otherwise requires 250 v. DC at 4 ma and 6.3 v. AC or DC at 600 ma. $1\frac{1}{8} \times 9\frac{1}{2} \times 5\frac{3}{4}$ " deep. With tubes. Shpg. wt., 7 lbs. **98 S 667. Net.....\$74.50**



SP-10 10-Watt Amplifier

Rated output, 10 watts. Response, +0.5 to -0.2 db from 20-20,000 cps. Harmonic distortion less than 0.5% from 30-15,000 cps at 10 watts; less than 0.5% from 20-20,000 cps at 3 watts. Input imp., 100,000 ohms. Output imp., 4, 8, 16 ohms. Supplies 250 v. DC at 8 ma and 6.3 v. at 1.2 amps. $6\frac{1}{2} \times 13\frac{1}{2} \times 9$ " deep. With tubes. Shpg. wt., 20 lbs. **98 SX 668. Net.....\$99.50**

SP-20 20-Watt Amplifier

Outstanding quality. 20 watts rated. Frequency response, +0.3 to -0.2 db from 20-20,000 cps. Harmonic distortion less than 0.5% from 30-15,000 cps at 20 watts; less than 0.5% from 20-20,000 cps at 6 watts. Input imp., 100,000 ohms. Output imp., 4, 8, 16 ohms. Supplies 200 v. DC at 8 ma and 6.3 v. at 1.2 amps. $7\frac{1}{4} \times 13\frac{1}{2} \times 9$ " deep. 31 lbs. **98 SX 669. Net.....\$134.50**

LC-1A 15" Duo-Cone Speaker

Olson-engineered for superb fidelity from 50-16,000 cps. Features "Acoustical Dome" design to achieve remarkably authentic reproduction. High-frequency cone with special diffusers assures wide-angle treble dispersion. Excellent dispersion angle of 120°. Crossover freq., 1600 cps. Imp., 16 ohms. Magnet wt., 2.5 lbs. Dia., 17"; depth $7\frac{1}{4}$ " Shpg. wt., 23 lbs. **98 DX 672. Net.....\$179.95**



SL-12 Extended-Range 12" Speaker

Olson-engineered. Usable range from 50-16,000 cps. Wide dispersion throughout. Very clean bass and crisp treble. Handles 10 watts with minimum distortion. Imp., 8 ohms. Magnet wt., 14.5 oz. Dia., $12\frac{1}{4}$ "; depth, $6\frac{1}{8}$ ". Shpg. wt., 4 lbs. **98 DX 670. Net.....\$22.95**

SL-8 Extended-Range 8" Speaker

Usable range from 65-10,000 cps; wide dispersion angle throughout range. Natural treble and full bass reproduction. Will handle 10 watts. Imp., 8 ohms. Magnet wt., 6.8 oz. Dia., $8\frac{1}{8}$ "; depth $4\frac{1}{2}$ " Shpg. wt., $3\frac{1}{2}$ lbs. **98 D 671. Net.....\$18.95**

FREE 268-Page 1954 Buying Guide

Write today for the complete guide to the world's largest selection of High Fidelity systems, amplifiers, tuners, speakers, changers, recorders and accessories. If it's anything in Hi-Fi, it's in stock at ALLIED.

ALLIED RADIO
Everything in High-Fidelity



ALLIED RADIO CORP., Dept. 17-M-3
100 N. Western Ave., Chicago 80, Ill.

Send FREE 1954 Catalog

Ship the following:.....\$.....enclosed

Name.....

Address.....

City.....Zone.....State.....

inside this package on your Jobber's shelf...



is the world's toughest transformer



CHICAGO

C-TYPE

With 10" color-coded leads brought out through fibre board base cover. Lead ends are stripped and tinned for easy soldering. Flange-mounted unit.

there's nothing tougher than **CHICAGO**

"Sealed-in-Steel" construction

CHICAGO "New Equipment" transformers (available in 3 mountings) feature one-piece drawn-steel cases—the strongest, toughest, best-looking units you can buy. The one-piece seamless design, enclosing an electronically perfect construction, provides the best possible electrostatic and magnetic shielding, with complete protection against adverse atmospheric conditions. For every application: Power, Bias, Filament, Filter Reactor, Audio, MIL-T-27, Step-down—ask your electronic parts distributor for CHICAGO "Sealed-in-Steel" Transformers—the world's toughest with that *extra* margin of dependability.

Free CHICAGO Complete Line Catalog

You'll want the full details on all CHICAGO "Sealed-in-Steel" New Equipment Transformers and complete replacement transformer lines. Write for your free CHICAGO Catalog today, or get a copy from your electronic parts distributor.

H-TYPE

Hermetic sealing meets all MIL-T-27 specs. Steel base cover is deep-seal soldered into case. Ceramic bushings. Stud-mounted unit.



S-TYPE

Steel base cover fitted with phenolic terminal board. Convenient numbered solder lug terminals. Flange-mounted unit.



CHICAGO STANDARD TRANSFORMER CORP.

3501 W. ADDISON ST., CHICAGO 18, ILL.



Don't let the Capitols go by, then, without making your own decision. A lot depends, remember, on the acoustics in your listening room. It is a safe bet that Capitol records will sound terrific in a big, live listening room. For a small, padded living room, try London or the earlier and very live Mercury Living Presence discs.

Albeniz-Arbo: Iberia. Orch. des Concerts Colonne, Sebastian. **Urania URLP 7085**

Fauré: Pelléas et Mélisande; **Dukas:** La Péri. Orch. des Concerts Colonne, Sebastian. **Urania URLP 7097**

Urania in the past has been reissuing assorted German radio tapes—my impression being that the dates have progressed a bit faster than time has and are now almost caught up in the main, having begun with early German tapes probably from before we knew there was such a thing. I take it that Urania's "50—15,000—" trade mark now indicates its brand new records; the above are two of the kind. A sharp, glittering technique but with a good background liveness make these excellent as to Hi-Fi acoustics. The string tone is bright, well blended and not too steely, which is more than can be said of most of the discs above, all of which these surpass. Clean recording, too, and fine surfaces.

The Dukas-Fauré disc is musically unusual, the Fauré piece—a mild and attractive item, the Dukas a novelty of stunning unimportance—it has a superb array of orchestral brilliance, up to the famous Apprentice Sorcerer, but practically no content at all. Sheer, brilliantly contrived noise and as such it makes splendid Hi-Fi!

TECHNICANA

High Fidelity

An editorial on the meaning and use of the term *high fidelity* ("la haute fidélité") appears in the June, 1953 *Revue du Son*, signed by M. J. de Cadenet. It is defined as "... the quality possessed by an electro-acoustic chain that would give the listener the same auditory impression as if his ears had replaced the recording microphone". But M. de Cadenet concludes that technical exactitude (which would necessarily involve binaural processes) is not the complete answer. The results are judged aesthetically, and it is felt that musical standards must be involved. We have too much of a tendency to consider the quality of an electro-acoustic installation on a purely technical plan. Comparison with the original, it is concluded, must be on an "aesthetic plane," which may not yield the same results as purely physical fidelity.

This reviewer might add that if the electro-acoustic chain that is being discussed does not go beyond the recording microphone or the reproducing loudspeaker, and if such factors as the relative acoustical conditions between the concert hall and the living room, the balance of sound from the different instruments, and so on are not taken into account, there can be little to disagree with in this editorial.

Record Surface Noise

The July, 1953, issue of *Wireless World* reports on a lecture delivered by D. T. N. Williamson on "Suppressing Gramophone Surface Noise." Particular reference was made to the "impulsive" type of noise associated with dust particles attracted to plastic long-playing discs.

Analysis of a typical pulse shows that it can be distinguished from recorded program transients by the fact that its energy content above 20,000 cps or so is higher. The use of a high-pass filter with this cut-off can therefore furnish a segregated pulse-actuated signal. Such a signal is used to operate



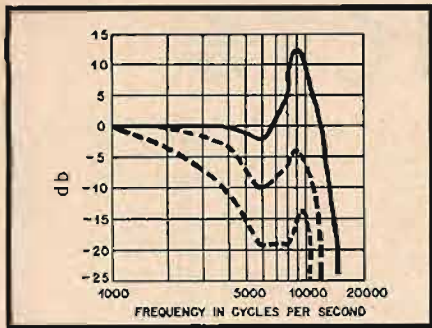


Fig. 1

a gate circuit that squelches the program—music and noise pulse both—momentarily. Mr. Williamson stated that experience has shown the ear to be tolerant of individual pulse deletions of up to 250 microseconds duration. The cumulative time taken up by the cut-off periods, however, could be as high as one tenth of the total program time.

"Clicks" were successfully removed from a specially marked record, but it is stated that some further work is required to perfect the gating circuit.

LP Record Pickups

The July, 1953, issue of *Wireless World* also carried an article by G. H. Russell, discussing "Inexpensive Pickups on Long-Playing Records." Mr. Russell points out that the increased compliance of the long-playing record material reduces the frequency of the high-frequency pickup resonances. Tests conducted with a moderately priced pickup, using an LP test record, showed a very annoying peak of about 12 db at 9,000 cps. (See Fig. 1) Such a peak results in a buzzing string tone ("reminiscent of a cloud of mosquitoes in flight"), in rapid cut-off as the frequency of the recorded signal is raised, and in an amplification of distortion in the recording.

A pickup whose upper resonance is above 14,000 cps is expensive, and also involves added amplification due to relatively low output. The solution to the resonance problem proposed here is the use of an anti-resonant electrical circuit, shown in (A) of Fig. 2. The improvement in pickup performance from the original response is evident from the graph in (B).

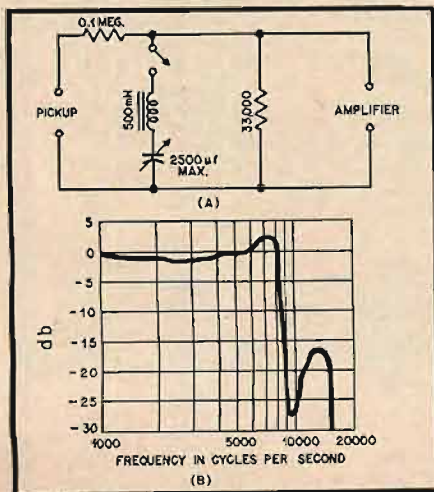


Fig. 2.

db's

by L. H. Bogen
Member, Audio Engineering Society
Vice President, David Bogen Co., Inc.

ANOTHER SURPRISE FROM A SURPRISING AMPLIFIER:



The Bogen DB10A now features Record Compensation (and the cost is still only \$54.45)

For several years now, the Bogen DB10 amplifier has been supplying a very happy solution to the problem of how to assemble a good system at a realistic price.

By selecting the DB10 (and the later DB10-1), thousands of purchasers have saved enough money on the amplifier to be able to afford a really good speaker set-up. (I think this makes for a more sensibly balanced system, since it is generally acknowledged that amplifiers have been brought to a higher stage of perfection today than speakers.)

To this field-proved amplifier, our Engineering Dept. has added a new refinement for 1954: *record equalization control*. Through the use of 8 additional positions on the circuit selector switch, the listener will now be able to compensate for the varying characteristics of the different makes of records in his collection: "LP" position—Approximately equal to the AES curve; for optimum response from American microgroove records.

"78" position—For shellac classical records (in good condition).

"Pop" position—Similar to the "78", with a sharp cut-off (about 2000 cycles) for a more mellow tone, and for reducing surface noise of worn records.

In addition, we provide calibrated tone controls to correct modifications for other records, such as FFRR and orthophonic.

Bogen

for 25 years, manufacturers of fine electronic equipment

The Saturday Review Home Book of Recorded Music and Sound Reproduction writes of the Bogen DB10: "This is a compact little marvel of tone and versatility for the price. It was resourceful enough to compete over most of its range with several amplifiers costing three times as much..."

Now you get record equalization too, and the price is still only \$54.45.



Companion FM-AM Tuner is the Bogen R604

This unit fills a real need in the market for an FM-AM tuner with a solid circuitry, excellent performance and minimum controls, to sell for under \$100. Sensitivity is 5 micro-volts for 30 db quieting. FM Frequency Response is 50-15,000 cps \pm 1 db. Stability is exceptionally good, with Automatic Frequency Control and temperature-stabilized oscillator effectively preventing drift and eliminating warm-up period.

Send for your copy of "Understanding High Fidelity"

This book, we think, strikes a nice balance between theory and the practical aspects of hi-fi. It covers such subjects as: How to evaluate and select the best components for your location, listening requirements and budget. For a copy, mail the coupon with 25¢.



MAIL COUPON NOW

David Bogen Co., Inc., Dept. VL
29 Ninth Ave., New York 14, N. Y.

Send "Understanding High Fidelity" (for which I enclose 25¢), and free catalog.

name _____

address _____

city _____ zone _____ state _____

Send free catalog only.

NEW PRODUCTS

• **Magnetic Amplifiers.** Remarkably high power handling capability for their size and weight characterizes a new line of miniaturized magnetic amplifiers now being manufactured by D & R, Ltd., 402 E. Gutierrez St., Santa Barbara, Calif. Special core materials, winding techniques, and mountings, coupled with the use of high-frequency a.c. power, permits



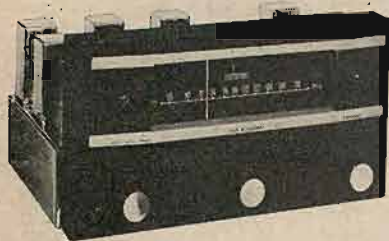
attainment of rapid response time and high power-handling capacity in units extremely small and light. The Model MA-48 illustrated weighs only three ounces, yet delivers a power output conservatively rated 25 watts.

• **High-Gain Audio Input Tube.** Amplifier manufacturers primarily will find interest in the Genelex Type Z729 pentode, a low-hum, low-noise, low-microphonic voltage-amplifying tube manufactured by General Electric Company, Ltd., of England, and marketed in this country by British Industries Corporation, 164 Duane St., New York 13, N. Y. The Z729 fits a standard 9-pin miniature socket, and has been expressly designed for use in high-gain preamplifier and equalizer stages. An internal shield completely



surrounding the elements is one of the tube's features. Data sheets giving full technical information and performance curves are available from British Industries Corporation.

• **Craftsmen FM Tuner.** Remarkable performance characteristics are embodied in the new Model C900 FM Tuner, recently introduced by The Radio Craftsmen, Inc., 4401 N. Ravenswood, Chicago 40, Ill. De-



signed for unusual sensitivity, low distortion, and maximum stability, the tuner includes a number of advancements in circuitry and components. Cascode double-

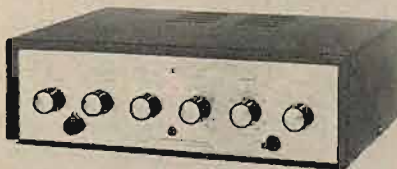
triode r-f amplifier affords sensitivity of 1 μ v for 20 db quieting. Low regeneration and easily aligned transitionally-coupled i-f stages result in less than .05 per cent intermodulation throughout the entire circuit. Amplified AFC reduces drift 100 times. Tubes may be replaced without need for realignment. AFC action is continuously variable. Descriptive sheet available on request.

• **"Write-On" Labeling Tape.** Identification of tape recordings is made easier with "Scotch" write-on tape No. 48, recently introduced by Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Pressure sensitive, the tape is supplied in a continuous roll of 40 labels which are applied directly to the sides of the reels. Printed on the white tape is "Reel



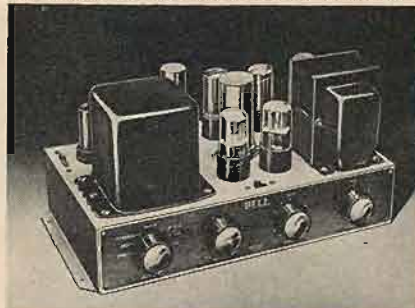
No. — Data — Subject", together with blanks for filling in the desired information. The tape is supplied with a special matte finish which can be written on with pen or pencil.

• **Scott Transcription Amplifier.** Resembling in appearance the "front end" of a conventional remote-control amplifier and but little larger in size, the new Scott Model 99-A is in reality a complete 10-watt amplifier and power supply, including preamp-equalizer and full-range controls. Treble and bass controls afford both boost and cut, and are continuously variable. An automatic loudness control is pro-



vided with means for adjusting compensation from zero to full. Selector switch permits ready choice of four inputs. Frequency response is flat from 20 to 20,000 cps. Harmonic distortion is less than 0.8 per cent and intermodulation under 0.3 per cent at 10 watts. Output tubes are balanced automatically by a self-balancing phase-inverter system. Dimensions are 13 1/4 x 3 3/4 x 9 3/4 ins. Descriptive bulletin will be mailed on request to Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.

• **Bell High-Fidelity Amplifier.** Although moderate in price, the new Bell Model 2199



amplifier represents no compromise in audio characteristics or operating flexibility. Output is 12 watts at less than one per cent distortion, and frequency response is 20 to 20,000 cps \pm 0.5 db. Six controls include a seven-position selector

switch which provides equalization for all types of records, as well as inputs for TV, tape, and tuner. Speaker outputs have impedances of 4, 8, and 16 ohms. There is also a high-impedance output jack for feeding recorders. Volume control is compensated. Separate bass and treble controls provide both boost and droop. Removable brushed-bronze escutcheon and 1 3/4-in. extension shafts simplify mounting in any cabinet. Bell Sound Systems, Inc., Columbus, Ohio.

• **E-V 4-Way Speaker System.** Handsome cabinetry is combined with advanced engineering design in the Georgian, a new



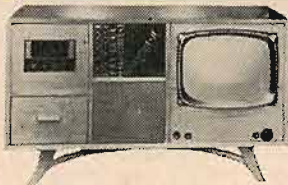
Electro-Voice multispeaker reproducer which utilizes a Klipsch "K" horn with special 15-in. driver for exceptional bass response. An electrical crossover feeds frequencies above 300 cps to a compression-type horn-loaded mid-low frequency driver with 58-in. path length. An acoustic crossover confines frequencies from 1000 to 3500 cps to a special diffraction horn. Above 3500 cps, an E-V Super Sonax very-high-frequency driver takes over to extend response beyond the upper limit of audibility. The unit is equipped with two controls, one to govern "presence", the other to control brilliance. Dimensions are 52" h x 34" w x 26" d. For complete description and technical specifications write to Electro-Voice, Inc., Buchanan, Mich.

• **Low-Priced Tape Recorder.** Introduced as the lowest priced tape recorder with comparable characteristics, the new Telectro is a dual-track unit with operating speed of 3 3/4 ips. Features include fast forward and rewind, three high-impedance inputs, and recording level indicator. A



single control permits switching from record to play to idle. The unit handles spools up to 5-in. diameter, and may be operated with the cover closed. It is housed in an attractive luggage-type carrying case and measures 7 x 10 x 11 ins. Weight is 14 lbs. Manufactured by Telectro Corporation, 35-18 37th St., Long Island City 1, N. Y.

HARVEY the House of Audio

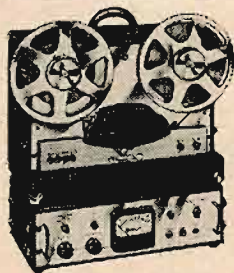


RIVER EDGE

LOWBOY Model P-1260
For TV and Hi-Fi

A sturdily constructed, handsomely finished 60-inch cabinet designed to house TV chassis and Hi-Fi components. Accommodates picture tubes up to 21-inches with 15-inch loudspeaker, and 27-inch tube with 12-inch speaker. When 15-inch speaker is used, record storage compartment, shown in illustration, is eliminated. Made with perma-bonded heavy plywood and lumber, treated with protective lacquer, and hand-rubbed. Styling is modern and matches any decor.

Model P-1260 in Cherry or Cordovan Mahogany.....\$195.00



MAGNECORD PROFESSIONAL TAPE RECORDER

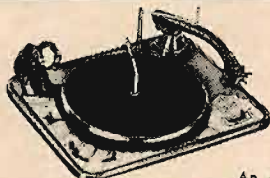
M80 Series

Provides full range response: 30 to 15,000 cycles at 7 1/2 inches/sec., and 30 to 20,000 cycles at 15 inches/sec. Has new, slot-loading feature, and automatic tape lifter. After loading, all operations are pushbutton control. Starts and stops within 1/10 second. Accommodates 10 1/2 inch reels. Flutter and wow are less than .1% at 15 inches/sec. Employs high quality, low noise amplifiers with direct-coupled cascade input stages. Can be adapted for remote operation.

M80-A chassis only for rack mounting.....\$1240.00

M80-AC portable, with cases.....1295.00

M80-ACC console complete with cabinet.....1345.00



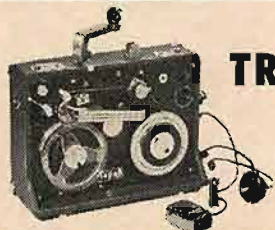
GARRARD CROWN

RECORD CHANGER

Model RC-90

An entirely new changer with outstanding innovations. A new type of 4-pole motor provides absolutely silent operation, and freedom from wow, waver, and rumble. Gives instant selection of speeds with all three speeds adjustable ± 3 rpm. Other features include: gentle pusher platform, weighted turntable, manual position for single records, finger-lift for manual use of tone arm, muting switch, automatic shutoff, and interchangeable plug-in cartridge heads.

Model RC-90 Record Changer..... Less cartridge \$66.00



The NEW TRAVIS TAPAK

Portable
TAPE RECORDER

A dry-cell battery-operated tape recorder which closes up to small suitcase size: 10x14x5 1/2 inches. The Tapak is ideally

suited for on-location recording anywhere: at sea, in the air, aboard trains, in cars, or on foot. It erases, records, monitors, and has built-in editing device. Provides for fast power-rewind and instantaneous playback through single earphone headset. Drive mechanism is spring-powered. Runs 5-6 minutes on one winding. Indicates when spring has run down, and permits rewinding without interrupting recording operation. Records at 7 1/2"/sec.

Complete with microphone, earphone, two flash cell A batteries, and 67 1/2 v. B battery.....\$329.45

Visit the HARVEY AUDIOtorium

If you want to See and Hear the finest . . . the widest selection of high fidelity equipment . . . be sure to visit the HARVEY AUDIOtorium. It will thrill you.

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

REK-O-KUT

12-inch, 3-Speed TURNTABLES

Model L-743



A broadcast quality turntable designed for discriminating users . . . professionals and audiophiles. Driven by 4-pole motor. Turntable itself is made of cast aluminum, and exerts no pull on magnetic cartridges. It is precision machined with a heavy rim for dynamically balanced flywheel action.

A single knob permits instantaneous selection of any record speed: 33 1/3, 45, or 78 rpm. Record slippage is eliminated through use of new mat material. There is virtually no rumble, wow or flutter. Complete with 45 rpm record adaptor.....\$59.50

Model T-12H A DeLuxo version of the above for the ultimate in turntable design for 33 1/3 and 78 rpm only. Driven by constant speed hysteresis synchronous motor.....\$119.50



The REL Precedent FM TUNER

Unquestionably the finest FM tuner ever made. This successor to the famous 646B incorporates every important advance developed in the art of FM reception. Sensitivity is 2 microvolts for better than 40db quieting. Frequency response is 30 to 40,000 cycles ± 1 db. Waveform distortion is less than .5% for 100% modulation. Provides 2-volt output to high impedance, and .2 volts to 600 ohms. Front panel includes slide-rule dial, tuning meter, signal strength meter, tuning control, radio frequency and audio gain controls, and power switch. Power supply is self-contained. Supplied complete with tubes.

Chassis only (for custom installations).....\$325.00

Relay Rack Model.....335.00

Cabinet Model (Mahogany, Walnut or Blonde).....360.00

The FERRANTI RIBBON PICKUP



Designed by D. T. N. Williamson, this new pickup represents years of study and development. It is a complete unit of pickup head and arm with the head interchangeable for either standard or microgroove records.

Frequency response is uniform to 20,000 cycles with output provided to 100 kc. Only 3 grams stylus pressure. Mechanical resonance has been kept to 3 cycles, well below the recording range. Greater than normal compliance promotes uniform response and minimizes record wear. Both heads employ diamond styli with an elliptical stylus used for standard groove records. When used with appropriate transformer, output is 20 mv into 100,000 ohms.

Ferranti Pickup with arm and transformer.....\$76.95

Specify standard or microgroove.

Extra Head (standard or microgroove).....37.50

R. C. A. MICROPHONES

Broadcast quality units of tested and proven performance ideal for on-the-air and recording studio applications. Known to, and preferred by leading sound engineers.

Model 44-BX (Ribbon).....\$129.00

Model BK-1-A (Pressure).....79.50

Model 77-D (Poly-Directional).....175.00



HARVEY RADIO COMPANY, INC.

103 W. 43rd Street, New York 36, N. Y. JUdson 2-1500

let

DUBBINGS^{CO., INC.} show

you the simple, accurate way to

PLOT YOUR OWN FREQUENCY CURVES

with our new, inexpensive test instrument:

D-500 TEST LEVEL INDICATOR

and two new, and different test records:

D-100 AND D-101 FOR PHONO PERFORMANCE

THIS IS WHAT MUSIC LOVERS CAN NOW DO!

CHECK

D-100 TEST RECORD
\$3.50.

PLOT

D-101 TEST RECORD
\$4.95.

CALIBRATE

D-500 INDICATOR
\$3.95

OPERATE...

"THE MEASURE OF YOUR PHONOGRAPH'S PERFORMANCE"

Check frequency response (30-12,000 cps flat response). Check for Rumble, Hum, Flutter and Wow. Check stylus compliance and tone arm tracking ability.

"THE MEASURE OF YOUR PHONOGRAPH'S EQUALIZATION"... Plot your own recording characteristic curves for Columbia LP, AES, NARTB, RCA's "New Orthophonic".

with the TEST LEVEL INDICATOR Calibrate your equalizer for flat response on all recording characteristic curves. Calibrate your amplifier tone controls to double for an equalizer.

WITH PRECISION...WITHOUT EXPENSIVE VOLTMETERS...

order from your local dealer or mail this coupon to:

DUBBINGS CO., INC.
DEPT. AE-3
41-10 45 ST., L.I.C. 4, N.Y.
Stillwell 4-7370

Enclosed is Check Money Order for \$.....
 D-100 TEST RECORD @ \$3.50.....\$.....
 D-101 TEST RECORD @ \$4.95.....\$.....
 D-500 TEST LEVEL INDICATOR @ \$3.95.....\$.....
Postage and Handling.....\$.50
TOTAL.....\$.....

FREE!

HI-FI CATALOGUE RECORDING SERVICE BULLETIN "B"

Name.....

Address.....

City.....Zone.....State.....

PLEASE PRINT

NEW LITERATURE

• **Vaco Products Company**, 317 E. Ontario St., Chicago 11, Ill., illustrates and describes screw drivers of almost every type, including all of the recessed head models, in a new pocket piece now being distributed to dealers. Of particular interest to audio engineers is a non-magnetic unit made of beryllium copper which should be an excellent tool for servicing tape recorders.

• **Minnesota Mining and Manufacturing Co.**, 900 Fauquier St., St. Paul 6, Minn., will mail upon written request two recent issues of "Sound Talk" bulletins titled respectively "Low Frequency Problems in Magnetic Recording" and "Splicing Techniques for Magnetic Tape." Both of these publications are worthy additions to any collection of magnetic recording data.

• **S. O. S. Cinema Supply Corp.**, 602 W. 52nd St., New York 19, N. Y., does an excellent job of living up to its reputation as "The Department Store of the Motion Picture Industry" with a new 80-page catalog commemorating the firm's 28th anniversary. Virtually every mechanical and electronic device required for motion picture film production is listed and priced. A handy cross-reference index assists in finding any item desired.

• **Sun Radio and Electronics Co., Inc.**, 650 Sixth Avenue, New York 11, N. Y., in its new High Fidelity Audio Equipment Catalog, features an absorbing five-thousand-word article on the subject of planning and installing a home music system. Hundreds of illustrations and descriptive text cover the many high fidelity items on the market today.

• **Cannon Electric Company**, 3209 Humboldt St., Los Angeles 31, Calif., recently issued a revised bulletin on its XL series of low-level sound connectors. Coded XLS-1953, the 4-page 2-color pamphlet contains detailed technical information and is fully illustrated with dimensional sketches, sectional drawings, and exploded views of plug and receptacle. Copy will be mailed upon request.

• **CBS-Hytron**, Danvers, Mass., has prepared a series of design rating charts and curves defining the performance of the firm's new Type 5AW4 high-vacuum rectifier under a wide variety of operating conditions. A CTS-rated tube, the 5AW4 is designed to replace the 5U4. It has electrical characteristics similar to those of the older tube, but it incorporates many of the features of transmitting tubes which afford much longer life.

• **General Cement Manufacturing Co.**, 904 Taylor St., Rockford, Ill., has just announced a new 64-page catalog which gives detailed descriptions, specifications, and prices of the complete line of G-C products for use in the manufacture and repair of electronic equipment. Requests should specify Catalog 156.

• **Engineering Products Department**, RCA Victor Division, Camden 2, N. J., applies the self-explanatory title "Power Plant Communications Systems" to a new 16-page booklet in which are graphically shown many methods of using such systems to improve operating efficiency. This publication should be in the hands of all concerned with power plant management. Requests should specify Form P-831.

• **Terminal Radio Corporation**, 85 Cortlandt St., New York 7, N. Y., is now distributing the new 1954 edition of the Terminal Audio Guide. One of the more complete catalogs of its kind, it contains 130 pages devoted solely to audio equipment for both professional and custom hi-fi installations. Classifications include: Radio and TV tuners; record changers; recorders and recording equipment; amplifiers; speakers; cabinets; parts and accessories. Copy will be mailed free on request.

DISC RECORD

(from page 21)

switch that is closed at the start of a recording; terminals 1 and 3 to the Micro-switch that is closed at the end of the recording; terminals 5 and 6 go to a toggle switch on the recorder base for manual control of the turntable motor.

The operating sequence is as follows:

1. Put on blank disc and screw down conical aluminum clamping nut.
2. Connect tape recorder to AUTOMATIC SPIRALLING CONTROLS plug.
3. Turn on a.c. power to both recorders.
4. Put edited tape on Ampex; set controls for playback.
5. Turn on suction pump.
6. With meter switch on HEAT, press stylus switch and set heat adjusting rheostat so that meter indicates 0 VU. Then set meter switch at microgroove or standard, as required. Set equalization and gain controls also.
7. Turn turntable switch on.
8. Turn microscope lamp switch on.
9. Lower cutter head to record and check groove with microscope.
11. Cut a run-in spiral by depressing MANUAL push-button (to get a lead-in groove for record changer operation).
10. Set spiralling selector at SEPARATION.
12. Start tape.

The recording is now being dubbed. This continues until a foil strip closes the contacts on the automatic spiralling control. When this occurs, a spiral groove is cut for about 3/32 in. (measured radially) and then the recording of the next selection on the tape starts. At the end of this selection, another foil marker again starts the spiralling motor, and the cycle is repeated until the last selection is being cut.

The operator may now remove the finished record, put on another blank, and start the cycle once more. The equipment described enables the average good operator to take care of about twelve recording set-ups simultaneously, instead of the usual two or three.

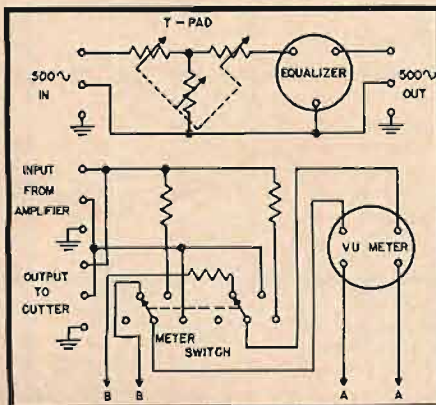


Fig. 2. The audio section of the control panel, in schematic form.



A new concept
of recorded music

THE HEATHKIT Dual RECORD PLAYER KIT

- Plays all record sizes, all speeds
- Newly developed ceramic cartridge
- Dual Matched speakers
- Acoustically correct cabinet enclosure
- Automatic shut off for changer and amplifier

MODEL RP-1

\$59.50

SHIPPING
WT. 30 LBS.

Shipped
Express
Only

Here is a new introduction to quality record reproduction. A simple to operate compact table top model with none of the specialized custom installation problems usually associated with high fidelity systems. Two matched speakers mounted in an acoustically correct enclosure reproduce all of the music on the record, reproduction with the unique sensation of being in a halo of glorious sound. This spectacular characteristic is possible only because of the diffused non-directional properties of the matched speakers. The performance level of the Heathkit Dual is easily superior to that of the ordinary

phonograph or console selling for many, many times the price of the Dual. Automatic record changer plays all three sizes at all three speeds with automatic shut off for both changer and amplifier after the last record is played. A wide range ceramic cartridge features an ingenious "turn-under" twin sapphire stylus for LP or 78 records without turning the cartridge. Simplified easy to assemble four tube amplifier featuring compensated volume control and separate tone control. Proxilyn impregnated fabric covered cabinet supplied completely assembled. You build only the amplifier from simple detailed step-by-step instructions. No specialized tools or knowledge required.

If a kit project has ever tempted you here is the perfect introduction to an interesting and exciting pastime. The Heathkit Dual Kit includes cabinet, record changer, two 6" speakers, tubes and all circuit components required for amplifier construction. Build the Heathkit Dual and enjoy unusually realistic room filling reproduction of fine recorded music.

OTHER *Famous* HEATHKIT AMPLIFIERS

THE HEATHKIT 6 WATT AMPLIFIER KIT

Model A-7B

\$15.50

Ship. Wt. 10 lbs.

The Heathkit Model A-7B Amplifier features separate bass and treble tone controls — two compensated inputs — three output impedances 4, 8, and 16 ohms — frequency response $\pm 1\frac{1}{2}$ db from 20 to 20,000 cycles — push pull beam power output at full 6 watts.

Heathkit Model A-7C with preamplifier stage..... **\$17.50**

HEATHKIT *High Fidelity* AMPLIFIER KIT

\$35.50

Model A-9A
Ship. Wt. 17 lbs.

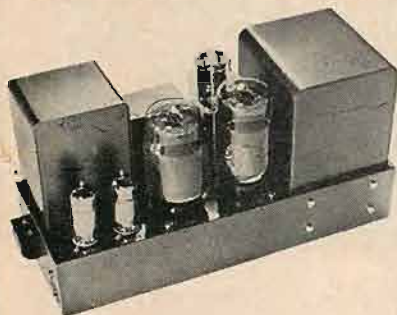
A 20 watt high fidelity amplifier especially designed for custom installations. Low hum and noise level 9 pin miniature dual triodes in pre-amplifier and tone control circuits. Four switch selected inputs. Frequency response ± 1 db 20 to 20,000 cycles. Output impedances of 4, 8, and 16 ohms.

Write For Free
CATALOG
New 32 page 1953
Catalog lists all kits,
specifications, sche-
matics and latest
price information.

HEATH COMPANY
BENTON HARBOR 25
MICHIGAN

YOU SAVE BY ORDERING DIRECT FROM FACTORY

**Now At Leonard . . .
A New Peak
In Listening Pleasure!**



**BEAM QUAD AMPLIFIER
& CONTROL UNIT**



complete unit **23750** NET

amplifier \$120 net
control unit \$130 net

Here is one of the finest amplifiers made today . . . brought to even greater perfection by the amazing new Beam Control Unit. Technically perfect . . . almost audibly perfect . . . The Beam Quad gives you a new ease of operation!

Guess work and effort are eliminated . . . Replaced by pushbutton controls, automatic circuit correction, harmonic filtering and many other brand new, built-in devices.

Full range fidelity—10 to 60,000 cps; Built in pre-amp. 1.5-40 mv. inputs; Less than 0.03% distortion. Automatic circuit correction.

Mail & Phone Orders filled . . . 25% Deposit, Balance COD. Send for Free Hi-Fi Catalogue, "L"!

LEONARD RADIO

69 Cortlandt St.
New York City
Cortlandt 7-0315

PHONOGRAPH CARTRIDGE

(from page 23)

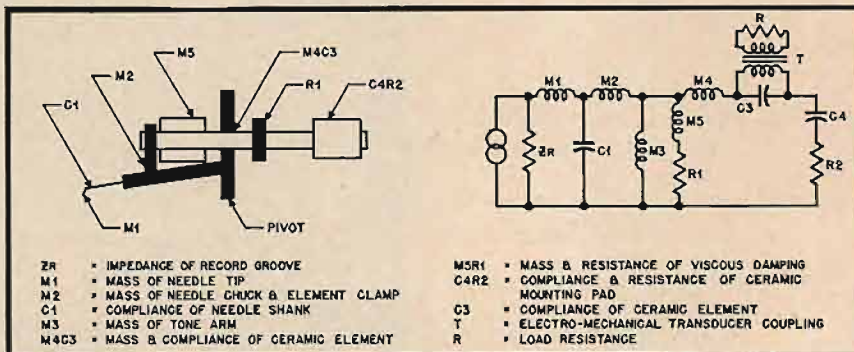


Fig. 6. Electro-mechanical equivalent circuit of a ceramic pickup cartridge.

constant. The sensitivity of this element, while somewhat lower than Rochelle Salt at 72° F., is of the same order of magnitude and does not ordinarily require changes in associated equipment.

In all piezoelectric materials, sensitivity and dielectric constant are dependent upon temperature. In a practical Rochelle Salt pickup, maximum output occurs at 72° F., and may temporarily drop to 60 per cent of this value at 90° F. The temperature output curve of barium titanate is relatively flat and the loss of sensitivity is negligible throughout temperature ranges encountered by any phono cartridge. Because of a dielectric constant four and one-half times greater than Rochelle Salt and an ultimate strength approximately five and one-half times greater, a practical titanate element can be much smaller in all dimensions. Accordingly, the effective mass of the element and associated drive mechanism is much less. Mass must be held to an absolute minimum to prevent excessive mechanical impedance from appearing at the needle with resulting distortion and increased wear on record and stylus.

Development of the Ultra-Linear Cartridge

In the last few years, ceramic cartridges have been available for use in commercial home phonographs. A ceramic of this type has sufficient output voltage to replace the majority of Rochelle Salt units. However, response has been restricted to 4000 to 5000 cps. This limitation has usually been considered desirable. In fact, some manufacturers have required a 2500-cps "roll-off" to minimize surface noise and distortion.

In contrast to this performance, basic requirements for the Ultra-Linear ce-

ramic cartridge were set up as follows:

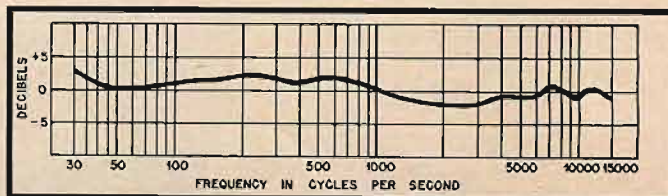
1. Frequency response was to fall within 2½ db of the New Orthophonic curve throughout the range of 30 to 15,000 cps without requiring equalization in associated equipment.
2. Output voltage was to be adequate to drive standard amplifiers without preamplification.
3. Lateral compliance should be 3.0 × 10⁻⁶ cm/dyne or higher, with maximum allowable damped vertical compliance consistent with mechanical stability in all arms and changers. These values are important factors in reducing record and stylus wear.
4. The stylus should be replaceable and of a standard type.

Reinforcing the high-frequency response above the constant amplitude level a required amount is one of the most important problems of adapting an amplitude device to a complex curve such as the Orthophonic characteristic. This is often accomplished by allowing the system to resonate in this range and damping to the desired level. The result is a somewhat peaked response falling off rapidly above resonance. Needle impedance can become quite high in such cases producing mis-tracking, distortion and actual damage to the record groove.

Damping Methods

Damping is necessary in any cartridge and can be applied in a number of ways. Common practice is to rely on materials such as viscoloid, audiod, and various rubber compounds. While they are usually necessary for mounting and restraining the element, undesirable stiff-

Fig. 8. Frequency response of E-V model 84 cartridge



ness and temperature instability result if these materials are used entirely. The property of a viscous material (a true mechanical resistance) can be expressed as:

$$F = kv$$

where F = force developed upon an immersed body,
 k = a constant dependent upon the viscosity of the material,
 v = velocity of motion.

If the viscous material were utilized as a fulcrum or restraining medium on the element, the applied force or "drive" would be greater at the higher frequencies where the velocity is increasing. Thus it is possible to incorporate a resistance for damping purposes and, at the same time, to reinforce the high-frequency response. A very low "Q" can be obtained, which is essential for a smooth response.

Viscous loading of the element is used in this cartridge by surrounding the ceramic with a viscous material. Coupling to the viscous material is adjusted to the correct value by means of a small metal vane attached to the midpoint of the ceramic. The material itself is a silicone prepared for this application in which values of viscosity, plasticity, mass, and stiffness have been established for optimum results. Silicone has excellent chemical and physical stability, particularly with respect to temperature.

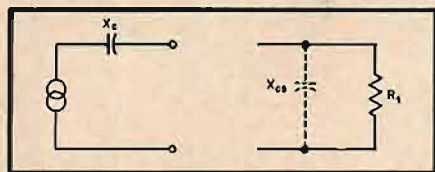


Fig. 7. Equivalent of pickup having a capacitive impedance working into a resistance load shunted by stray and circuit capacitance.

Equivalent Circuit

Equivalent circuits using electro-mechanical analogies are often useful in understanding the operation of a mechanical system. The equivalent circuit of the Ultra-Linear ceramic cartridge is shown in Fig. 6. The conversion of mechanical energy to electrical energy is represented by the transformer T . R_l is the actual load resistance on the cartridge.

Input Circuits

The electrical circuit of any piezoelectric device can be represented by a capacitance in series with a generator, as in Fig. 7. It should be recognized that the shunt capacitance of a lead and input circuit directly across the cartridge will not affect the frequency response to a noticeable extent. A voltage divider is set up consisting of the reactances of the ceramic capacitance (X_c) and the shunt capacitance (X_{cs}). The ratio of these reactances is constant at all frequencies. The net result is a given reduction in signal voltage at all frequencies.

The low-frequency response of a ceramic cartridge, however, is directly dependent upon the value of load resistance

A New Standard in Listening Satisfaction



BEAM

QUAD

Amplifier and Control Unit

- Full Range Fidelity
10 to 60,000 cps—
(Attenuated 20 to
20,000 cps)
- Built-In Pre-Amp.,
1.5-40 mV. Inputs
- Push-Button Recording
Equalization and
Program Selection
- Plug-In Matching to
Pick-Up Type
- Automatic Circuit
Correction
- Unique Stability, with
Less Than 0.03%
Distortion
- Beautiful Styling to
Match Any Decor

The finest in contemporary amplifiers, brought to an even *finer* point by the most versatile control instrument ever designed—this is the new Beam QUAD Amplifier and Control Unit.

Every care has been taken to assure complete operating facilities and faultless reproduction in this superb amplification system. Relatively *perfect* technically, the Beam QUAD is also relatively *perfect audibly*. And your thrill at its sound is enhanced by the ease of its operation—by the fact that guesswork and effort on your part are eliminated. Push-button controls, *automatic* circuit correction, harmonic filtering and other *built-in* devices make your listening enjoyment *absolute*. Audition the QUAD Amplifier and Control Unit at your audio dealer's *today*. Prove to yourself that this is the world's finest amplification system, that here truly is a *new standard in listening perfection*. Complete data sheet on request. Also send for free brochure on revolutionary new Beam "Stentorian" full-range loudspeakers.

QUAD II Amplifier and QC II Control Unit
System Complete, \$237.50 net
QC II Control Unit Only \$120.00 net
QUAD II Amplifier Only \$130.00 net

BEAM

QUAD

BEAM INSTRUMENTS CORPORATION

U. S. Agents
350 FIFTH AVENUE • NEW YORK, N. Y.

HYCOR TYPE 4201 PROGRAM EQUALIZER



Features . . .

- **LOW HUM PICKUP** through the use of toroid coils.
- Switch contact noises are inaudible even at microphone levels.
- **Low frequency equalization** peaked at 40 cycles and 100 cycles in 2 db steps up to 12 db.
- **High frequency equalization** peaked at 3 kc, 5 kc and 10 kc in 2 db steps up to 12 db.
- **Low frequency attenuation** in 2 db steps at 100 cycles and has a maximum attenuation of 16 db.
- **High frequency attenuation** in 2 db steps at 10 kc and has a maximum attenuation of 16 db.

\$195.00

General Specifications . . .

DIMENSIONS: Standard rack panel, slotted, 3½" high. Maximum depth 7½".
CIRCUIT: Bridged "T" constant impedance.
IMPEDANCE: 500/600 ohms, in-out.
INSERTION LOSS: 14 db constant.
CONTROLS: Low and high frequency selector switches. Low and high frequency controls in 2 db steps, in-out key.
FINISH: Engraved panel, medium gray baked enamel. (Special colors and finishes upon request.)

Send for Bulletin E

HYCOR SALES COMPANY
of California

11423 VANOWEN STREET
NORTH HOLLYWOOD, CALIF.

Representatives:

BEEBE ASSOCIATES
5707 W. Lake St., Chicago, Illinois
BURLINGAME ASSOCIATES
103 Lafayette St., New York City
HARRISON J. BLIND
1616 Cord St., Indianapolis 24, Ind.

A NEW PRINCIPLE IN TURNTABLES!

OUTSIDE IDLER DRIVE

*NON-METALLIC TABLE

—Solid, ¾" thick, dimensionally stable die stock—cork latex covering—non-bell-like—never needs lifting from well.

*CONSTANT SPEEDS

33.33, 45, 78.26 — "Floating Idler" decouples motor vibration from chassis — sturdy, micro-balanced 4-pole induction motor on isolation mountings, carefully positioned for minimum hum.

Complex mechanisms are eliminated in the NEW D & R DR-12, the most significant advance in turntable design in 17 years!

A new magnitude in low noise level and IM distortion due to minimum flutter and vibration . . . all parts easily

See the NEW DR-12 at leading HI-FI dealers, or write for descriptive literature to . . . Audio Equipment Division, D & R, Ltd., 402 E. Gutierrez St., Santa Barbara, California

THE D & R DR-12, a completely new design, allowing improvements in basic engineering never before possible!

Turntable only, with standard panel mounting . . .

\$78.50

mahogany box mounting, extra

accessible, machined to professional tolerance . . . especially designed for the more exact requirements of LP record reproduction.

Acclaimed by HI-FI experts and broadcasters as the ideal combination of laboratory quality and moderate cost.

d & r LTD.

(R_1). At low frequencies, X_c becomes appreciable and a smaller portion of the signal is available across R_1 . For this reason, a minimum load resistance of 3 megs is recommended for flat bass down to the lowest frequency permitted by tone arm resonance.

Output at 1000 cps is 0.6 volt as measured on the RCA 12-5-49 V frequency test record. This record represents the normal reference level for microgroove recording. Figure 8 illustrates an actual response curve taken on the RCA record.

Distortion tests, using the Cook "N-A Beam" test record indicate inter-modulation well below 2 per cent throughout the entire recorded range. This method is specified as it is easily duplicated and evaluated by anyone without special equipment.

Extensive "A-B" listening tests have corroborated all laboratory data and demonstrated the improved performance of the Model 84 Ultra Linear ceramic cartridge.

VIBRATION REDUCTION

(from page 25)

expected, the vibrations dealt with are those which occur at low frequencies. The various equations do not take resonance into account but explain the phenomenon below resonance where dynamic and static deflections are nearly the same. If one remembers that the natural resonant frequency of a solid varies inversely with its weight and directly with its stiffness, it is obvious to conclude that constructing panels as rigidly as possible helps to raise the resonant frequency to a region where damping is more easily accomplished by the use of padding and sound absorbing materials. This is easily demonstrated with the test set up illustrated in Fig. 6. Connected in this manner, the oscilloscope indicates the power factor of the load. At resonance, the power factor is unity and a straight line appears on the scope. Power factors at non-resonant frequencies show up as loops of various widths. If the oscillator is adjusted until a panel resonance is detected, it may be observed that the application of hand pressure to the vibrating panel will cause the straight line to open up into a loop, and by returning the oscillator it will be found that the resonant frequency occurs at a higher fre-

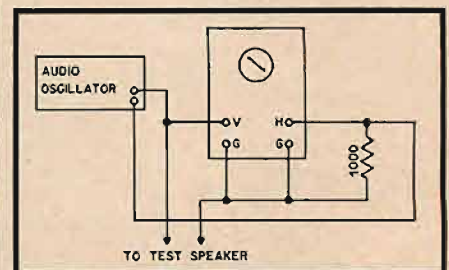


Fig. 6. Test circuit used for checking impedance and resonant frequency of speaker in enclosure.

quency. During this test, of course, one must not pick an oscillator frequency which corresponds with the natural acoustical resonance of the cabinet. In this case applying pressure to the panels will have little effect.

SAMPLE PROBLEM

Consider the bass reflex cabinet shown at (A) in Figure 3. Assume that it is constructed of 1-in. plywood (7/8-in. dressed), and that all corners are joined in such a manner that the panels are rigidly supported.

The top panel will exhibit the smallest maximum deflections because it is the smallest panel. The deflection of unit beam 1 is given by equation (6).

$$Z_{max} = \frac{K L^3}{384 I}$$

In this case I , the moment of inertia, from Table II is .049 and

$$Z_{max} = \frac{K 13^3}{384 \times .049} = 117 K$$

Since unit beams chosen from the bottom or sides would have identical dimensions, the maximum deflection of these panels would be the same as the top panel.

The maximum deflection of the front panel is determined by considering unit beam 2. In this case

$$Z_{max} = \frac{K 26^3}{384 \times .049} = 936 K$$

The deflection of the back panel is similar.

Because of its shape, the area of the front panel below the port (6x26 in.) exhibits a deflection which is characteristic of unit beam 3, which is a cantilever. The deflection is given by

$$Z_{max} = \frac{K L^3}{8 I} = \frac{K 6^3}{8 \times .049} = 551 K$$

In determining the bracing required to reduce front and back panel vibration to a value consistent with the top panel, consider the load as the area defined by panel "P" in (B). Its width is roughly 10 inches, and the deflection is 936/117 or roughly 8 times as severe as for unit beam 1, the required stiffness of the brace beam is 8x10 or 80 times that of unit beam 2. From Table II it may be seen that the best brace would be a 1x4. The stiffness factor equals 3.49/.049, or 71, which is close enough to the desired value. Actually it may be more desirable to use a 2x3 as shown at (B) with a stiffness factor of 245/.049, or 50, in some instances where a brace 1x4 would adversely affect the acoustics of the cabinet. Since such effects are generally not serious near the back of the cabinet, it is recommended that 2x4's be used. Here the stiffness factor is 6.45/.049, or 132. If three braces are used as shown at (C), each will support approximately one fourth of the total load. This makes the stiffness factor equal to $8 \times \frac{33K}{4}$ or 66 K. If the above calculations are applied successively to the braced panel shown at (C), two deflections are obtained.

Since both sub-panels and braces vibrate in unison, the final deflection is obtained by adding the two and the sum will be found to equal 117 K.

Because of the short length of unit beam 3, sub-panel Q (A of Fig. 3) requires less bracing than sub-panel P. Just to be on the safe side however, a 2x3 should be installed as shown.

The reader will note that all the braces used add up to a total volume of 1/2 cu. ft. which is about 1/12 of the cabinet volume.

"TAB" THATS A BUY

DIAMONDS AN "LP'S" BEST FRIEND

- Protect your records that's "sound" advice. Mail your cartridge, we replace stylus at cost of diamond only.
- A. Diamond single stylus for Astatic, Philco, Magnavox, RCA, Shure & Webster cartridges \$12.00
 - B. Diamond (.001) LP & sapphire (.003) 78 for G.E. RFX047, 050, 051 cartridge \$14.00
 - Same except diamonds (.001) & (.003) \$24.00
 - C. Diamond single (.001) or (.003) for G.E. RFX040, 041, 042, 046 \$12.00
- Prices are prepaid to your door*

ARE YOU A PILE-IT?

Record Collectors
Your Pile of LP's
Need Not Be
Sensational Record Cabinets
"Grow As You Go"

Each section holds 150 records W 25 1/4" x D 14 1/2" x H 17 1/2" in quality finish mahogany, walnut or blonde.

- Model 700 Base .. \$25.45
- Model 701 Filler .. \$24.45
- Model 7B Top \$ 4.75

"TAB" WILL BUY, SELL AND SWAP AS WELL

WE SELL NEW & USED EQUIPMENT—ALL ITEMS ARE SOLD ON MONEY BACK GUARANTEE. WE BUILD TO YOUR SPECIFICATIONS AND RECONDITION YOUR PRESENT EQUIPMENT. ALL EQUIPMENT "TAB" ADVERTISES ON THIS PAGE IS BRAND NEW.



PORTABLE AUTOMATIC PHONOGRAPH

Excellent reproduction, hi-fi console quality, two heavy duty 8" speakers, 8 watt, 4 tube, amplifier, separate base & treble controls, VM-951 changer & Sonotone slip cartridge, plays 7, 10, 12" & intermixes 10 & 12" records. Beautiful suntan leatherette finish. 18 1/2" D/16 1/2" W/8 3/4" H Shp. wt. 30 lbs. Reg. \$109.95

"TAB" special prepaid to your door
Model 3A6 hi-fi portable phonograph prepaid . \$ 89.95

"LYNNE" 800 HI-FI AMPLIFIER AND PREAMP WITH EQUALIZATION

20-30,000 cps within 1 db at 3 watts & 1 1/2% harmonic distortion at 8 watts. Six controls, and all the features of \$85.00 amplifiers, plus added "Lynne" extras. 11" W x 5" H x 9 1/2" D, 6 1/2 lbs.

Model 800 "TAB" Special \$37.50

"TAB" HIGH FIDELITY PACKAGE

- Grommes 50PG3 \$ 3.90
- Garrard RC80 \$ 45.08
- G.E. RFX050 \$ 8.20
- G.E. A1400 \$ 39.95
- Universal 711 \$ 39.95
- Total \$187.08
- "TAB" Special \$162.00

THAT'S "TAB" THATS A BUY

Dept. A-E 111 LIBERTY STREET, NEW YORK 6, N. Y., U.S.A.

HI-FI POWER SUPPLY

Tops for hi-fi sound, Williamson or similar amplifiers. New "Solo" constant voltage power supply. Choke & capacitor filtered, 3% regulated, output 420 V/250 MA. D.C. filament; A.C. 12.6 vct/6 amp or two 6.3 V common at 6 amp each. Filament; A.C. 5 1/2 amp. Size 12" L/10" H/5" W. Wgt. 27 lbs. "TAB" special \$49.98 \$18.98



QUALITY RECORD CABINET

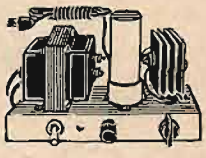
LP's play best when vertical at rest. Compact, smartly styled, selected mahogany veneer. Made by master furniture craftsmen. Divided in four sections. Holds 120 records. H 25" x W 20" x D 15". Wgt. 25 lbs.

- Model 466M mahogany \$13.95
- Model 466B blonde \$15.75

DC ON FILAMENTS

A must for "super hi-fi". No hum level with DC in the filament supply. Bridge selenium rectifier 6000 mfd brute filter, 6.3 or 12.6 volts DC/2 amp for preamp or amplifier.

- "TAB" model 2DCT \$12.98
- Same 6.3 or 12.6 V/4 amp supply "TAB" model 4DCF \$20.98



NEW UNIVERSAL FM TUNER

Automatic thermal drift compensation. Built in power supply. Hi-gain plus selectivity. Out performs higher priced 10 or 12 tube sets. Handsome mahogany cabinet. L 11 1/2" x W 7" x D 7"

- Model 711C \$44.75
- Model 711 less cabinet \$39.95

BUDGET \$\$\$ COMBO

ENJOY RECORDS & FM. THE MODEL 3AG SUPERIOR PORTABLE WITH ADDED OUTLET TO WORK WITH 711C HI-FI TUNER PREPAID* \$130.00

711C TUNER WITH COLUMBIA MODEL 205M, PREPAID* "TAB" SPECIAL \$180.00



COLUMBIA 360

A ROOMFUL OF SOUND IN A COMPACT HI-FI PACKAGE. 3 SPEED AUTOMATIC CHANGER, 2 SPEAKERS, TONE CONTROL, COMPENSATED VOLUME CONTROL & LATEST DESIGN FEATURES. SET IN BEAUTIFUL MAHOGANY CABINET. PREPAID TO YOUR DOOR*

- Model 205M table model \$139.50
- Model 207M console \$169.50
- Model 107M "XD" extra speaker & clock . . \$ 24.95

BUY RIGHT WITH "TAB" THATS SOUND HI-FI ADVICE

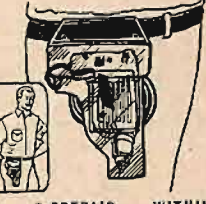
Headquarters leading hi-fi manufacturers. Before buying consult "TAB" for your audio needs. Outline your problems and we will help in selecting, trading, exchanging, or buying hi-fi equipment. Write and be convinced. We sell all the leading audio manufacturers. From stylus, pickups, tuners, turntables, preamp, amplifiers, speakers, cabinets, combinations & record furniture.

BUY RIGHT! "TAB" WRITE! PRICED RIGHT WE SHIP THROUGHOUT THE WORLD.

EXECUTIVE SPEED-WAY KIT

A must for hi-fi's who roll their own. Combo holster, ass't. chrome vanadium speed drill bits, 1/4" electric drill w/Jacobs chuck & attachments for polishing, sanding, buffing, UL appl'd., polished chromium finish. In heavy vinyl plastic holster. Prepaid*

- Model A1000 executive kit \$24.00



* PREPAID WITHIN CONTINENTAL LIMITS OF THE 48 STATES. CHECK WITH ORDER OR 25% DEPOSIT. PH.: RECTOR 2-6245

Quality
you can hear
costs little more...



The
CLARKSTAN RV 201
magnetic pickup with sapphire
stylus: net price \$15.00

Discover for yourself the truly exciting difference a Clarkstan Magnetic Pickup gives to your music enjoyment—a difference you can hear. If your ear is tuned to the finest in sound, you'll want the vivid, life-like reproduction obtainable only with the Clarkstan RV 201 Variable Reluctance Pickup—over 15,000 cycles of low distortion, flat response is yours. Ask your hi-fi sound jobber to let you hear this difference. Then you, too, will join the growing thousands of discriminating music lovers who buy only the best in pickups—the Clarkstan RV 201.

a sound investment . . .

Type—Magnetic, variable reluctance with removable stylus.

Armature—Stylus is armature; weight 31 mg (.031 g)

Response—Flat to over 15,000 cps.

Stylus—Sapphire with standard .003" radius ball point or .0012" as desired. Stylus are interchangeable and replaceable. Other sizes available.

Needle Force—5 to 7 g for LP micro-groove; as low as 9 g for standard records.

Output—60 mv at 1000 cps with lateral displacement of .001".

Recommended Termination—High impedance.

Electrical Characteristics—Inductance 350 milihenries at 1000 cps; 'Q' 1.05; DC Resistance 1450 ohms.

Mounting—Standard holes 1/8" between centers, 3-48 screws.

Weight—30 grams.

SEE YOUR HI-FI SOUND JOBBER OR WRITE FACTORY

Pacific Transducer Corp., Dept. E 123
11921 West Pico Blvd. • Los Angeles 64, California

Send me free literature on the Clarkstan RV 201 Magnetic Pickup.

NAME _____
ADDRESS _____
CITY _____

MAGNETIC TRANSFER

(from page 20)

permanently magnetic condition. Increasing the number of lines of flux per unit area of the magnetized turn allows more lines of flux to be induced into the unmagnetized turns for the same contacting areas. Thus the initially unmagnetized turns now have more lines of flux to be cut by the coil of the playback head. This in turn subsequently allows for a greater playback or transfer output. The fact that the signal on the originally unrecorded turns of wire appears as a series of bursts when viewed on an oscilloscope screen probably is dependent upon the manner in which the turns of wire lie against each other. That is, this is probably an effect of geometry.

The decrease in amplitude of the trans-

fer signal as the distance between the magnetized and unmagnetized portions of wire increased probably came about from the fact that the actual magnetization of one turn of wire by the next was an inefficient process. That is, there was always a magnetic loss and consequently the actual transfer of magnetism became less and less the further along the unrecorded wire one went. This continued until no signal was left on the wire.

The rise of the curves of transfer vs. increasing recording current was believed based on the fact that as the current was raised, more lines of flux were induced in the wire and consequently into the unmagnetized turns and therefore, was the cause of increased trans-

TABLE I

Sample No.	Transfer 1000-cps output	Transfer	Recording Current-ma		
1	17	-25	.47	$H_c = 320$	
	22	-25	.70		
	31	-4	1.30	$B_r = 2500$	
	32	+12	2.00		
	.004 in.	32.5	+16		10.00
	32	+8	30.00		
	31.5	+9	50.00		
31	+3	80.00			
2	20.5	-21	.47	$H_c = 260$	
	30	-16	.70		
	31.5	-4	1.30	$B_r = 1900$	
	.004 in.	32	0		5.00
	31	-4	10.00		
	30	-15	30.00		
	28.5	-16	50.00		
27	-20	85.00 (max)			
3	12-17	-21	.47	$H_c = 440$	
	17	-25	.70		
	31.5	-15	2.0	$B_r = 1080$	
	.004 in.	32	-10		5.0
	32	-6.5	10.00		
	31	-12	50.00		
	31.5	-18	85.00 (max)		
4	18	-25	.47	$H_c = 250$	
	24	-22	.70		
	31.5	-3	2.0	$B_r = 1480$	
	.004 in.	32	-2		5.0
	31	-6	10.00		
	26	-21	50.00		
	23	-22	85.00		
5	18	-25.5	.47	$H_c = 230$	
	25	-24	.70		
	32	+1	2.0	$B_r = 2800$	
	.004 in.	32	+8		5.0
	(Another source)	31.5	0		10.0
	31.5	-7	20.0		
	30	-11	85.0		
6	24	-23	.47	$H_c = 280$	
	30.5	-12	.70		
	32	+8	2.0	$B_r = 2600$	
	.0036 in.	32	+10		5.0
	31.5	-8	10.0		
	30	-10	50.0		
	30	-12	85.0		
7	22	-22	.47	$H_c = 320$	
	28	-20	.70		
	31.5	-6	2.0	$B_r = 2300$	
	.0036 in.	32	+6		5.0
	31.5	0	10.0		
	30.5	-13	50		
	29.5	-20	85.0		

fer. The fact that the curve leveled off and decreased was probably a self-demagnetization effect of the tiny magnetized magnets making up the wire. As the recording current increased, the magnetic fields of these small magnets affected each other, i.e., demagnetized each other, to a greater and greater extent. This could account for the transfer decrease observed.

The reason for the higher maximum transfer value for .004-in. wire as compared to .0036-in. wire of the same remanence is believed to be based upon the following explanation: The number of lines of flux for a larger sized wire is greater than for a wire of finer diameter, both wires having the same B_r . That is, transfer appears to be dependent not on the number of flux lines per unit area but rather on the total number of lines for the area involved. These

would increase as the area increased even though the B_r remained the same.

Conclusion

It was learned that the remanence and coercive force of a stainless steel recording wire had a definite influence upon the transfer characteristics of the wire. Increasing remanence caused higher transfer values for a given recording current. Increasing coercive force necessitated higher recording currents in order to attain the maximum transfer value of the wire. In addition, it was noted that the maximum transfer value attained was lower with wires of finer diameter, indicating the direction to be followed to reduce transfer.

The author wishes to thank the Wilbur B. Driver Co. for their kind permission to publish this article.

SOUND HANDBOOK

(from page 28)

occasionally the oscillation is at so low a frequency that it can be observed as a very slow oscillatory motion of the speaker cone, sometimes referred to as "breathing."

The standard cure for such regeneration is the use of added R-C sections of filtering, called de-coupling networks, as illustrated in (B) of Fig. 15-4. De-coupling networks improve the anti-hum effectiveness of the filter, but their primary purpose is to prevent alternate stages from having a common load impedance. No more than two successive stages of amplification can be fed from the same B supply point without danger of regeneration. Phase-splitters that use two tubes must be considered as two stages, and the preceding amplifier should be fed from a de-coupled point.

Hum and Noise

We may now turn to a more detailed consideration of the way in which noise is introduced into the signal channel, and of ways to combat it. Although the additional components may be periodic rather than composed of random frequencies, they are classified as noise because of their irritating nature, in accordance with the definition of noise of the American Standards Association.

Noise can be readily generated by defective tubes, resistors, capacitors, lead connections, and so on. We will confine ourselves here to discussing noise inherent in original design rather than that resulting from defective parts. Three types of noise will be considered: hum, "microphonic" disturbances, and thermal noise. Two other types of noise which the signal may pick up are record surface scratch and turntable rumble. These are associated with mechanical activities of the pickup and of the phonograph motor rather than with electronic flow in the amplifier, and are referred to in appropriate chapters.

Probably the most common "bug" in individually built or design model audio amplifiers of high gain is hum. Modern low-output pickups and tape reproducing heads require amplifiers of such gain that several potential sources of hum, which might not have had any significant effect in an amplifier of lower gain, must be carefully eliminated.

Hum Level

The amount of hum at the output of an audio amplifier, or at some point within the amplifier, is most often described in terms of the decibel relationship between the hum voltage or power and the maximum signal at that point. This procedure is followed in recognition of the fact that the tolerable amount of hum depends upon its relative level in the total range of amplitudes being reproduced. The absolute amount of hum produced by a public address system in a large hall, for example, may be considerably greater than the hum produced by a low-power living room amplifier, but the amount of noticeable hum of the two may be the same.

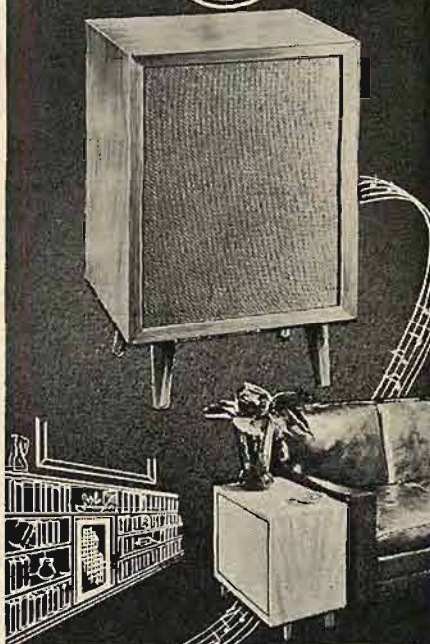
A relative rating of this type, however, must be used with care. There is a certain amount of amplifier hum output which is introduced above the volume control and which therefore remains constant regardless of the volume control setting and the level of reproduction. This hum will have a higher ratio to the signal when soft passages are being reproduced. It may leap into prominence if the loudspeaker system is especially efficient and if the maximum power capacity of the amplifier, upon which the hum rating is based, is far in excess of the power used. In the latter case it is important to know the relationship of the hum level to the maximum electrical output actually in use rather than to the output capabilities of the amplifier. The absolute minimum

MAXIMUM TONAL REALISM In Minimum Space At Minimum Cost!

KINGDOM

SOUND COMBINATION

featuring **LORENZ** Speakers



Here is a sound combination that makes music come alive in every home. The acoustically engineered KINGDOM CABINET is made of Hardwood $\frac{3}{8}$ " thick. Reproduces both high and low frequencies with full tonal realism. Small in size. Versatile and Decorative. . . . Blends with modern or traditional interiors. Furnished completely assembled with LORENZ LP-215 WOOFER, LORENZ LP-65 TWEETER AND KINGDOM HP-1 HIGH PASS FILTER (Shown below). All perfectly matched and balanced to bring you all the musical charm and enchantment of the original performance. . . . Natural, clear and crisp up to 16,000 cycles.

COMPLETE KINGDOM SOUND COMBINATION cabinet with speaker system. Size: 13" x 16" x 19". Available in colors to harmonize with the following finishes: Mahogany or Blonde, Net \$69.50 Unfinished \$67.00

KINGDOM CABINETS ONLY for 8" speakers or 2-way systems: Mahogany or Blonde. Net \$26.95 Unfinished \$24.45

CHAIRSIDE STAND Net \$6.95



'WOOFER' LOUSPEAKERS AND TWEETERS

Made Expressly for KINGDOM Products
The LORENZ Speakers have been tested and found excellent with the KINGDOM CABINETS, the Rebel TV CABINETS and ELECTRO VOICE BARONET. Other well-designed cabinets should work equally well.



LP-65
LORENZ
TWEETER

Carries the highs—Clean, Clear and Crisp up to 16,000 cycles. Power: 2 watts. Impedance: 5.5 ohms. Size: 2 $\frac{1}{2}$ " dia. Net \$8.50



HP-1 KINGDOM
HIGH PASS FILTER

Used with the LORENZ LP-65 TWEETER it will extend the range of any speaker to the limit of human audibility, going smoothly from 4,000 CPS up to 16,000 CPS. Net \$4.95



LP-215 LORENZ
'WOOFER' LOUSPEAKER

A masterpiece of sound engineering. Performs smoothly over the full range. Response: 40—13,500 cycles. Power: 8 watts. Impedance: 4 ohms. Size 8 $\frac{1}{2}$ " dia. Net \$22.50

Write for Detailed Specifications

KINGDOM PRODUCTS, Ltd.
23 Park Place, New York 7, N. Y. • WOrth 4-8585

Specify Emitron KT-66

The NEW

Custom
DC-AC CONVERTER
by Carter



Delivers MORE Power
for PROFESSIONAL Use

These latest-of-all Carter DC to AC Converters are specially engineered for professional and commercial applications requiring a high capacity source of 60 cycles AC from a DC power supply. Operates from storage batteries or from DC line voltage. Three "Custom" models, delivering 300, 400, or 500 watts 115 or 220 V. AC. Wide range of input voltage, 12, 24, 32, 64, 110 or 230 V. DC. Unequaled capacity for operating professional recording, sound movie equipment and large screen TV receivers. Available with or without manual frequency control feature.



HOW LEADING NETWORKS
USE CARTER CONVERTERS

Photo shows Tommy Bartlett, star of NBC "Welcome Travellers" program, aboard N.Y.C. R.R. "Twilight Limited." His Carter "Custom" Converter makes recording possible on board the train, from regular train current converted to 110 V. AC. Radio networks, stations, program producers use Carter Converters for all sorts of on-the-spot recording.

MAIL COUPON FOR CATALOG

Carter MOTOR CO.
2648 N. Maplewood Ave.
Chicago 47

Carter Motor Co.
2648 N. Maplewood Ave., Chicago 47

Please send new catalogs containing complete information on Carter "Custom" Converters and other Rotary Power Supplies.

Name _____
Address _____
City _____ State _____

value of the output hum of an amplifier, in microwatts, may therefore be a useful rating to have in addition to the relative rating in db below maximum output.

The Federal Communications Commission regulations permit a total hum and noise level for AM broadcast stations, exclusive of microphone and studio noises, of 50 db below 100 per cent modulation (representing maximum audio level) at frequencies between 150 and 5,000 cps, and 40 db down from the maximum signal outside of this frequency range. FM stations are required to keep their hum noise level 60 db below the maximum amplitude of passages being broadcast. Modern amplifiers should, and commercial amplifiers usually do meet or exceed the FM requirements.

If a 10-watt amplifier has 10 microwatts of hum output the signal-to-hum ratio is 10/0.0001, or a million to one. Converting to db by the power formula:

$$db = 10 \log \frac{P_1}{P_2} = 10 \log \frac{1,000,000}{1} = 60$$

we find the hum level to be 60 db below 10 watts.

It would be extremely difficult to measure 10 microwatts in the low-impedance secondary of an output transformer, as the voltage involved is minute. The voltage across the relatively high-impedance primary winding of the output transformer is much greater, and may be measured with a low-scale a.c. voltmeter or calibrated oscilloscope of known volts/inch sensitivity. (If the latter is used, peak-to-peak indications are employed directly; sensitivity is normally rated in sine-wave r.m.s. volts.)

The secondary is connected to the proper value of resistive load rather than to the loudspeaker, in order that the impedance rating of the primary, which is a reflected value, be accurate. The square of the voltage across the primary, divided by the primary impedance, will then give the power of the hum output. For example, 0.2 volts across a 4,000-ohm secondary indicates a power of 10 microwatts.

The hum level of voltage amplifiers is calculated in the same way, except that the db/voltage formula [$db = 20 \log (E_1/E_2)$] is used.

Examination of the Fletcher-Munson curve will reveal the fact that 60-cps hum, at the usual order of intensity that might be expected of such a disturbance, requires an intensity level at least 10 db higher than that of 120-cps hum to be heard with the same loudness. Suppression of hum at harmonic frequencies of the line is therefore especially important. One of the best methods (and certainly the simplest) for checking final noise level in a complete home reproducing system is a listening test, which automatically takes into consideration speaker efficiency, hum frequency, and acoustical conditions under which the reproducing system will perform. With the volume control set for high but usable volume and no program material present, an exceedingly low hum level would be represented by little or no audible sound in a quiet room at a distance of two or three feet from the loudspeaker.

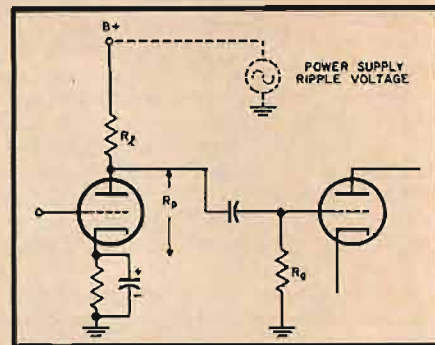


Fig. 15—5. Application of power supply ripple voltage to the voltage divider consisting of plate resistor as an upper arm, and the parallel combination of tube and grid resistor as lower arm.

Sources of Hum

The sources of hum in an audio amplifier may be divided into four main categories:

1. Insufficiently filtered B supply, the common garden variety of hum.
2. Inductive or capacitive pick-up, by some point along the signal channel, from components or leads carrying a.c. or pulsating d.c.
3. Coupling from a.c. heaters.
4. Differences of a.c. potential along the chassis or between different chassis.

Hum is also introduced into the signal in r.f. circuits, in which case it is called "modulation" or "tunable" hum.

B+ Filtering

Alternating ripple in the plate supply of a resistance-coupled stage is applied to the voltage divider formed by the load resistor and tube impedance and is coupled to the grid of the following stage, as illustrated in Fig. 15—5. It is sometimes thought that B+ hum is introduced by plate modulation of the electron stream in the tube being supplied, but vacuum tubes are relatively insensitive to plate voltage changes, and the fractional ripple voltages involved cannot have an appreciable effect on current flow. Thus the tube does not have to be in its socket for ripple in its plate supply to be introduced into the signal. As a matter of fact less plate supply hum will be introduced with the tube in place than without it.

The voltage division of plate-supply ripple will be most favorable to a low hum level when the tube has low plate resistance, when the circuit uses a high value of plate resistor, and when the grid resistor following, which is effectively in parallel with the plate resistance of the tube, is low in value. Pentodes are more susceptible to B+ ripple than triodes because of the fact that their plate resistance is higher, and because electron flow in the tube may be screen modulated by the ripple voltage. The screen requires a more highly filtered supply than the plate.

When there is doubt as to whether hum is due to inadequate filtering an extra resistance-capacitance section may be temporarily connected in series between the suspected stage and the B+ line. For the output stage the test circuit would have to be an inductance-capacitance section.

TIRED MAN'S CABINET

(from page 27)

It goes without saying that the work has been a great deal of enjoyment. At present the biggest remaining problem is the elimination of a small amount of hum which seems to originate in the output stages of the tuner. It has recently been written that no tuner on the market possesses all the desirable qualities of quietness and freedom of hum that could be found in a good high fidelity amplifier. Some day perhaps someone else may be confronted with this problem and will write a story on ways and means for substituting the two 6J5 output tubes with something more quiet. This again falls into the technical field and the writer must wait until someone else more qualified is sufficiently annoyed with this problem that he publishes something about it.

RECORDS

(from page 40)

be magnified, and a slight rocking back and forth gives an extremely accurate "geared down" adjustment to exactitude. It took a brain to think that one up.

The gadget wasn't designed directly for stylus examining, of course, and there is a bit of trouble sometimes in operating on your needles, since styli are not ordinarily mounted on flat planes. But I've managed usually to rest the device on some handy part of the cartridge and so locate the jewel in reasonably steady focus. It is definitely possible with this "mike" to see stylus damage, though the magnification is about the minimum one can get away with.

My "Vista" came direct from Japan (at an absurdly low price there) but I've seen it advertised in the U.S. and you'll probably find it in the ads that feature such imports. Sold under various trade names.

Maximilian Weil's Stylus-Disc is a somewhat controversial offering, it seems, that can easily involve one in the kind of mathematics that we used to fight about in the first days of the microgroove—remember? (Who has the most distortion at what diameter?) I'll steer clear of it—I've given the disc a good trial on all the styli I could find hanging around, checked against both the sound and the sight, via the "Vista," previously described.

The Stylus-Disc, from Audax, is of a soft material, cut with bands of eccentric grooves that swing the pickup from side to side heavily. In order to approximate the friction of a musical groove, they are modulated with a fixed high pitched tone, of about 3000 cps. You're supposed to play the bands with your pickup, extra-weighted with a quarter dollar on the end, and observe what happens. "Gray" effects indicate stylus trouble. The company warns that the disc is sensitive and detects incipient damage before it actually is risky.

Well, I began with incipient guilt, expecting to find most of my much-used points in unmentionable condition. No such thing!

NEW WILLIAMSON TYPE

Heathkit AMPLIFIER KIT

FEATURES

- Practically distortionless. Harmonic and intermodulation distortion both less than one half of 1% at 5 watts.
- Frequency response ± 1 db from 10 cycles to 100 kilocycles.
- After Lansing PEERLESS or ACROSOUND transformers available.
- First Williamson type Amplifier supplied with matching preamplifier.

When selecting an amplifier for the heart of a fine high-fidelity audio system, investigate the outstanding advantages offered by the Heathkit Williamson type Amplifier. Here is an amplifier that meets every high-fidelity audio requirement and makes listening to recorded music a thrilling new experience through naturally clear, lifelike reproduction of sound at all tonal levels. Wide acceptance of the Heathkit Williamson type Amplifier by the most critical purchasers clearly demonstrates that high-fidelity can be coupled with low cost. For factual information regarding the Heathkit Williamson type Amplifier, consult "CONSUMERS RESEARCH ANNUAL CUMULATIVE BULLETIN 1952-53."

This outstanding amplifier is offered with the optional choice of the ACROSOUND output transformer or the PEERLESS output transformer. ACROSOUND features ULTRA-LINEAR circuitry, which is the exclusive development of the Acro Products Company and provides a greater margin of reserve power efficiency and increases power output. PEERLESS features additional primary taps to permit the optional choice of either the extended power circuitry, now enjoying current popularity, or all of the advantages of the original Williamson type circuit.

The construction manual has been simplified to the point where even the complete novice can successfully construct the amplifier without difficulty. Write for a free catalogue containing complete specifications and schematics of the Heathkit Williamson type Amplifier.

HEATH COMPANY
BENTON HARBOR 25, MICH.



PRICES OF VARIOUS COMBINATIONS

- W-2 Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. Shipped express only. **\$69.50**
- W-2M Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer and Power Supply) Shipping Weight 20 lbs. Shipped express only. **\$49.75**
- W-3 Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. Shipped express only. **\$69.50**
- W-3M Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer and Power Supply) Shipping Weight 20 lbs. Shipped express only. **\$49.75**
- WA-P1 Preamplifier Kit only, Shipping Weight 7 lbs. Shipped express or parcel post. **\$19.75**

ENJOY THE FULL RICHNESS
OF FULL FREQUENCY RECORDING . . .

The
FAIRCHILD
SERIES 215
HIGH-COMPLIANCE
Diamond Cartridge

Now only **\$37.50**
WITH FINEST DIAMOND STYLUS

This amazing new cartridge, a radical departure from ordinary cartridge design, achieves near-zero mass of stylus assembly. The result is HIGH COMPLIANCE—accurate, distortion-free tracking which reproduces without listening fatigue the full, rich tonal qualities of the most sensitive recordings.

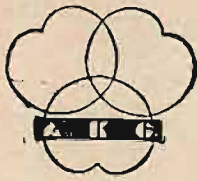
"Amazed at new purity of sound . . . clarity . . . distinctness of orchestral texture . . . which all add up to something fabulously beautiful!" says B. H. Haggin, noted Record Reviewer.

FAIRCHILD RECORDING EQUIPMENT: 9th Ave. & 154th St., Whitestone, N. Y.
Manufacturers of the World's Finest Professional Sound Equipment

ORDER FROM YOUR AUDIO DEALER or mail coupon for FREE folder

Without obligation, please mail FREE folder, "HI-FI FACTS for the Music Lover"

Name.....
Address.....
City..... State.....



3 OUTstanding DYNAMIC MICROPHONES

D-20



Models D-12 and D-20 are cardioid type unidirectional moving coil dynamic microphones with single diaphragm and a phase-shifting network. Its frequency range is extended by new patented principles. The cardioid pick-up pattern provides an easy solution to the feedback problem and eliminates audience and background noise. Both models are provided with a wind screen to permit quiet outdoor operation. The units are spring-suspended inside the microphone case.

D-12 SPECIFICATIONS

Frequency range 40 to 12,000 cps
Frequency response ± 4 db max.
Discrimination between front and rear at all frequencies Approximately 15 db

D-20 SPECIFICATIONS Studio Model

Frequency range 30 to 15,000 cps
Frequency response ± 3 db max.
Discrimination between front and rear at all frequencies 15 db min. to approx. 25 db

BOTH MODELS

Effective output level -50 dbm
(referred to a sound pressure of 10 dynes/cm²)
Sensitivity—60-ohm open circuit 0.14 mv/ μ b

D-12



CONTROLLABLE-PATTERN MODEL

Model D-36 is a dynamic studio microphone with remotely controlled directional characteristics. A selector unit is provided to adjust a number of characteristics by turning the knob on the scale. A schematic representation is given by eight different patterns. A new era in pick-up technique starts. The sound engineer can, from the control room, select between two cardioid patterns in opposite direction, or six other characteristics including the omni- and bi-directional patterns. Changes may be made during program pick-up so as to adjust the microphone to the reverberation of the individual studio, or for such effects as varying the apparent distance of the artist from the microphone.

D-36



Control knob indicates pattern directly on scale

D-36 SPECIFICATIONS

Frequency range 30-15,000 cps. Frequency response ± 3 db max.
Effective output level . . . -50 dbm (referred to a sound pressure of 10 dynes/cm²). Sensitivity—60-ohm open circuit, 0.14 mv/ μ b.
Output level and sensitivity equivalent to D-12 and D-20 so that both models may be used together with operating ease.

Akustische und Kino-Geräte

Ges. m. b. h.

Nobilegasse 50,

Vienna XV, Austria

I didn't get any "gray" effect or any effect at all for the first five or six tries, including an Audax diamond that I was sure must be poohed out. By golly, I looked at it with "Vista" and it *looked* OK too. Check—negative. But I had to find at least one bad needle, and couldn't. An old GE 78 sapphire—nope. OK. A still older fixed-stylus early GE cartridge? OK. A CAC, much used. OK. And "Vista" said yes, too. This was too good to be true.

Enfin—I found a CQ Astatic with a diamond shaped sapphire point; that is, a sharp triangle where the round ball should have been. That should do it, and it did. Not gray, but shiny, however; it seemed to polish the Audax grooves. Didn't matter—I could see the change in their looks. Bad point, by every test. (I broke it off, just to end that experiment. An old Pfanstiehl sapphire cartridge with a lop-sided flat (via "Vista") made a fine gray trace on the Stylus-Disc. Check again. Mathematics or no, the prognosis seemed fairly good, though by this time I'd just about used up the available test grooves, both micro-groove and 78.

Aha! A diabolical idea. I pulled forth a brand new, untouched crystal cartridge with an ALL-GROOVE sapphire. What would the Stylus-Disc do about that? I am happy to report that the results were emphatic. The all-groove point, brand new, produced a lovely, healthy band of dark damage on the microgrooves, fully as bad as the worst used point I'd tried! On the 78 side of the disc the same all-groove point seemed to do OK. Moral: Keep away from all all-grooves for your LP's and 45's.

Point Pressure

How about measuring stylus pressure? That's another tough problem for the home user, though the professional engineer and the advanced amateur may well have the requisite tools. Most changer and arm and cartridge makers blithely talk about adjusting stylus pressure with never a thought as to how the poor dope at home is supposed to go about doing it. Baby's bath scales won't help and not even a postage letter weigher is any good—not with our present gram pressures.

Again, I've tried this and that home point pressure device without much luck so far. Note well that an excellent new solution for the home is the GE arm with the built-in scale balance, a type of gadget until now quite unavailable for ordinary home use, at lowish cost. But what to do with some other arm—any other among millions?

I've tried the Clarkstan pressure gauge and must report a fundamental trouble with all spring scales that operate from underneath the pickup point, resting on the turntable or on the hand. The spring is in itself accurate enough; but its end, the tiny cup into which you place the stylus point, moves up and down in a *curved track*, an arc. That means that either the pickup or the supporting base must move forwards and back as the stylus moves up and down. If not, things tend to jam and the reading—at such tiny pressures as a few grams—can go way off. Of course if you can place the scale sidewise to the pickup so that the arch is in line with the arm's swing, the trouble is greatly decreased (though not removed since the arm's travel is also an arc) but in most machines there isn't room for this sort of trial.

Weathers, the FM pickup firm, has a new stylus pressure gauge that hangs from above, and removes this trouble neatly, allowing for considerably more accurate readings, as far as I've been able to observe. No springs—a system of simple

BRITISH TECHNICAL PUBLICATIONS

ANNOUNCING a revised (1953) edition of *The Wireless World RADIO DATA CHARTS*. This 91-page book contains 43 abacs, covering all phases of radio and electronic design. A most comprehensive source of reference of lasting value \$2.00

AUDIO HANDBOOKS by N. H. Crouhurst
No. 1 "Amplifiers" \$1.00 ea.
No. 2 "Feedback"
No. 3 "The Use of A.F. Transformers"

PRACTICAL HANDBOOKS, giving constructional details \$1.00 ea.
"The Oscilloscope Book" by E. N. Bradley
"Magnetic Recording" by M. L. Quartmaine

THE WILLIAMSON AMPLIFIER, 2nd Edition. Reprints of original articles in *The Wireless World* magazine and subsequent papers by the designer of the Williamson circuit . . . \$1.00
All Above Prices Postpaid—(Trade Enquiries Invited)

Annual Subscriptions to British Periodicals

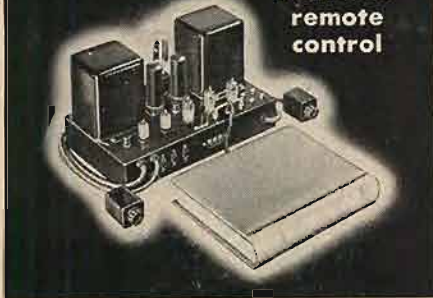
THE WIRELESS WORLD for the general field of radio and TV \$ 4.50
THE WIRELESS ENGINEER for research engineers \$ 7.00
ELECTRICAL REVIEW for the electrical industry \$11.00

Order From

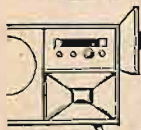
BRITISH RADIO ELECTRONICS LTD.
1833 Jefferson Place, N. W.
Washington 6, D. C.

ultra-fidelity
ultra-utility with ultra-smart

"LIBRETTO"
remote control



HEAR the difference, SEE the difference
in the *Rauland* model 1826
ultra-fidelity ensemble



The proof of unprecedented superiority of the new RAULAND Ultra-Fidelity Ensemble is in its unmatched performance. That proof awaits you now at your Hi-Fi dealer. The Master Amplifier is of matchless quality. The unique self-powered

"Libretto" Remote Control-Preamp, with its amazing flexibility, is an ingenious innovation. The laboratory tests are a revelation, but the ultimate proof of superiority is in the thrilling listening and operating experience. The specifications summarized below can only hint of the quality of this new dimension in sound.



the master amplifier

A truly superb instrument with frequency response of ± 0.3 db, 20 to 40,000 cps at rated 20 watts output. Harmonic distortion less than 0.5% at rated output, less than 0.3% at 10 watts. Intermodulation distortion less than 0.4% at 1 watt (home level), 0.7% at rated output (measured at 60 and 7,000 cycles 4 to 1 ratio). Output imp., 8 and 16 ohms. 4-position input selector—for magnetic pickup, crystal pickup and 2 auxiliary. Dimensions: 14" x 9" x 8" high.



the LIBRETTO
remote control

A true remote control, completely self-powered and capable of operation several hundred feet from amplifier. Uniquely fashioned in the form of a luxuriously bound book (only $8\frac{3}{4}$ x 11 x 2" thick). Backbone lifts to provide easy access to tuning controls. Operates flexibly in either horizontal or vertical positions.

CONTROL FUNCTIONS

- 6-position crossover control (flat, 150, 300, 450, 700, 1000 cycles).
- 6-position roll-off control (flat, -5, -8, -12, -16, -24 db at 10,000 cps).
- Volume Control—instant choice of conventional control or loudness control.
- Bass Tone, +24 db to -20 db at 20 cps (db calibrated).
- Treble Tone, +18 db to -30 db at 10,000 cps (db calibrated).

Custom-Engineered, Custom-Styled
For Audio Connoisseurs

See the RAULAND 1826 Ultra-Fidelity ensemble at your Hi-Fi dealer, or write for full details.



RAULAND-BORG CORPORATION
3515 W. Addison St., Dept. AD, Chicago 18, Ill.

levers and a circular turning weight gives readings from 1 to 10 grams with fair exactitude. You hook the bottom under the pickup and lift the whole works, by a ring, slipped over your finger; take the reading when the music stops playing or as the point loses contact. Basically a sound idea and I recommend it, or similar devices of the sort, when and if. But I've a few annoyances to air, of the minor-irritation sort, in the hopes that Weathers will make changes.

First, the two little levers slip over pins to assemble the gadget. Fine—but every time you put it down, and every other instant in between, the things fall off again. Extremely exasperating, and the levers will be lost behind the radiator or inside your amplifier in a day or so if I know most people's habits. The levers should be fixed, or at least shouldn't fall off in every breeze! Secondly, the thing is right-handed. I'm lefty. Got to break your neck or climb out the window and look in, to read it. Why not print both sides. (One side reads more exactly, but even so. . .) I'm also a bit suspicious of the friction at the top of the little indicator arc; it's at a crucial point.

All in the spirit of better Audio, etc., and I recommend the gadget for those who would Know the Worst as to their own pickups' pressure. Final note: Be sure to hook the Weathers gauge directly at the stylus point spot on the arm, not ahead or behind. A short distance either way reflects a false reading by several grams.

Dubbings' Tests

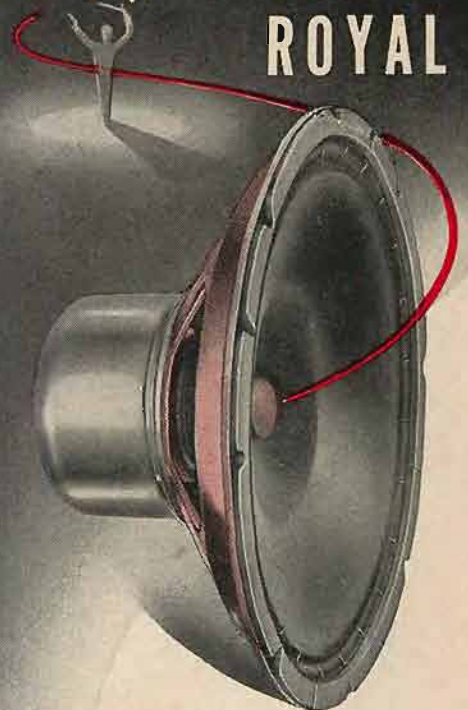
And now, finally, to the trickiest and most complex set of gadgets of the month, the Dubbings Co. test records and the Test Level Indicator.

As for the first Dubbings disc, D-100, there's not much to say and all of it good. A straight frequency run in the usual bands heads things off, and will tell a lot of people whether their phonographs produce highs and lows, or merely middles. 30 to 12,000. (High enough—a 15,000-cps band isn't going to stand up and many people can't hear it anyhow.) A 45-second unmodulated band rather neatly—if you follow the excellent and simple directions—sorts out audible hum and rumble. A 3000-cps steady tone uses your ear in its best range to check wow. A set of 400-cycle bands each up 3 db over the last is for tracking and compliance; Dubbings says a home machine is OK if it plays the first three without fuzziness. My system played 'em all very nicely. (Seems like I need some really good punk equipment around. I can't get anything to go wrong.) Sides A and B are identical—two records for the price of one, or something. (But a good idea.)

D-101 gets more complicated. It's called *The Measure of Your Phonograph's Equalization* and includes complete frequency band runs according to the four main recording curves, labelled Columbia LP, NARTB, AES, and RCA New Orthophonic. Again, both sides are identical. Level-setting bands at 1000 cps occur at both the beginning and the mid-point of each range and are easily picked out by sight. Good.

Here we are at the ragged edge of the whole amateur-professional schism—and I much admire Dubbings' enterprising and reasonable fling at that old dragon, equalization, a monster that has slain many of the best of us, on both sides of the professional fence. It's sorta hopeless—not even Dubbings can untangle the mess; and there are complications for the amateur here that are almost overwhelming. Thanks to somebody, the simple explanations of the earlier

THE *New* SUPER-ROYAL



High Fidelity Speakers

BY

Permoflux

WITH THE

Famous Treated Slotted Cone
FOR LOW RESONANCE

This exclusive Permoflux feature, plus New design in magnetic structure, utilizing heavy Alnico 5 ring magnet, results in extended distortion free, low frequency response.

The specially designed single cone radiator reproduces both high and low frequencies with exceptional clearness, and avoids the inherent distortion of coaxial or 2 way systems.

See and hear the Super Royal at your High Fidelity Dealer

Available in 3 sizes
8, 12 and 15 inch.

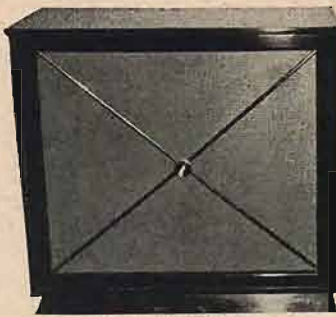
For descriptive literature write to . . .

Permoflux CORPORATION
4902 Grand Ave., Chicago 36, Ill.
West Coast Plant
236 S. Verdugo Rd., Glendale 5, Cal.

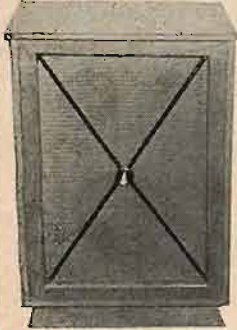
The undying CHARMS of MUSIC—reproduced
are most fully realized in

The incomparable
ISOTONE
Acoustic Spiral Speaker System
(patented)

- Absolute listenableness—for the super-critical music lover.
- Acoustic damping down to unity, with perfect definition throughout the entire tonal range: (20 to 22,000 cps).



"THE BAROQUE" 15 cu. ft.



"THE RONDINO" 9 cu. ft.

- Three-way speaker system of the finest units operating in an adequately supplementary circuit; special damping process, solid construction preclude spurious hang-over, ringing, or distracting resonances. The ISOTONE definitely sets the limit to the approach to tonal perfection, brushes the borderland of realism.
- Patrician cabinetry, hand-rubbed. Blonde Oak or polished mahogany 20 watts and 30 watts.

On demonstration at our showroom, 247 Fourth Ave.,
New York 3, N. Y., or write for information to

ISOTONE
Acoustic Spiralways, Inc.,

666 East 164th Street,
New York 56, N. Y. Phone: ORegon 3-0283

Authoritative and Enlightening...



*Acknowledged the Leading Publication
in the Field of Sound Reproduction*

If you are novice, hobbyist, experimenter, or engineer... if you are a lover of music... and in pursuit of sound, undistorted... Audio Engineering will be your faithful, reliable companion all the way. You will find no more pleasureable and stimulating reading than there is in AE; absorbingly interesting material, valuable and authentic data, workable detailed instructions... all comprehensively and yet practically presented.

"What to Do" and "How to Do" will guide your every move through this thrilling experience we call Audio.

Each new issue brings New Ideas, New Slants, and Latest Developments... month in and month out... twelve times a year.

BE SURE to get your copies REGULARLY.

MAIL this
Coupon
NOW

AUDIO ENGINEERING

P. O. Box 629, Mineola, N. Y.

Enclosed is Check Money Order for \$ _____
Please send a copy of each new issue of Audio Engineering for the next
 12 months; 24 months to:

Please Print

Name _____

Address _____

City _____ Zone _____ State _____

Subscription Price: U.S.A., Canada and Pan American Union: 1 year... \$3.00 2 years... \$5.00. Other countries: 1 year... \$4.00 2 years... \$7.00.

D-100 are continued on this disc, to make the best of the trouble. Moreover, a lot is left to the listener's good ear, which is an immeasurably wise thing to do.

With this disc alone, you can quickly get a good idea of equalization settings on these four familiar curves either through the usual bass and treble tone controls minus separate equalizer system, or via the fixed equalization positions now so popular, the record acting as a check on their performance. But you must of course have a voltmeter. No other way, ordinarily, to measure the signal strength. Cheap ones aren't accurate. Good ones cost. And that is that. Cuts out 99 per cent of phonograph users.

—But not quite. Dubbings, having got this far, has found itself bound to push on, and the Test Level Indicator is the result, a gadget strictly for home use that is designed to take the place of a fancy and complex voltmeter at a low cost, about \$3. With it, you can use the Dubbings records to measure your phonograph's exact output to the speaker on any of the test LP bands, and thus you can check its frequency response and equalization quite simply.

The gadget mounts three small light bulbs (radio dial type) in a small plastic box; when the thing is hooked onto your speaker leads via alligator clips, the bulbs light up progressively at 3 db differences in level. You set it at "neutral" via the level-set bands at 1000 cps on the test records; then you may check deviation as accurately as a couple of db (3 db is as small a difference in sound intensity as you can hear) in your machine's response from the recorded frequencies, for each of the recording curves. (i.e.—for those who may be unfamiliar with this sort of jargon—if your set plays the AES-curve bands "flat" all the way up and down when it is set for AES response, it is operating correctly, and will reproduce an AES-curve musical record in correct tonal balance, correctly equalized.)

A neat and intriguing little device and it performs admirably in every way—except for one most unfortunate weakness: the bulbs burn out, with too much volume. Do they burn out!

Dubbings pessimistically gives buyers a couple of spares; I killed nine of them, in my diabolic way, in a half hour of dicker-ing. As I say, I have a heavy hand on light equipment, and use it deliberately in such cases. But I fear, nevertheless, that others may have the troubles I had and I'm wondering whether something couldn't be done about it, to make this extremely useful gadget a bit more shock-resistant.

Specifically, I burnt out bulbs in these easy ways. (1) Though I carefully kept the volume down low, as instructed, I got impatient with the tone signal test bands and moved the pickup onward a few times. Mostly, all was well; but one slightly firmer drop of the stylus produced a mild plop in the speaker—and burnt out two bulbs. (2) I turned on my phonograph motor. The "pop" of the switch (my muting condenser was loose) burnt out the whole set of bulbs instantly. That could happen with any old switch in the nearby electrical neighborhood. (3) I clipped the test leads onto a speaker plug, loosening it slightly. The speaker line was jostled loose for an infinitesimal fraction of a second a bit later. Bulbs blew. (4) In rearranging my equipment I happened to pull out a phono input plug in the back of my amplifier, forgetting that the Test Indicator was still connected. When the ground connection broke for a tiny instant, with the usual loud hum—the bulbs blew, all of them. Took me quite a while to figure what had done it that time.

Enough said? and yet this is an excellent device, on a sound and reasonable principle. All that is needed is some sort of safety factor. Neon bulbs—two would be enough—might do it, but with a transformer the price would be up. Perhaps an overload circuit of some sort ahead of the bulbs would do it. I'm going to try 4-volt bulbs instead of the 2-volters (#40 instead of #48) to see what may happen then. What say Dubbings? Let's not lose such a good idea.

You can use the Dubbings records with a "real" voltmeter and I highly recommend them to all readers who rank between the utter amateur and the man who already owns his own oscilloscope and signal generator.

P.S. One question, largely curiosity on my part. When volt readings are taken with the speaker in parallel in the output circuit—as Dubbings suggests—is not the response affected directly by the speaker's operation, including the effects of the enclosure and even of the room—standing

waves, for instance? My own readings suggested that this was the case. An ideal speaker enclosure in an ideal acoustic situation (not for listening but for speaker performance) would reflect pretty much the electrical output of the system; but few home owners have such conditions.

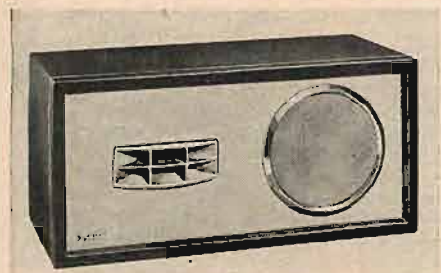
I doubt if the deviations thus occasioned are important enough to spoil the readings from these test discs, yet some users may be unduly disturbed at what seem to be peaks and valleys in over-all response, even when the average is set to equalize a given curve. Not vital because, as I well know, many a home system, including a vast number of mis-used hi-fi outfits, are so drastically and horribly off on equalization that even an accuracy of 6 or 8 db in these records would be plenty to do a good corrective job. How many times have I seen—and heard—a system exuding highs at roughly 20 db boost from the flat or correctly equalized position! Let's not worry about details.

THE AUDIO FAIR IN REVIEW

(from page 32)

entry into the audio industry with its first Fair appearance. High-fidelity equipment on display was easily recognized as coming from a firm thoroughly versed in building electronic devices to a high standard of precision.

"High-fidelity speaker performance in a small package" was the introductory theme of Jensen Manufacturing Company's new "Duette" two-way speaker system. Comprising a special 8-inch woofer plus a multicell horn-loaded compression-



type tweeter, the Duette is housed in a compact enclosure which may be mounted in a bookshelf or used on a table where space is restricted. Sharing interest with the Duette were Jensen's new H-530 and H-520 coaxial speakers, both of which offer an exceptionally high standard of performance within their respective price ranges.

Klipsch and Associates, along with demonstrating the original Klipschorn, introduced the Rebel III, a smaller back-loading enclosure designed to improve the performance of direct-radiator speakers. Moderately priced, the Rebel III is an impressive performer.

The popularity of the Baruch-Lang miniature corner speaker system was well evidenced by the crowds which attended the exhibit of Kloss Industries. Stressed in the display, as in the firm's current advertising, was the fact that Kloss was the original manufacturer of the Baruch-Lang unit, and that the company sells direct to consumers at considerable savings.

An improved version of the Karlson Ultra-Fidelity enclosure, a handsome-ap-

pearing cabinet which utilizes the exponential slot principle, held the spotlight in the exhibit of Karlson Associates, Inc.



John Karlson, company president, gave frequent lectures in order to familiarize acoustic engineers and audio hobbyists with the unique approach to speaker matching which allows a relatively small enclosure to "surpass the bass response of a 31-foot horn."

In its second Fair appearance, The Kelton Company displayed an entire line of economically-priced high-fidelity music systems, also a number of individual components. Here, incidentally, is excellent evidence of how rapidly the audio industry is expanding; last year the company's display was devoted almost entirely to the first public showing of the Kelton speaker.

A new line of miniaturized professional preamplifiers, line amplifiers, and power supplies were featured in the exhibit of Langevin Manufacturing Corporation. Of equal interest were the standard audio devices for sound service organizations and those for wired-music services, for which Langevin has long been noted.

In an initial Fair appearance, Kingdom Products, Ltd., introduced the Lorenz woofer-and-tweeter combination which, when used with the Kingdom high-pass

PILOT Hi-fi at TERMINAL

For the ultimate in
HIGH FIDELITY TUNERS
the AF-824 FM-AM
PILOTUNER



\$119.50

10 tubes, with two stage pre-amplifier equalized according to LP NAB, AES and foreign recording standards selected by Switch. Three magnetic phono and crystal and AUX. inputs. Two stage audio amplifier with cathode follower output. Sensitivity on FM-AM 10 MV. Audio frequency response $\pm 1/2$ DB, 20 to 20,000 cps. Hum level 80DB below one volt with hum balancing adjustment provided. Controls: Volume, Equalizer, Treble, AM-FM-PHONO-AUX, Bass, Tuning and AFC on-off. Built-in antennas for FM and AM.

THE AA-901 AMPLIFIER



\$99.50

New improved Williamson type Amplifier using famous KT-66 tubes. Power Output: 10 watts — less than 0.1% distortion, 25 watts — less than 0.3% distortion, maximum output — 30 watts. Frequency Response ± 1 DB 15 to 50,000 cycles. Hum Level 90 DB below 10 watts. Speaker output impedance 8 and 16 ohms. Tube complement 6SN7GT, 6SN7GT (2), KT-66 (2) Push-Pull Power Amplifier, 5U4G Rectifier.

FREE! NEW 1954 AUDIO GUIDE

You'll want this up-to-the-minute TERMINAL AUDIO GUIDE. The most complete catalog of its kind . . . Information-packed . . . A Ready Reference to the world's finest Audio equipment in all price ranges to suit your taste and budget. Amplifiers, Speakers, Radio Tuners, TV, Record Changers, Recorders, Custom Furniture, P.A. and Sound Equipment for professional and home installation.

Send for Your Free Copy Today!

Radio • Audio • Video • Electronic Equipment

Phone: WOrth 4-3311

Terminal
RADIO CORP.

85 Cortlandt St. • New York 7, N. Y.



Broadcast EQUALIZER PANEL



Type FA-14-A

- FACILITIES** Provides equalization for *two* lines
- OPERATION** *Front-panel adjustment* in steps of 3db
- RANGE** Equalizes short lines up to 15 KC...long lines up to 10 KC
- MOUNTING** Simple clamp-type mounting—fits any 19" rack. Requires just 3½" height clearance

For complete information write: General Electric Co., Section 44123, Electronics Park, Syracuse, New York.

Other G-E Audio Equalization & Filter Accessories Include:

- FA-1B-A Sound Effects Filter Panel
- FA-14-B Equalizer Unit

GENERAL ELECTRIC

IN ORDER TO FIND IT— WHY NOT BIND IT?

Your reference library of AUDIO ENGINEERING can be up-to-the-minute by keeping your copies in an AUDIO Binder.

APPEARANCE . . . Your den, workshop . . . or wherever you do your experimentation can be kept in "apple-pie" order when all your copies of AUDIO ENGINEERING are within easy reach. The deep, blue cover will harmonize with any color scheme and . . . in addition, the backbone will be gold-stamped with AUDIO ENGINEERING and any year you specify.

CONVENIENCE . . . No more wondering what happened to last month's issue . . . or the month before . . . Just reach for your Binder and no time is lost finding the information you need . . . AT ONCE.

WORKMANSHIP . . . Dupont Fabricord . . . stainproof and washable . . . rigid backbone with bound-in metal support . . . center channel to keep magazines securely in position.

COST . . . For only \$2.75 you can have this handsome binder for your ready reference.*

* (Foreign orders add 50¢ per binder)

Audio Engineering
P. O. Box 629, Mineola, N. Y.

Enclosed find \$ for Binders

Name

Address

City Zone State

Year Wanted 1951 1952 1953 1954.

filter and specially designed enclosure, provides an economical means of achieving excellent audio performance. Also intro-



duced was the English-made Emitron Type KT-66 tube, known the world over as an excellent output tube for audio amplifiers.

True, it was a little on the bulky side—but Brother how did it sound. Thus is interpreted this observer's reaction to the new Model D-55060M speaker system shown by James B. Lansing Sound, Inc. In reality a scaled-up version of the company's well-known Model 34001, the new unit makes use of two woofers and a theatre-type tweeter to give forth with music which is plenty cool, son, plenty cool.

The Fair was chosen by Livingston Electronics Corporation as the propitious occasion for announcing its entry into the commercial record field. Both binaural and standard microgroove records will be distributed under the Livingston label, with a catalog of recordings currently available now on the press. Equipment spotlighted in the Livingston exhibit included the company's binaural reproducer arm and a new twin-channel stereophonic amplifier.

Stereophonic sound from a single input source was the center of attraction in the exhibit of Madison Radio Sound, participating in the Audio Fair for the first time. The firm's Multichannel amplifier is designed for either single or binaural input, and is startling in the dimensional effect it gives to the former—at times approaching the qualities of a dual-input system.

The long-awaited introduction of the Model M80 professional tape recorder brought literally thousands of visitors into the exhibit of Magnecord, Inc. And, it may be said with full truthfulness, their enthusiasm was without limit. In addition to occupying display space at the Fair itself, Magnecord engaged a large parlor on the New Yorker's mezzanine to conduct a press exhibition of the M80, as well as the newest Magnecord binaural equipment. Response of those who attended was more than gratifying.

The keynote of the display of Jeff Markell Associates is well defined in a statement by Jeff Markell, company president—"We are designing all our units to make audio cabinetry look like furniture you would want in your living room rather than like equipment enclosures." How well

Mr. Markell's company is carrying out this premise was dramatized by a stunning enclosure which successfully solves the problem of vibration transmitted mechanically from speaker to equipment housing. Known as Model RC-130, the unit employs shock mounting in its construction to achieve the desired isolation of the two basic sections.

Appearing as a Fair participant for the first time, H. S. Martin & Company introduced its new Model 153-T AM-FM tuner



with built-in control amplifier. Sensitivity of the tuner is one microvolt for 20 db of quieting. Both tuner and preamp are designed to be powered by the Martin 352-B power amplifier. The 153-T is notable for its inviting appearance as well as for its exceptional performance.

Highlighted in the exhibit of the Mark Simpson Manufacturing Company were the new Masco "Custom Ten" 10-watt high-fidelity amplifier, the "Concert Master" 20-watt amplifier, and the new Model 53 tape recorder. Although low in price, the "Custom Ten" provides five equalization curves for all modern records, separate bass and treble tone controls, and a bass-and-treble-compensated volume control. The new Masco tape recorder incorporates a two-motor mechanism and is available with or without built-in AM tuner.

Along with the highly-regarded Model 50W-2 50-watt amplifier, McIntosh Laboratory, Inc., displayed a new 30-watt amplifier, also a new preamp-equalizer unit which is remarkable in the flexibility of control it provides. Designated Model C-108, the new McIntosh "front end" features push-button switches which permit accurate logging of tone control settings for various recordings. In appearance too, the C-108 is a distinct innovation.

Precision with a capital P was the order of the day in the exhibit of Measurements Corporation. As at previous Fairs, this was the spot to go for meeting many of the country's leading design and development engineers. Jerry B. Minter, Measurements vice-president, was on hand a great part of the time receiving congratulations on his election as president of the Audio Engineering Society.

It would be a little redundant to review the Minnesota Mining & Manufacturing Company exhibit on the basis of the various types of Scotch brand magnetic tape which were shown; every conceivable type of tape was there, period. On the other hand, the 3M display must be singled out as highly exceptional because of the excellent literature which was distributed. The writers of these pieces are to be commended for their ability to describe the technical side of magnetic recording in a vocabulary which makes it entirely understandable to the layman.

Assembled in the exhibit of Newcomb Audio Products Company was one of the more inclusive showings of fine audio

equipment in the entire show. Along with the company's complete line of high-quality amplifiers and transcription players there was featured an excellent demonstration of two-channel dimensional sound. Binaural or stereophonic—call it what you will—when played the Newcomb way it is an unforgettable experience.

A number of unique electronic developments were unveiled in the showing of the new 1954 radios and radio-phonographs introduced by Motorola, Inc. Among them



was a new oval-type inverted speaker which offers improved tone and greater speaker area than conventional units for similar application. Among completed instruments, the bulk of attention was focussed on the Motorola Sonata radio-phonograph, a low-cost table combination which includes an AM receiver and three-speed record changer.

Orradio Industries built an intriguing display around the firm's use of colors—brown, green, and red—to distinguish various grades of Irish brand recording tape. The completeness of the Irish line is entirely in keeping with the Orradio advertising theme—"World's Largest Exclusive Magnetic Tape Manufacturer."

The Fair offered no more impressive showing of home tape recording equipment than that assembled in the suite occupied by The Pentron Corporation. A Pentron accessory, a 4-position electronic mixer which may be used with any tape recorder, came in for more than due share of attention. Through use of this unit as many as four microphones and/or tuners and record players may be mixed into a single input, this affording the flexibility usually associated only with professional equipment.

Clearly proved in the suite occupied by Permoflux Corporation was the fact that excellent reproduction of sound does not necessarily entail high cost. Permoflux, through its excellent moderate-priced speakers, has gone a long way toward popularizing the hobby of custom building home music systems. And, through the high-fidelity headphones which are a virtual necessity for true binaural listening, the company has built a unique stake in the professional audio field as well.

Making an initial Fair appearance, Pickard & Burns introduced a complete assembly of high-fidelity components which were remarkable in their performance. Incidentally, this display was unique in the fact that its prime function was to bring the equipment developed by Pickard & Burns to the attention of prospective manufacturers rather than end users.

If for no other reason, the exhibit of Pickering and Company would have excited attention because of the great interest

THE SYMBOL OF QUALITY

in **TRANSFORMERS**

QUALITY

you can see!

"Beauty is only skin deep,"
but the distinctive appearance of Triad Transformers is an outward evidence of inner quality, more than simply good looks.

Brilliant design, fine materials, precision manufacturing techniques and skilled craftsmanship contribute to the end result, which looks like—and is—the finest transformer made.

Triad Transformers are sold by principal jobbers in leading cities.

Write for Catalog TR-53F.

4055 Redwood Ave., Venice, California

ASCO Offers Finest Audio Equipment at LOW COST



Sensational New FM 607 FM PILOTUNER



\$59.50

For the first time ever at this dramatic low price! 8 Tubes including Rectifier with two stage Audio Amplifier and Cathode Follower Output. Audio distortion .2% at 1 volt output. Response ± 5 DB, 20 to 20,000 cycles. Unusually sensitive. Slide rule dial with illuminated scale permits unit to be left open on shelf or easily installed in cabinet. Three simple controls **\$59.50**

Famous Williamson Type AA-903 AMPLIFIER



\$69.50

Williamson Type 10 Watt Amplifier with built-in pre-amplifier. 7 tubes including Rectifier with push-pull output tubes. Decorative front panel may be removed for cabinet installation. Frequency response ± 1 DB 15 to 40,000 cycles. Distortion less than 1%. Controls include on-off volume, separate Bass and Treble, and Equalizer selector switch for LP, NAB, AES and Foreign Recordings **\$69.50**

Visit ASCO—America's Largest Tape Recorder Center

Come in to see our wide selections of tape recorders . . . Ask for your FREE copy of "Sound Advice", 148 Pages of new Hi-Fi data, by Irving Greene. Or send coupon enclosing 10¢ (or stamps) for handling.

ASCO SOUND CORP., 115-117 W. 45 St. New York City

Please send me copy of "SOUND ADVICE". Enclosed 10¢ for handling . . .
 —FM 607 PILOTUNER @ \$59.50
 —AA903 AMPLIFIER @ \$69.50
 Total Amount Enclosed

NAME
 ADDRESS

of visitors in the Model 260 turnover-type diamond-styli cartridge, which received its public preview at last year's Audio Fair. But other reasons there were aplenty; among them was the Pickering audio input system. This company should take justified pride in being virtually the first to sense the need for a "front end" of professional precision for use with home music systems, and to make it available at reasonable cost.

Pilot Radio Corporation, in its first Fair appearance, introduced a number of new tuners and amplifiers in the moderate price range. Outstanding was the Model AF-824 tuner, which includes among its features a built-in preamplifier with bass and treble tone controls, as well as variable equalization for both domestic and foreign recordings. Engineers and hobbyists alike were impressed by the steps Pilot is taking to make excellent audio performance available at prices well in keeping with modest incomes.

Portable Gramophone Company, another of the Fair's newcomers, introduced the new Dorset portable phonograph, at this writing the only portable to employ a Gar-



rard record changer. Other quality features of the Dorset include a 6-tube amplifier, an 8-inch high-quality speaker, record compensator, and tone control, all of which contribute to the Dorset's impressive performance.

Precision Electronics, Inc., whose Grommes Model 50PG was one of the first amplifiers to bring true high-fidelity performance to the moderate-price field, gave evidence that the firm's efforts in this direction are unabated, with the introduction of Type RC-1 record compensator. For connection between magnetic pickups and preamplifiers which are not equipped with controls for record equalization, the RC-1 provides correct playback curve for all types of recordings. It is also equipped with a slide switch which changes loading to match Pickering, G. E., and Audak pickups.

Support for the belief that there is going to be a big market for long-playing tape reproducers was seen in the remarkable interest commanded by Presto Recording Corporation's Model PB-17A, a unit which plays as long as eight hours without attention. The PB-17A makes musical programs, with or without commercials, available to hotels, restaurants, industrial plants, department stores, etc., at moderate cost. Presto's other new tape equipment, the RC-11 recorder for example, also met with great approval, as did its extensive line of disc recording equipment. In the words of Thomas B.

Aldrich, Presto's sales manager, "—disc recording, in spite of tape, is a long way from bowing out of the picture."

A repeat hit was scored by R-J Audio Products. Fair visitors never seem to tire of hearing clean, fundamental bass way down in the organ-pedal-note range issuing forth from an enclosure no higher than a bookshelf and only a couple of feet in length. This year, to animate the display, the wooden top of the R-J cabinet had been replaced with Plexiglass, thus disclosing constructional details.

By far the most inclusive display ever to grace an Audio Fair was that presented by Radio Corporation of America's RCA Victor Division. Occupying a dozen rooms, RCA pulled out all the stops in presenting an exhibit which had as its focal point the new RCA custom-built high-fidelity radio-phonographs, as well as the company's new line of amplifiers, tuners, speakers, and tape recorders. In addition to showing equipment which is now available, the exhibit included an "in-the-future" demonstration of stereophonic sound. A number of brief lectures by well-known RCA engineers contributed further to make this exhibit one of lasting and pleasant impression.

The Radio Craftmen, Inc., introduced in its exhibit a new packaged home music equipment assembly consisting of tuner, amplifier, three-speed record changer, and a coaxially-mounted dual speaker system. Heretofore, the company has sold only separate components. Other new Craftmen developments shown were the C900 FM tuner with 1-microvolt sensitivity, and the C210 high-fidelity dual-chassis TV for remote control.

The FM tuner to end all FM tuners was given its first public showing by Radio Engineering Laboratories. Known as the REL Model 646-C, it includes virtually every known refinement for realizing the full potential of FM transmission and reception. Adding a touch of nostalgia to the REL suite was the original FM receiver designed and constructed by Dr. E. H. Armstrong.

New developments in magnetic recording materials were the center of attraction in an inviting display by Reeves Soundcraft Corporation. Sharing featured spots were Reeves' new Mypar Lifetime recording tape, and a strip of CinemaScope film. Mypar is a tape of tremendous strength, and is virtually non-breakable in normal usage. CinemaScope, on whose development Reeves worked in conjunction with Twentieth-Century Fox, is largely a refinement of the Reeves Magna-Stripe process and contains four magnetic sound tracks as well as picture area on 35-mm film.

One item which had to be seen as well as heard in order to be fully appreciated was the high-fidelity amplifier ensemble shown by the Regency Division of Industrial Development Engineering Associates. Not inexpensive,—it sells for close to a thousand dollars—the Regency system matches in visual beauty the perfection of its sound quality.

The Fair presented no more impressive showing of precision record-playing equipment than that assembled by The Rek-O-Kut Company. The latest Rek-O-Kut turntables are supreme examples of excellence in both mechanical and electrical construction. Also coming in for a great share of attention was an improved version of the Rek-O-Kut portable disc recorder.

In addition to displaying the excellent characteristics of Revere tape recorders, Revere Camera Company in its exhibit received a great play from visitors with the demonstration titled "Can You Hear 17,000 Cycles?" Tones of 10, 12, 15, and 17



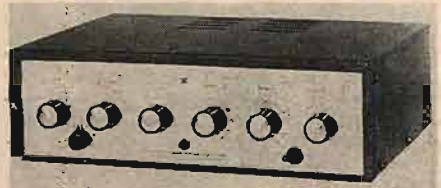
kc were recorded and played back on a standard Revere Model T-10 recorder; participants in the test were split in their curiosity as whether they could hear the 17-kc tone, and whether the recorder could reproduce it. About 40 per cent of the listeners heard the tone, which was a 100 per cent indication of its existence.

An extensive line of cabinetry ranging from "Kits to Consoles" for housing hi-fi equipment and TV receivers was shown by River Edge Industries. River Edge has secured the cooperation of many leading equipment manufacturers, who furnish pre-production drawings of audio and TV chassis prior to distribution to dealers, and thus is able to supply cabinets pre-drilled and pre-cut for most standard amplifiers, tuners, and record players.

Engineering features of the British-made Collaro record changer were clearly shown in the exhibit conducted by Rockbar Corporation, American distributors. Highly-regarded and widely-used on the Continent, the Collaro changer is well on the way toward duplicating the experience in this country. The smoothness of Collaro changer operation was particularly attractive to Fair visitors.

A Fair newcomer, Shields Laboratories, Inc., came through with a thoroughly interesting display which embraced high-fidelity amplifiers, preamps, speaker enclosures, and a number of audio measuring instruments. Observers were emphatic in their approbation of the components which were shown.

Exceptional attention was created by two new amplifier developments in the exhibit of Hermon Hosmer Scott, Inc. One, known as Model 99-A, resembles in appearance and size the "front end" of a



conventional remote-control amplifier, yet is a complete 10-watt amplifier in every respect, including variable record equalization and separate bass and treble controls. Audio characteristics are equal to those of much bulkier counterparts, and the price is remarkably low. The other, known as the Model 121-A Dynaural equalizer-pre-amplifier, is introduced by Scott as offering "complete control and compensation for any record and record condition, past, present, and future." Not inexpensive, the 121-A is designed strictly for the demanding connoisseur.

A unique preamplifier-equalizer in which the loudness control automatically takes over when bass is boosted, was introduced by Sonex, Inc. The loudness control is inactive when the bass control is in zero position. Step-type rolloff and turnover controls give 25 possible equalization curves. The unit gave a thoroughly satisfying demonstration in conjunction with the Sonex ultra-linear power amplifier.

One of the Fair's more inclusive displays of moderate-priced recording equipment was that presented by Sonocraft Corporation. Fully justified was Sonocraft's position as one of the leading firms engaged in the sale of sound equipment to schools and colleges.

Something new in pickups—the Titone ceramic cartridge—was given a public initiation by Sonotone Corporation. Demonstration brought out the wide frequency range of the unit, as well as the fact that it requires neither a preamplifier nor equalizer. Particularly impressive to visitors was the turnover model in which only the stylus rotates.

Visitors to the Stephens Manufacturing Corporation exhibit were deeply impressed by the improved line of Stephens high-fidelity speakers, also by the Stephens "wireless microphone" which permits complete mobility to stage and TV performers. Among the speakers the featured spot was occupied by the Model 628, the finest home reproducer in the Stephens line. Affording full rear horn loading, the 628 is a handsome piece of furniture which may be used either in a corner or against a straight wall.

Of the many items on demonstration in Stromberg-Carlson Company's exhibit, a combination tuner-amplifier and the RF-475 coaxial speaker came in for special attention. In its new Type SR-405 self-



contained units, Stromberg-Carlson combines in a single chassis all the features of its popular 10-watt hi-fi amplifier and a high-quality AM-FM tuner with no duplication of controls. The result is an assembly ideal for custom installations. The 15-inch RF-475 speaker contains a 10½-pound Alnico V magnet, which incidental intelligence tells us is energized by one of the largest magnetizers in the world.

Tangibly Great Sound Reproduction

IS WHAT YOU'LL HEAR AND FEEL WHILE LISTENING TO POPULAR OR CLASSICAL MUSIC THROUGH A

BROOK
HIGH QUALITY
AUDIO AMPLIFIER



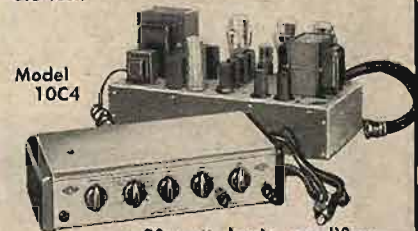
Model 22A

—handsomely compact 10-watt single-chassis combination. Quality sound, at cost so low any music lover can afford it.



Model 12A4

— combining famous BROOK 12A power amplifier, and flexible 4B pre-amplifier, at moderate cost.



Model 10C4

— 30-watt basic amplifier—remote control pre-amplifier combination; higher power for full-bodied orchestral passages.



Model 7

— Self-powered pre-amplifier perfect compliment to any good basic amplifier.

Every BROOK Amplifier is built to the highest possible standards of quality.

Write for full information on the complete BROOK line; also name of your nearest dealer. Dept. AM-3

BROOK ELECTRONICS, INC.

First in the High Quality Audio Field Since 1934
34 DeHART PLACE, ELIZABETH, N. J.

New Flyweight Magnemite*



Electric-Motor Battery-Operated Portable Recorder

The ideal recorder for newspaper reporting, recording lectures, telephone monitoring, field reports traveling secretary, on-the-spot interviews, reference recording, customer interviews, salesmen reports and secret recordings. Combines, for the first time, ease and efficiency of operation with maximum reduction of weight. Performs anywhere, producing professional results under adverse conditions. Fly-ball governor-controlled electric motor plus triple shielding assures constant speed and freedom from hash. Weather-tight, satin-finished, aluminum alloy case gives complete protection to recorder. Three models available in speeds of 15/16, 1 1/8 and 3 3/4 ips.

Check these unusual features:

- ★ Records for 4 full hours (Model 310-A)
- ★ Operates from self-contained dry cells
- ★ Immediate playback.
- ★ Size: 5 1/2 x 9 x 12 inches.
- ★ Weight: only 8 pounds.

Write for complete technical literature and direct factory prices to Dept. AE



AMPLIFIER CORP. of AMERICA

398 Broadway, N. Y. 13, N. Y.
*T.M. Reg. U.S. Pat. Off.

RECORDING TAPE (PLASTIC BASE)

at NET PRICES in Cartons of 12

WASHINGTON, D. C.:

WHERE ELSE WOULD THERE BE MORE RED ^ TAPE? *Magnetic*

- 1200 ft. plastic tape with plastic reel included.
- Each reel individually boxed.
- Choice of nationally famous top quality brands such as: Webcor (2906) 3.20; Reeves (SPN-12) 3.20; Audio (1251) 3.23; Scotch (111-A) 3.25; Panaoustic (711-A) 3.25; Irish, Professional grade (211 RPA) 3.30.
- Recording studios, schools, radio stations and other large quantity users—write for bulk price.

USED RECORDING TAPE (PLASTIC BASE)



1.99 for 7" — 1200 foot
.99 for 5" — 600 foot
.59 for 4" — 300 foot
.29 for 3" — 150 foot
Plastic reels included with all above sizes.

Money cheerfully refunded if you do not find this tape cleanly erased and as good as new. (If you are skeptical and from Missouri send us 12¢ in stamps and we'll roll you a sample.)

New empty plastic reels in boxes for easy labelling. 3" 10¢; 4" 22¢; 5" 24¢; 7" 30¢; 7" Professional reel (2 1/4" hub) 45¢ ea. EMPTY BOXES: 3" 3¢; 4" 5¢; 5" 5¢; 7" 10¢ ea.

We carry new recorders, recording blanks, tape, tape recorders, etc. at large savings. PLEASE INCLUDE SUFFICIENT POSTAGE.

COMMISSIONED ELECTRONICS CO.
2503 Champlain St. N.W., Washington 9, D. C.

One of the more satisfying displays was conducted by a new company—Tannoy (Canada) Ltd., sole distributors for the North American continent of the English-made Tannoy Dual-Concentric loud-speaker. Aside from an impressive demonstration, visitors found great interest in the Tannoy die-cast cone housing which is equipped with international-standard fixing holes. Design of the casting permits elimination of frontal cavity resonance by providing means for mounting the speaker in front of the enclosure, as well as conventionally on the inside when desired.

A new light-weight, inexpensive tape recorder was given its first public showing by Telectrosonic Corporation. Easy to operate and distinctive in appearance, the Telectrotape recorder is certain to make its mark in the audio firmament.

There is little to be known about styli which couldn't be learned in the display of The Tetrad Company. Excellent photomicrographs were used to show the effects of a worn stylus on records, and to compare the wearing qualities of sapphire and diamond. Also interesting were the color slides showing the various steps in stylus manufacture. Visitors who just happened to bring a stylus along (could there be such?) were offered free microscope and shadowgraph examination.

Never again will those who visited the Thorens Company exhibit take for granted the precision of Swiss manufacturing processes. Seldom does one encounter the painstaking care which is so evident in the Thorens line of record changers and single players. History repeated itself in that the feature of the exhibit was the Thorens model which was described in the 1952 version of the present observation as "the changer to end all changers."

One of the Fair's more informative displays was conducted by Tung-Sol Electric. Here were shown receiving tubes of many types, including of course the Tung-Sol-developed Type 5881—but more important was the fact that the suite was staffed with competent engineers who were entirely gracious in answering the intricate questions which tubes invariably seem to bring on.

Excellent audio performance, notwithstanding its small size and moderate price, was easily apparent in the new packaged hi-fi phonograph introduced by Ultrasonic Corporation. Also impressive was the Ultrasonic Model U-25 speaker system, a compact triangular enclosure for corner installation.

The inherent quality of UTC transformers was well evidenced in the exhibit of United Transformer Corporation. Pioneer in the audio industry, UTC has earned a position of unquestioned leadership in the design and manufacture of transformers for high-fidelity equipment of every description.

One of the more pleasant experiences to those of us in the audio industry has been the witnessing of the impressive and well-deserved growth of University Loudspeakers, Inc. University was among the trailblazers in the early days of audio, and today those pioneering efforts are well evidenced in the universal demand for the company's hi-fi speakers and Musicorner enclosures. Although a number of new University items were displayed at the Fair, interest in the familiar Models 6201 and 6200 and the Diffusicone was unsurpassed.

Thousands of descriptive catalogs clutched in the hands of Fair visitors provided eloquent evidence of the welcome accorded Utah Radio Products Company on its re-entry into the firmament which is High Fidelity. It doesn't seem like too many years since Utah was among the top kicks in the speaker industry, and this observer joins many other old-timers in wondering where they've been all this time.

Attractively featured in V-M Corporation's exhibit was the company's new Model 935HF Triomatic record changer. Designed for use with magnetic cartridges, the 935HF is equipped with a four-pole four-coil motor to reduce hum, and a weighted and balanced turntable to assure constant speed. Appearance of the unit is especially striking. Because of low lateral pressure required to operate the changing mechanism, the 935HF will accommodate pickups with stylus pressure as low as five grams.

Both completed units and components were featured by Video Corporation of America. Lest the company name throw you for a loss the "units" were strictly audio, with nothing whatever to do with TV. Exceptional interest was accorded the Model HF-90 table phonograph which employs a six-watt amplifier, a Collaro changer, and two six-inch speakers in a balanced acoustical chamber.

Weathers Industries built an effective exhibit around a record-playing assembly which is being advertised and merchandised as The Debonnaire. It consists of the Weathers FM pickup system and a manual turntable completely assembled and ready to plug into an existing audio system. Also shown was the new Weathers tone arm designed for use where mounting space is limited, and the Weathers pressure gauge for measuring stylus pressure.

A three-speaker table phonograph called the Webcor "Musical," which includes in its design such high-fidelity features as a loudness control, a five-watt amplifier with extended frequency range and negligible



distortion, and a Webcor Diskchanger equipped with a GE magnetic cartridge was starred in the display of Webster-Chicago Corporation. Webcor, incidentally, has adopted the triple-speaker idea in a striking new tape recorder which was introduced to a gathering of audio authorities and music critics in New York shortly after the Fair closed.

Belated recognition of the Fair by the recording industry as a propitious spot for the display of high-fidelity records was evidenced by the presence of Westminster Recording Company as a prominent exhibitor. It is initiative of this type which, along with the company's magnificent

PROFESSIONAL DIRECTORY

Custom-Built Equipment

U. S. Recording Co.

1121 Vermont Ave., Washington 5, D. C.
Lincoln 3-2705

"EVERYTHING IN HIGH FIDELITY"

From Primary Components
to Completed Custom Audio Equipment

KIERULFF

Sound Corp.

820 West Olympic Blvd. • Los Angeles 15, Calif.
Richmond 7-0271 Zenith 0271

"WE HAVE IT"

HI-FI COMPONENTS EXCLUSIVELY

HOLLYWOOD ELECTRONICS

7460 MELROBE AVE.
HOLLYWOOD 46
CALIFORNIA
WEBSTER 3-8208

FULL DIMENSIONAL SOUND



THE ULTIMATE IN

HIGH FIDELITY RECORDING



Look for this symbol on record albums you buy

HI FI ENGINEER

To evaluate hi fi equipment for home use: tuners, amplifiers, speakers, enclosures, record players and components, etc. Strong interest in and knowledge of field; degree, good technical background and experience. Include full resume and salary desired in first letter. Box DD-1 Audio Engineering.

You got troubles? Let us fix them!

COMPETENT ENGINEERS FULLY-EQUIPPED AUDIO LABORATORY

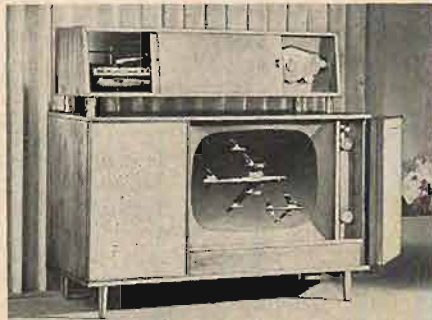
Distortion, frequency-response, and other measurements; hum elimination, correction of faulty operating conditions, performance improvement to your requirements. Write, describing your problems for estimate.

Box PV-1, AUDIO ENGINEERING

records, is rapidly propelling Westminster into a position of well-deserved supremacy. Incidentally, the new Westminster hi-fi test record is a humdinger.

The new amplifier circuit known as "Powrtron," introduced to Fair visitors for the first time by White Sound, Inc., left no doubt as to its ability to deliver ultra high fidelity. Demonstrated in conjunction with a White speaker enclosure, the Powrtron amplifier delivered some of the cleanest sound to be heard.

More than gratifying was the attention paid by dyed-in-the-wool audio fans to the handsome new high-fidelity combinations which were displayed by Zenith Radio Corporation. All of the Zenith instruments



incorporate the company's exclusive Cobra-Matic Record Changer with built-in stroboscope. In addition to playing all standard 7-, 10-, and 12-inch records automatically, the Cobra-Matic will handle the new "talking book" records which revolve at 16-2/3 rpm. Infinite variable speed control permits operation from 10 to 85 rpm. If any particular Zenith model was singled for more than due share of interest it was the L2894-H, a distinctive radio-phono-TV combination styled in the modern trend, with an acoustically designed bass reflex speaker enclosure.

the audio exchange exchanges audio
the audio exchange exchanges audio
the audio exchange exchanges audio
the audio exchange exchanges audio

Information on trading HI-FI components on request. Write or call for free catalog AE

the audio exchange exchanges audio

the audio exchange inc.

159-19 Hillside Avenue • Jamaica 32, N. Y.
Olympia 8-0445

TECHNICIAN

With knowledge of high-fidelity audio sought by progressive New York City firm. Will produce and market high-quality line of amplifiers and speakers. State qualifications and salary desired. Box DD-2, Audio Engineering.

VERSATILITY

Sine & Square Wave AUDIO GENERATOR KIT



EICO Model 377K

- Extremely stable Wien bridge oscillator
- Sine waves from 20 to 200,000 cps in 4 bands
- Square waves from 60 to 50,000 cps
- Response flat ± 1.5 db from 60 to 150,000 cps
- Calibration accuracy $\pm 3\%$ or 1 cps, whichever is greater
- Improved cathode follower output circuit for high output over wide load range
- 10V out at 1K Ω load (rated), 14V at 10K Ω , 8V at 500 Ω
- Continuously variable output attenuator
- Distortion only 1% of rated output
- Hum less than 0.4% of rated output
- 1% bridge resistors, 4 gang tuning condenser
- Rugged steel case, deep-etched panel

KIT \$31.95

WIRED \$49.95

LOWEST COST

See it at your Jobber!

Write for FREE Cat. AE-12



Electronic Instrument Co., Inc.
84 Withers St., Brooklyn, N. Y.



MASCO 10-Watt Custom High Fidelity Amplifier

MASCO Custom Ten

WITH 8 POSITION EQUALIZATION SELECTOR

gives you **HIGH FIDELITY**

that makes every instrument in a recording live and breathe!

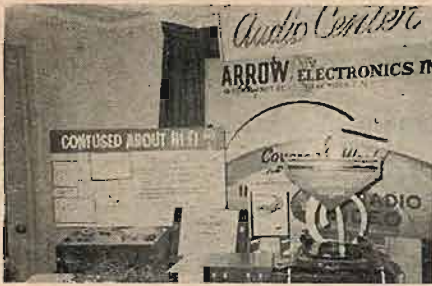
Selects and correctly compensates for the characteristics of TV tuner, radio tuner, crystal phonograph pickup; plus magnetic phonograph pickup equalized for FIVE different recording characteristics including the NEW ORTHOPHONIC RECORDING CURVE.

Wide range frequency response — 20 to 20,000 cycles $\pm 1/2$ db. Ten watts of power output at less than 1% harmonic distortion. Recorder output jack permits recording while listening.

Unsurpassed in high tonal definition, in faithfulness of reproduction, in hearing satisfaction. Hear it today at your dealer's.



MARK SIMPSON MFG. CO., Inc.
32-28 49th St., Long Island City 3, N. Y.



Left to right: Arrow Electronics, Inc., Asco Sound Corporation, Hudson Radio & Television Corp.

The Distributor-Exhibitors

WHAT CAN BE SAID about the distributors who exhibited at the Fair? They all have essentially the same equipment to show, and relatively little can be done to make the same equipment look any different no matter how it is placed.

Instead of extolling the exhibits or the equipment shown by the distributors, we prefer to take this space to extol these important organizations for the work they have to do in carrying the message to the ultimate user of audio equipment. For the

tuners. So both turn to the distributor's salesman for advice, and it is these men who are the final contact in the long line from manufacturer to consumer.

The consulting room of a professional man could scarcely be more enlightening to the student of human nature than the sales room of an audio distributor. The questions asked, the problems outlined, and the constant weighing of the merits of this unit against that one all add up to an interesting picture of the hi-fi business. The distributor's salesman has, over the past

few years, developed into a competent consultant on audio, and we take off our hat to him. He has tact and patience and an enormous fund of information on a complicated subject, and we know of few other types of business in which so much depends on the salesman.

Our sincere compliments, therefore, to this group of men who struggle to make every newcomer to hi-fi a true convert, men who must satisfy every customer as to the performance, cost, and appearance of the merchandise they sell.

Left to right: Leonard Radio, Inc., Radio-Wire-Television, Inc., Sonocraft Corporation.



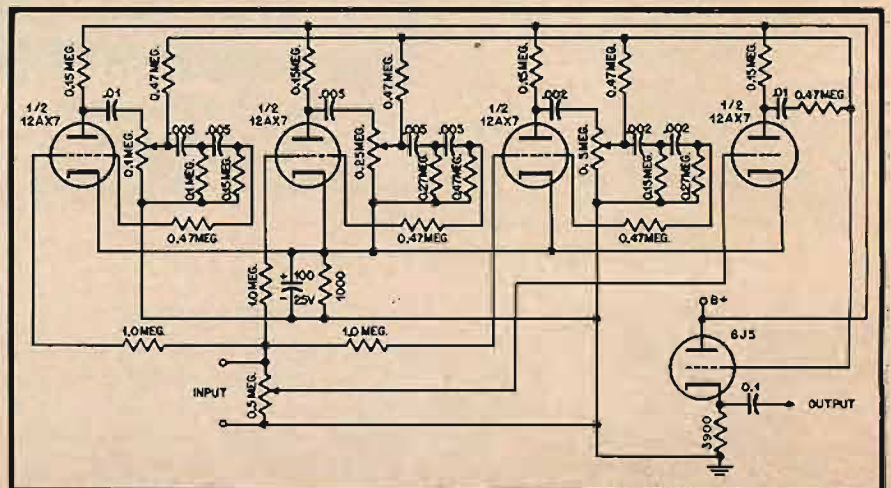
distributor and his salesmen are far more than purely a selling organization—each one of the men on the "firing line" has to be a diplomat and an engineer in addition to being a good salesman. People shopping for any product in the audio category are—in most instances—in a field where they are not too familiar, and consequently they have to rely on the sales engineer to advise them on the equipment they need. What may be ideal for the well-to-do buyer with a 30×50 foot living room may not fit the requirements of the small-apartment dweller. The needs of the suburbanite are likely to differ appreciably from those of the city folk, particularly with respect to



Sun Radio & Electronics Co., Inc.

CORRECTED SCHEMATIC

The article, "A Three-Element Bass Control" by Glen Southworth, which appeared in the October issue has been the subject of considerable correspondence from readers who were plagued by the reproduction of the schematic, Fig. 5 on page 25. Remade, the cut now shows the decimal points in more readable proportions. *Æ* regrets the inconvenience caused to any of its readers.



Industry Notes ...

The Ampex Corporation has created a wholly-owned subsidiary to be known as the **Ampex Loudspeaker Company**, according to recent announcement of Alexander M. Poniatoff, president. Initial output will consist solely of theatrical speakers to fulfill Ampex commitments to equip theaters with multi-directional sound systems used with 3-D and wide-screen techniques. Ampex speakers are being built under license from **James B. Lansing Sound, Inc.**, under management of Thomas L. Taggart, Ampex comptroller.

Newark Electric Company, 223 W. Madison St., Chicago 6, Ill., is inaugurating its second expansion program within a period of eighteen months. After increasing space from 12 to 25 thousand sq. ft. in May, 1952, Newark added another 10 thousand sq. ft. in November; latest expansion will be used largely to increase sales space and high-fidelity demonstration quarters.

Pentron Corporation, Chicago, is substantially increasing production facilities to meet the demand necessitated by growing sales. According to announcement of Irving Rossman, Pentron president, newly-leased quarters will be devoted essentially to assembly operations.

Reeves Soundcraft Corporation has licensed 20th Century-Fox Film Corporation to use Soundcraft's Magna-Stripe process in the production of release prints for CinemaScope productions, according to Frank B. Rogers, Reeves vice-president. Soundcraft has installed in the Fox Hollywood studios a Magna-Striping machine which is now working full time on the production of multistriped print stock for a number of CinemaScope productions soon to be released.

Personal Notes—

Arthur Z. Adelman has joined his father's firm, Leon L. Adelman Co., manufacturers' representative, as field representative . . . Entire electronic industry shares bereavement of **Burnstein-Applebee, Inc.**, at recent death of **Joseph A. Burnstein**, company president . . . **C. G. Barker**, former vice-president of **Magnecord, Inc.**, has been named distribution manager of **The National Company**, Malden, Mass., **Chris J. Witting**, manager of the **Dumont Television Network**, has been named president of **Westinghouse Radio Stations, Inc.**, effective January 1 . . . **E. W. Nielsen** is new president of **Best Manufacturing Co., Inc.**, Irvington, N. J. **Brook Electronics, Inc.**, announces the appointment of **Evelyn J. Horne** to its advertising department.

More Money Spent

TO FIGHT POLIO

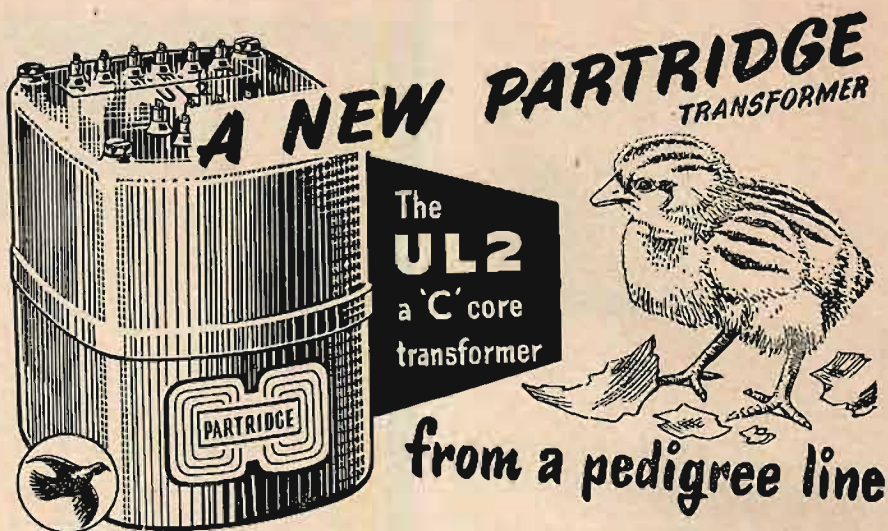
in '53

THAN EVER BEFORE

Join the
MARCH OF DIMES

IT WILL TAKE MORE IN '54!

January 2 to 31



Some salient characteristics:—

REFERRED PRIMARY LOADING. The standard models cover the requirements of all popular tubes. Each half primary is brought out separately to posts and is tapped at 43% of the turns.

POWER RATING. Peak 50 watts at 60 c.p.s. or 14 watts at 30 c.p.s. for less than 0.5% harmonic distortion without feedback.

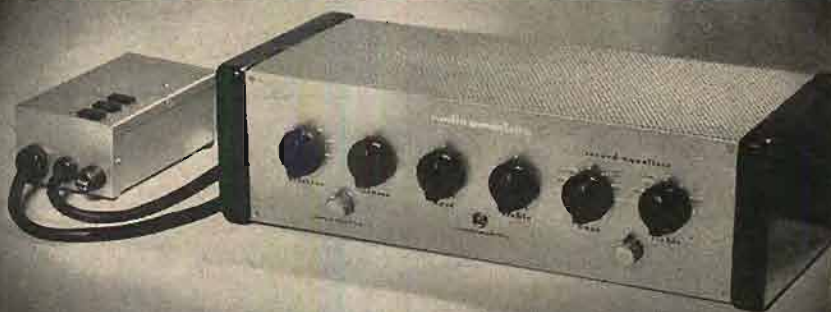
LEAKAGE INDUCTANCE . . . 10 mH. SELF CAPACITY . . . 500 pF. full primary.

. . . and it's **AVAILABLE NOW!** from your usual jobber; if in difficulty write direct—we'll see you are supplied without delay.

NOW for \$25 duty paid you can have this p.p. transformer specifically designed for really high-quality audio equipment. Having an extended frequency range and low harmonic distortion it enables a large measure of N.F.B. to be taken from the secondary circuit and applied three or four stages back. The superlative properties of the latest strip wound grain orientated material are used to the maximum advantage. The unit is hermetically sealed in a deep drawn case of purposeful design.

Ask for Technical Data . . . mailed free on request.

PARTRIDGE TRANSFORMERS LTD
TOLWORTH . . . SURREY . . . ENGLAND



Announcing the **AUDIO CONSOLETTA**
... a preamplifier of **THE HIGHEST quality**

In introducing our Audio-Consolette, we believe that we have set a new standard of quality for equipment of this type. Its top-grade components include carbon-deposit resistors, Allen-Bradley controls, and a high "Q" toroid.

Some features: 3 low level—4 high level inputs. Recorder & main outputs. Cutoff filter. Independent loudness compensator. Separate 6-position phono equalizers for bass & treble. Unusually low I.M. distortion. Totally inaudible hum at full gain. Ample voltage gain. Two-chassis construction. Write for specifications.

Audio Consolette **\$142.50**
Cabinet **12.50**

S. B. MARANTZ, 25 W. 45RD STREET, NEW YORK 36, N. Y.

SAVE
33 1/3%



This is our
GROUP SUBSCRIPTION PLAN

You and your friends and co-workers can now save up to \$1.00 on each subscription to **AUDIO ENGINEERING**. The more men in a Group, the more each saves. If you send 6 or more subscriptions for the U.S.A., and Canada, they will cost each subscriber \$2.00, 1/3 less than the price of a regular 1-year subscription. Present subscriptions may be renewed or extended as part of a Group.

AUDIO ENGINEERING is still the only publication devoted entirely to

- Audio
- Broadcasting equipment
- Acoustics
- Home reproduction systems
- Recording
- PA systems
- Psychoacoustics

(Please print)

Name

Address

Position Company

Name

Address

Position Company

Name

Address

Position Company

Name

Address

Position Company

Name

Address

Position Company

Name

Address

Position Company

U. S., Possessions, and Canada only.

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



A MONTHLY SUMMARY of product developments and price changes of radio electronic-television parts and equipment, supplied by United Catalog Publishers, Inc., 110 Lafayette Street, New York City, publishers of Radio's Master. These REPORTS will keep you up-to-date in this ever-changing industry. They will also help you to buy and specify to best advantage. A complete description of most products will be found in the Official Buying Guide, Radio's Master—available through local radio parts wholesalers.

- RCA—Added "Radiotron Designer's Handbook," 4th Edition, at \$7.00 user price.
- RIDER, JOHN F.—Added No. 148 "Guide to Audio Reproduction" at \$3.50 net.
- RINEHART BOOKS—Added "High Fidelity Techniques" at \$7.50 net.
- ACRO PRODUCTS—Added Model T0-330 Transformer at \$39.75 net.
- AMPEX ELECTRIC—Increased prices on the component parts of the Model 450 Audio Magnetic Tape Reproducer series.
- BROCIER ELECTRONICS—Added model 4W wall horn at \$420.00 consumer price.
- BRUSH ELECTRONICS—Added model BK455P "Soundmirror" high-fidelity tape recorder at \$289.50 list.
- FAIRCHILD RECORDING—Added model 828 automatic spiralling attachment at \$570.00 net; model 329 vacuum chip system at \$150.00 net.
- GENERAL ELECTRIC—Added model A1-200 preamplifier control unit at \$57.95 net; model A1-300 10-watt amplifier at \$47.75 net; model A1-400 12-in. dual coaxial speaker at \$41.95 net; model A1-406 loudspeaker enclosures, blonde at \$59.95 net, mahogany at \$59.95 net, unfinished at \$50.37 net.
- KINGDOM PRODUCTS—Added model LP65 2 1/2-in. tweeter at \$8.50 user price; model LP215 9-in. loudspeaker at \$22.50 user price.
- LANSING SOUND, JAMES B.—Added model 150-4B 15-in. low-frequency horn driver unit at \$114.00 net.
- NATIONAL HOLLYWOOD—Discontinued their sapphire phono needle series.
- ORRADIO INDUSTRIES—Increased price on "Irish" tape 195RPA, plastic base, 1200 ft. on plastic or metal reel to \$3.75 net.
- PENTRON—Discontinued model PB-1 tape player.

FOR SALE: Fisher Master Audio Control, model 50-C, used less than 40 hours, \$55. Call WA 7-8669 (N. Y.) or write Box CD-4, AUDIO ENGINEERING.

SACRIFICE: Brand-new Altec 604C in beautiful Unimode bass-reflex cabinet. Consumer's net \$300, selling for \$200. Reice Hamel, 325 Midwood Street, Brooklyn 25, N. Y. PR 2-4563.

FOR SALE: (Phila. area only) Presto 15-G turntable in wooden cabinet; Proctor Soundex multispeed turntable; Proctor and Pickering arms. \$100 takes all. Call GR 3-0948.

BROWNING RJ-12C AM-FM tuner with power supply, \$103, Apt. 3M, 34-35 76th St., Jackson Heights, N. Y. UL 7-8649.

CANADIANS—Two complete systems for sale, including Concertone recorder, Weathers pickup, Rek-O-Kut turntable. Write for details. L. K. Crabtree, 765 118th St., Shawinigan South, Quebec.

WANTED: Experienced efficient, dependable radio and Hammond Organ service man, to take over our shop and operate it as own business. \$2000 capital required. Will finance a portion if necessary. Must have good references as to character, dependability, and credit. A highly profitable opportunity for the right man. Previous Hammond organ experience not required if you have a good working knowledge of electronics. **TERRY'S MUSIC STORE, Inc.,** 309 Main St., La Crosse, Wis.

BRUSH BK-401 tape recorder chassis. Tape transport, recording amplifier, and playback preamplifier only. Recently checked by Brush dealer, \$65. Arthur Bunker, 4947 Ward Parkway, Kansas City, Missouri.

CLASSIFIED

Rate: 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.

WILLIAMSON amplifiers—buy direct from factory and save 50%. Prices start at \$56. Send postcard for list. Long Island Sound Co., 19 Bennett Place, Amityville, N. Y.

AUDIOPHILES wanted for part or full time work. Technical or secretarial experience desirable. Location: north suburban Philadelphia. Send resume of education and experience to Box CD-1, AUDIO ENGINEERING.

PRESTO Y-3 recorder in new condition, used less than 15 hours, 112 and 224 lines, 1D cutter, G.E. VR playback, \$400. C. F. Craig, 3802 Grand Ave., Omaha 11, Nebr.

3-WAY Klipschorn system built by Klipschorn sales engineer. Klipsch-type components. Seller will provide A-B against commercial Klipschorn. \$345. TWining 6-0916, Forest Hills, N. Y.

FOR SALE: Presto 90B recording amplifier, guaranteed excellent condition, \$285; Gray 603 Equalizer, \$30. Louis Brown, 2217 Alexander, Waco, Texas.

FOR SALE: Lowther PW1 corner horn, \$95; Lowther-Voigt PM2 driver also available. Royal II type enclosure, with Jensen 15-in. woofer, Stephens h.f. driver, Hoodwin SHD horn, 800-cps network, complete, \$175; new Pilot PA-911 preamp, \$22. All perfect condition. FOB. Hovland, 151 Hartford Tpk., Hamden, Conn.

KITS ASSEMBLED: designate tuner, amplifier, test instrument, add 25%. Bridges Electronics, Randolph Rd., Rockville, Md.

CRAFTSMAN RC-10 Tuner, like new, \$95. E. D. Dupre, 16-A Glendale St., Worcester, Mass.

WANTED: Used FM tuner, also tape recorder. Box CD-2, AUDIO ENGINEERING.

WRITE FOR FREE TRIAL and data on our "Battleship Bull" Williamson Amplifier. Nicely Associates, Kenton, Ohio.

SELL: Altec 604C, McIntosh C104A, University 4408, make offer. C. B. Parkinson, 431 Encinitas, Monrovia, Calif.

UNIQUE BARGAIN. New, guaranteed, in manufacturers' cartons: Browning RV31, \$88; Bell 2200, with pilot light, \$89; Wharfedale Super-12, \$58; R-J floor model, 12-in. enclosure, unstained, \$36; Garrard RC-80 with base, \$38; G.E. Golden Treasure, certified flawless diamond and sapphire, \$19.50. As complete system, rock-bottom price \$315. Box CD-3, AUDIO ENGINEERING.

FOR SALE: 5-cu. ft. speaker cabinet, \$10; 3-cu. ft. speaker cabinet, \$8; Meissner 8C FM tuner, \$35; Miller 585 tubeless tuner, \$7; Jensen P&R, ST-169, \$6; Triplet 666H volt-ohmmeter with case, \$12; two Western Electric 0-200 microammeters, \$18; 75 assorted tubes, 10% off net. T. M. Olsen, 745 E. 242nd St., Bronx 70, N. Y.

TRADE your unwanted electronics equipment for finest new audio components at **AUDIO LABORATORIES**, 2111 Camden Ave., Los Angeles, Calif.

FOR SALE: Magnecorder PT6-M, PT6-J, PT6-AH, extra equalizer, extra twin-track head, 2 carrying cases, \$400. Excellent condition. Associated Recording Studios, 1625 Broadway, New York 19, N. Y. Circle 5-7351.

FOR SALE: Concertone 1401D and 1401S tape recorders, brand new, full warranty, usual net \$345, unbelievable special, \$260; Nationally advertised Williamson Amplifiers (not kits—fully assembled, tested) featuring Peerless transformers, KT-66 output tubes, usual net \$99.95, our special \$75; BOZAK 3-way system, demonstrator, including 12-in. woofer, midrange, two tweeters, dividing network, 8-cu. ft. sealed enclosure, Bozak endorsed, usually \$225, close out \$165; many other interesting buys in new and second hand equipment, generous trade-ins allowed. Write for details to: Audio Bargain Center, Box 12, Fleetwood Station, Mt. Vernon, N. Y.

VIRGIN Presto Thermostat. Box 101, St. Albans, N. Y.

Audio Engineering—1953

SUBJECT INDEX

- Allied Radio Corp., New Home for. Oct., 31.
- Amplifiers**
- Distortion in Voltage Amplifiers, W. B. Bernard. Feb., 28.
- Everyman's Amplifier, G. Leonard Werner & Henry Berlin. Oct., 40.
- Feedback from Output Transformer Primary, *AUDIOLOGY*. May, 14.
- Feedback from Output Transformer Secondary, *AUDIOLOGY*. July, 14.
- Hum Reduction in Amplifier Development, *AUDIOLOGY*. June, 14.
- Improvements on the Universal Tape Recorder Amplifier. C. G. McProud. Sept., 44.
- Moderately Priced Amplifier Introduces Loudness Control Selector, L. H. Bogen & Alfred M. Zuckerman. May, 31.
- Optimum Loading for Power Amplifiers, *AUDIOLOGY*. Aug., 12.
- Pass Band of a Transformer Coupled Amplifier, Joseph F. Sodaro. June, 24.
- Precision Phase Splitting, *AUDIOLOGY*. Nov., 12.
- R-C Coupled Amplifier Charts, *AUDIOLOGY*. Oct., 12.
- Simplified Push-Pull Theory. Julius Postal. I, May, 19; II, June, 21.
- Stability Testing of Feedback Amplifiers, *AUDIOLOGY*. Sept., 14.
- Three-Channel Tone-Control Amplifier, Joseph F. Dundovic. Apr., 28.
- White Powrtron Amplifier, Stanley White. Nov., 32.
- Zero-Impedance Output Stage, R. G. Anthes. Jan., 21.
- Amplifiers, Pre-**
- High-Fidelity Phonograph Preamplifier Design, R. H. Brown. Apr., 19.
- Amplifier Design**
- Circle Diagrams for R-C Coupled Amplifiers, Olan E. Krusc. Feb., 22.
- Feedback—Degenerative and Regenerative, Rudolph L. Kuehn. Apr. 23.
- New Approach to Negative Feedback Design, N. H. Crowhurst. May, 26.
- ASCO Unveils Flexible Sound Display Room. Feb., 36.
- Audio for Leisure Hours. July, 25.
- Audio in the Year 1693, Allen H. Fry. Mar., 25.
- Æ Goes to London and Paris. June, 38.
- Audio Fair, The**
- Audio Fair—Los Angeles. Jan. 38.
- Audio Fair and AES Convention Reach New Heights. Nov., 29.
- Audio Fair Review. Dec., 28.
- Awards**
- Audio Engineering Awards. May, 24.
- Review of the Audio Engineering Awards, June, 28.
- Book Reviews**
- Applications of the Electronic Valve, by Dammers, Haantjes, Otte, and Van Suchtelen. Feb., 14.
- Basic Electronic Test Instruments, by Turner. Oct., 16.
- Circuit Theory of Electron Devices, by Boine. Dec., 6.
- Electrical Engineering—Theory and Practice, by Erickson and Bryant. Feb., 69.
- Electrophysiological Technique, by Dickinson. June, 63.
- Fundamentals of Automatic Control Systems, by Farrington. Mar. 10.
- Fundamentals of Engineering Electronics, 2nd Ed., by Dow. Feb., 69.
- Photoelectric Tubes, by Sommer. Oct., 16.
- Radio Interference Suppression, by Stephens. Feb., 14.
- Radiotron Designers Handbook, 4th Ed., edited by Smith. Sept. 12.
- Sound Reproduction, 3rd Ed., by Briggs. June, 63.
- Thermionic Vacuum Tubes and Their Applications, by Aldous. Nov., 49.
- Broadcasting**
- Auxiliary or Emergency Broadcast Control Room, Harold Reed. Mar., 26.
- Auxiliary Mixer for TV Studios, George A. Singer. Apr., 26.
- Binaural Radio Broadcasting, Harold T. Sherman. Jan., 14.
- Complete Remote Control of an Ampex 300, Richard F. Blinzler. Oct., 23.
- Simplified Program Switching Panel, Harold Reed. Feb., 25.
- Cabinets**
- Tired Business Man's Radio Cabinet and Speaker, C. C. Fraser. Dec., 26.
- Vibration Reduction in Loudspeaker Enclosures, Gladden B. Houck. Dec., 24.
- Components**
- Audio Transformer Design, N. H. Crowhurst. Feb., 26.
- Making the Best of an Audio Transformer, N. H. Crowhurst. Jan., 40.
- Output Transformer Design Considerations, *AUDIOLOGY*. Apr., 14.
- Construction Practice**
- Bread-Pan Layout, L. B. Hedge. Aug., 24.
- Making a "Front End" Handsome, William H. Burke. Nov., 20.
- Controls, Tone**
- Flexible Tone-Control Circuit, Basil T. Barber. Sept., 29.
- Selection of Tone-Control Parameters, Edgar M. Villechur. Mar., 22.
- Three-Channel Tone-Control Amplifier, Joseph F. Dundovic. Apr., 28.
- Three-Element Bass Control, Glen Southworth. Oct., 24.
- Controls, Volume**
- Note on Volume Controls, Charles P. Boegli. Apr., 40.
- Crossover Networks**
- Basic Design of Constant Resistance Crossovers, N. H. Crowhurst. Oct. 21.
- Dictating Machine—A Specialized Recording System.** Richard M. Somers. I, Aug., 22; II, Sept., 24.
- Electronic Music**
- Organ for One-Finger Artists, Richard H. Dorf. Sept., 19.
- Equipment Reports**
- Bogen R701 AM-FM Tuner, Sept., 42.
- Collaro Changer, Apr., 42.
- Concertone 1501-S Tape Recorder, July, 30.
- Leak TL-12 Amplifier, June, 42.
- Lorenz Speakers, Sept., 64.
- Newcomb Classic 25 Amplifier, Feb., 38.
- Pilotone AA-901 Amplifier and AF-821A Tuner, Mar., 44.
- Pilotuner, AF-824. Aug., 32.
- Rauland Model 1826 with the Libretto. Oct., 35.
- Sargent-Rayment SR-68 Tuner. July, 32.
- Sonocraft FM Tuner. Jan., 56.
- TapeMaster HF-500 Recorder. Oct., 34.
- UTC W-20 "Williamson" Kit. May, 42.
- Feedback**
- Feedback and Loudspeaker Damping, John A. Mulvey. Apr., 34.
- Feedback—Degenerative and Regenerative, Rudolph L. Kuehn. Apr., 23.
- Feedback from Output Transformer Primary, *AUDIOLOGY*. May, 14.
- Feedback from Output Transformer Secondary, *AUDIOLOGY*. July, 14.
- New Approach to Negative Feedback Design, N. H. Crowhurst. May, 26.
- Stability Testing of Feedback Amplifiers, *AUDIOLOGY*. Sept. 14.
- Handbook of Sound Reproduction,** Edgar M. Villechur. Chap. 8, Jan., 30; Chap. 9, Feb., 30; Chap. 10, Pt. 1, Mar., 32; Pt. 2, Apr., 29; Chap. 11, Pt. 1, May., 34; Pt. 2, June, 30; Chap. 12. Pt. 1, July, 26; Pt. 2, Aug., 26; Pt. 3, Sept. 36; Chap. 13; Oct., 42; Chap. 14, Nov., 25; Chap. 15, Pt. 1, Dec., 34.
- Hearing Aids**
- Design Considerations, *AUDIOLOGY*. Dec., 12.
- Sonotone Transistorized Hearing Aid, Harry A. Pearson. Aug., 19.
- Hum Reduction in Amplifier Development, *AUDIOLOGY*. June, 14.
- Loudspeakers**
- 75th Anniversary of First Dynamic Speaker, Murlan S. Corrington. Feb. 12.
- Basic Design of Constant-Resistance Crossovers. N. H. Crowhurst. Oct., 21.
- Coupled Loudspeakers, Charles W. Harrison, Jr. May, 21.
- Feedback and Loudspeaker Damping, John A. Mulvey. Apr., 34.
- Great Loudspeaker Mystery, H. A. Hartley. Jan., 33.
- Horn Enclosure for Custom Installations, Arnold J. Gassan. Sept., 22.
- Make Your Own Woofer, Curtiss R. Schaffer. Nov., 19.
- Practical Aspects of the R-J Speaker Enclosure, William Joseph & Frank Robbins. Jan., 19.
- Theatre Sound in a Small Package, Thomas R. Hughes. I, Feb., 19; II, Mar., 30; III, Apr., 24.
- Vibration Reduction in Loudspeaker Enclosures, Gladden B. Houck. Dec., 24.
- Measurements**
- New Volume Visualizer, Norman Prisma. Sept., 30.
- Twin-Triple Resistance Decader and Bridge, L. B. Keim. Sept., 34.
- Wide-Range R-C Oscillator, Lewis S. Goodfriend. Feb., 21.
- Musical Instruments**
- The Piano, Albert Preisman. I, Oct., 26; II, Nov., 22.
- Organ for One-Finger Artists, Richard H. Dorf. Sept., 19.

Patents

"First Inventor" Under the 1952 Patent Law, Albert Woodruff Gray. Mar., 40.
 Patentable Features in Radio Inventions, Albert Woodruff Gray. June, 36.
 The Protection of Ideas, Albert Woodruff Gray. Jan., 36.

Phase Splitters

Precision Phase Splitting, *AUDIOLOGY*. Nov., 12.

Phonograph Equipment

Effect of Load Impedance on the Frequency Response of Magnetic Pickups, Norman C. Pickering. Mar., 19.
 Lateral Mechanical Impedance of Pickups, J. G. Woodward and J. B. Halter. I, June, 19; II, July, 23.
 New Wide-Range Phonograph Cartridge, John F. Wood, Dec., 22.

Phonograph Records, The Best British, of 1952, H. A. Hartley. Apr., 44.

Phonograph Reproduction

The Columbia "360," Peter C. Goldmark. Mar., 28.
 Columbia "XD" Speaker System, Peter C. Goldmark. Oct., 36.
 Effect of Load Impedance on the Frequency Response of Magnetic Pickups, Norman C. Pickering. Mar., 19.
 High Fidelity Phonograph Preamplifier Design, R. H. Brown. Apr., 19.

Photography

Audio Photographers Check List, Eugene F. Coriell. Mar. 14.

Power Supplies

D. C. Pack for Heaters and Bias, Allan M. Ferrer. Sept., 33.

Psychoacoustics

Binaural or Stereophonic? R. J. Tinkham. Jan., 22.

Case for Music, John H. Thomson. Sept., 32.

Great Loudspeaker Mystery, H. A. Hartley. Jan., 33.

High Fidelity—An Essay on Scale Distortion, Joe L. Dickey. Apr., 21.

Great Mystery of Dannemora Dungeon, Emory Cook. Oct., 50.

Public Address Systems

Binaural Public Address, Charles F. Adams. Feb., 24.

Canadian House of Commons Sound Installation by Tannoy. Apr., 38.

Recording, Disc

Automatic Disc Recorder, Curtiss R. Schaffer. Dec., 21.

Evolution of a Recording Characteristic, R. C. Moyer, July, 19.

Flexible Single Recording and Dubbing Channel, Hal Magargle. Jan., 28.

Recording, Magnetic

Complete Remote Control of an Ampex 300, Richard F. Blinzler. Oct., 23.

Correction of Frequency Response Variations Caused by Magnetic Head Wear, Kurt Singer & M. Rettinger. July, 29.

Flexible Single Recording and Dubbing Channel, Hal Magargle. Jan., 28.

Improvements on the Universal Tape Recorder Amplifier, C. G. McProud. Sept., 44.

Magnetic Transfer of Stainless Steel Wire, Samuel Storchheim. Dec., 19.

Multiple-Track Magnetic Heads, Kurt Singer & M. Rettinger. Aug., 34.

Top Tape Recording Performance, Harold Reed. June, 26.

Stereophonic Sound

Binaural or Stereophonic? R. J. Tinkham. Jan., 22.

Binaural Public Address, Charles F. Adams. Feb. 24.

Binaural Radio Broadcasting, Harold T. Sherman. Jan., 14.

Great Mystery of Dannemora Dungeon, Emory Cook. Oct. 50.

Two-Channel Conversion for AM-FM Receivers, C. G. McProud. Jan., 25.

System Design

It Can Be Attractive, C. G. McProud. Nov., 30.

Matched Line of Hi-Fi Sound Equipment, Harry F. Olson. Aug., 29.

Simplified Program Switching Panel, Harold Reed. Feb., 25.

Tools for Building Temples of Tone. Oct., 54.

Tone Controls

Flexible Tone-Control Circuit, Basil T. Barber. Sept., 29.

Selection of Tone-Control Parameters, Edgar M. Villchur. Mar., 22.

Three-Channel Tone-Control Amplifier, Joseph F. Dundovic. Apr., 28.

Three-Element Bass Control, Glen Southworth. Oct., 24.

Transformers

Audio Transformer Design, N. H. Crowhurst. Feb., 26.

Making the Best of an Audio Transformer, N. H. Crowhurst. Jan., 40.

Output Transformer Design Considerations, *AUDIOLOGY*. Apr., 14.

Tubes

Power Tube Figure of Merit, Warren G. Bender. Mar., 21.

Volume Controls. A Note on, Charles P. Boegli. Apr., 40.

DO YOU HAVE YOURS?



If you live in the United States, you can subscribe for life at the new rate of \$25.00. If you are already a subscriber, we will refund a pro-rated amount based on your remaining term, or you can transfer it to a friend. This offer is good only in the U. S. and applies only to subscriptions entered by sending your request and check to the address below.

RADIO MAGAZINES, INC.,

P. O. Box 629, Mineola, N. Y.

Enclosed is check money order for \$25.00 for which please enter my subscription to *AUDIO ENGINEERING* for the rest of my natural life, and send Life Subscriber card to

Name (please print)
 Address
 City Zone State

Now Ready for Immediate Delivery

The New

MT-1 PRESTO-SPLICER
 for WELDING TOGETHER
 1/4" acetate tapes without
 cement or adhesives . . .

- Diagonal cut capable of withstanding 3 pound pull
- Inaudible with playback amplifier gain at maximum



\$65 F.O.B. Factory

For Milar Tape, add \$2

Sample splice and brochure on request.

PRESTOSEAL MFG. CORP.
 3727 33rd st., Long Island City 1, N.Y.

AUTHOR INDEX

- Adams, Charles F.
Binaural Public Address. Feb., 24.
- Anthes, R. G.
Zero-Impedance Output Stage. Jan., 21.
- Ayres, W. R. (AUDIOLOGY)
Feedback from Output Transformer Primary, May, 14.
Feedback from Output Transformer Secondary, July, 14.
Hearing Aid Design Considerations. Dec., 12.
Hum Reduction in Amplifier Development. June, 14.
Optimum Loading for Power Amplifiers. Aug., 12.
Output Transformer Design Considerations. Apr., 14.
Precision Phase Splitting. Nov., 12.
R-C Coupled Amplifier Charts. Oct., 12.
Stability Testing of Feedback Amplifiers. Sept., 14.
- Barber, Basil T.
Flexible Tone-Control Circuit. Sept., 29.
- Bender, Warren G.
A Power Tube Figure of Merit. Mar., 21.
- Berlin, Henry & Werner, G. Leonard
Everyman's Amplifier. Oct., 40.
- Bernard, W. B.
Distortion in Voltage Amplifiers. Feb., 28.
- Blinzler, Richard F.
Complete Control of an Ampex 300. Oct., 23.
- Boegli, Charles P.
A Note on Volume Controls. Apr., 40.
- Bogen, L. H. & Zuckerman, Alfred M.
Moderate Priced Amplifier Introduces Loudness Control Selector, May, 31.
- Brown, R. H.
High-Fidelity Phonograph Preamplifier Design. Apr., 19.
- Burke, William H.
Making a "Front End" Handsome. Nov., 20.
- Crowhurst, N. H.
Audio Transformer Design. Feb., 26.
Basic Design of Constant Resistance Crossovers. Oct. 21.
Making the Best of an Audio Transformer. Jan., 40.
A New Approach to Negative Feedback Design. May, 26.
- Cook, Emory
The Great Mystery of Dannemora Dungeon. Oct., 50.
- Coriell, Eugene F.
Audio Photographers Check List. Mar., 14.
- Corrington, Murlan S.
75th Anniversary of First Dynamic Speaker. Feb., 12.
- Dickey, Joe L.
High Fidelity—An Essay on Scale Distortion. Apr., 21.
- Dorf, Richard F.
Organ for One-Finger Artists. Sept., 19.
- Dundovic, Joseph F.
Three-Channel Tone-Control Amplifier. Apr., 28.
- Ferres, Allan M.
D. C. Pack for Heaters and Bias. Sept., 33.
- Fraser, C. C.
Tired Business Man's Radio Cabinet and Speaker. Dec., 26.
- Fry, Allen H.
Audio in the Year 1693. Mar., 25.
- Gassan, Arnold J.
Horn Enclosure for Custom Installations. Sept., 22.
- Goldmark, Peter C.
The Columbia "360." Mar., 28.
The Columbia "XD" Speaker System. Oct., 36.
- Goodfriend, Lewis S.
A Wide-Range R-C Oscillator. Feb., 21.
- Gray, Albert Woodruff
"First Inventor" Under the 1952 Patent Law. Mar., 40.
Patentable Features in Radio Inventions. June, 36.
The Protection of Ideas. Jan., 36.
- Halter, J. B. & Woodward, J. G.
The Lateral Mechanical Impedance of Pickups. I, June, 19; II, July, 23.
- Harrison, Charles W., Jr.,
Coupled Loudspeakers. May, 21.
- Hartley, H. A.
The Best British Records of 1952. Apr., 44.
Great Loudspeaker Mystery. Jan., 33.
- Hedge, L. B.
The Bread-Pan Layout. Aug., 24.
- Houck, Gladden B.
Vibration Reduction in Loudspeaker Enclosures. Dec. 24.
- Hughes, Thomas R.
Theatre Sound in a Small Package. I, Feb., 19; II, Mar., 30; III, Apr., 24.
- Joseph, William & Robbins, Frank
Practical Aspects of the R-J Speaker Enclosure. Jan., 19.
- Keim, L. B.
Twin-Triple Resistance Decader & Bridge. Sept., 34.
- Kruse, Olan E.
Circle Diagrams for R-C Coupled Amplifiers. Feb., 22.
- Kuehn, Rudolph L.
Feedback—Degenerative and Regenerative. Apr., 23.
- Magargle, Hal
A Flexible Single Recording and Dubbing Channel. Jan., 28.
- McProud, C. G.
Improvements on the Universal Tape Recorder Amplifier. Sept., 44
It Can be Attractive. Nov., 30.
Two-Channel Conversion for AM-FM Receivers. Jan., 25.
- Moyer, R. C.
The Evolution of a Recording Characteristic. July, 19.
- Mulvey, John A.
Feedback and Loudspeaker Damping. Apr., 34.
- Olson, Harry F.
Matched Line of Hi-Fi Sound Equipment. Aug., 29.
- Pearson, Harry A.
The Sonotone Transistorized Hearing Aid. Aug., 19.
- Pickering, Norman C.
The Effect of Load Impedance on the Frequency Response of Magnetic Pickups. Mar., 19.
- Postal, Julius
Simplified Push-Pull Theory. I, May, 19; II, June, 21.
- Preisman, Albert
The Piano. I, Oct., 26; II, Nov., 22.
- Prisament, Norman
A New Volume Visualizer. Sept., 30.
- Rettinger, M. & Singer, Kurt
Correction of Frequency Response Variations Caused by Magnetic Head Wear. July, 29.
Multiple Track Magnetic Heads. Aug., 34.
- Reed, Harold
Auxiliary or Emergency Broadcast Control Room. Mar., 26.
A Simplified Program Switching Panel. Feb., 25.
Top Tape Recording Performance. June, 26.
- Robbins, Frank & Joseph, William
Practical Aspects of the R-J Speaker Enclosure. Jan., 19.
- Schafer, Curtiss R.
An Automatic Disc Recorder. Dec., 21.
Make Your Own Woofer. Nov., 19.
- Sherman, Harold T.
Binaural Radio Broadcasting. Jan., 14.
- Singer, George A.
Auxiliary Mixer for TV Studios. Apr., 26.
- Singer, Kurt & Rettinger, M.
Corrections of Frequency Response Variations Caused by Magnetic Head Wear. July, 29.
Multiple-Track Magnetic Heads. Aug., 34.
- Sodaro, Joseph F.
The Pass Band of a Transformer Coupled Amplifier. June, 24.
- Somers, Richard M.
The Dictating Machine—A Specialized Recording System. I, Aug., 22; II, Sept., 24.
- Storchheim, Samuel
Magnetic Transfer of Stainless Steel Wire. Dec., 19.
- Thomson, John H.
The Case for Music. Sept., 32.
- Tinkham, R. J.
Binaural or Stereophonic? Jan., 22.
- Villchur, Edgar M.
Handbook of Sound Reproduction. Chap. 8, Jan., 30; Chap. 9, Feb., 30; Chap. 10, Pt. 1, Mar., 32; Pt. 2, Apr., 29; Chap. 11, Pt. 1, May, 34; Pt. 2, June, 30; Chap. 12, Pt. 1, July, 26; Pt. 2, Aug., 26; Pt. 3, Sept. 36; Chap. 13, Oct. 42; Chap. 14, Nov. 25; Chap. 15, Pt. 1, Dec. 34.
Selection of Tone-Control Parameters. Mar., 22.
- Werner, G. Leonard & Berlin, Henry
Everyman's Amplifier. Oct., 40.
- White, Stanley
The White Powrtron Amplifier. Nov., 32.
- Wood, John F.
A New Wide-Range Phonograph Cartridge. Dec., 22.
- Woodward, J. G. & Halter, J. B.
The Lateral Mechanical Impedance of Pickups. I, June, 19; II, July, 23.
- Zuckerman, Alfred M. & Bogen, L. H.
Moderately Priced Amplifier Introduces Loudness Control Selector. May, 31.

WE WERE AT THE FAIR

... and what pleased us most was the number of people who were pleased with us. "You still put out the best sounding sound", they said.

The reason is quite simple. We are more interested in producing good sound than we are in putting on a good show. We have devoted all our time and effort to the task of developing a complete sound system worthy of being designated 'high fidelity'. Here are the results. We offer them with pride.

HARTLEY 215 Loudspeaker	\$65.00
HARTLEY Baffle Enclosures	45.00 to 250.00
HARTLEY Tone-Control Preamplifier	37.50
HARTLEY 20 watt Amplifier	135.00

Write for free literature.

Prices slightly higher West of the Rockies



H. A. HARTLEY CO., INC.
521 East 162nd Street, Bronx 51, N. Y.
LUdlow 5-4239

Nearly everybody reads the audio anthology

and

the 2nd audio anthology

The original **audio anthology** is still being ordered by people who have worn out their first copy or who have just learned about the book. Contains reprints of 37 articles which appeared in **AUDIO ENGINEERING** from May 1947 through December 1949. An invaluable reference work on audio in the home.

the 2nd audio anthology continues from where the first left off and contains reprints of articles from January 1950 through July 1952. In both books the articles were brought up to date, corrected where necessary, and assembled by subject. **the 2nd a a** may still be had with board cover.

----- CUT OUT — MAIL TODAY —-----

Book Division, Dept. 3V,
Radio Magazines, Inc.,
P. O. Box 629, Mineola, N. Y.

Sirs: Enclosed is check money order for \$..... Please send me
..... copies of **audio anthology** (paper cover) @ \$2.00 each
..... copies of **the 2nd audio anthology** (paper cover) @ \$2.00 each
..... copies of **the 2nd audio anthology** (board cover) @ \$3.00 each

Name (please print)

Address

City Zone State

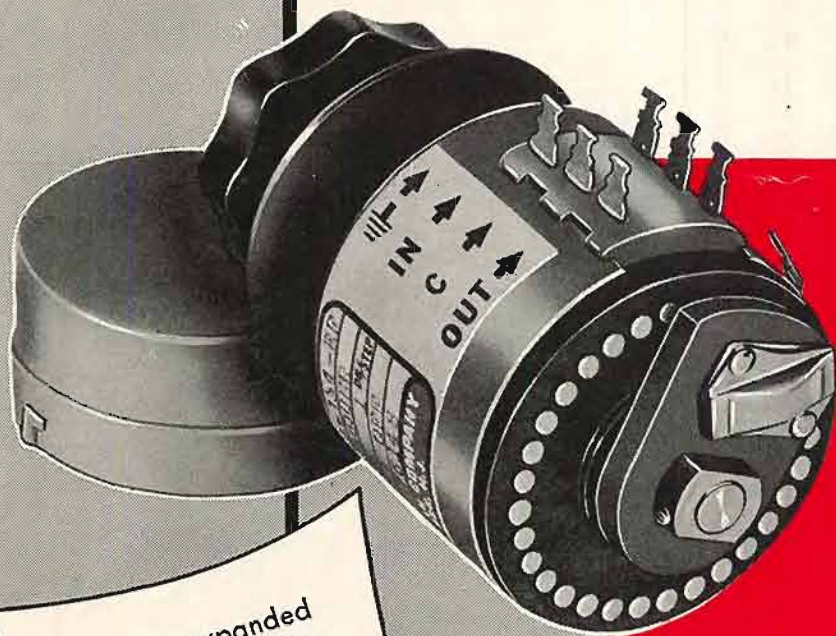
ADVERTISING INDEX

Akustische und Kino-Geräte	60
Allied Radio Corp.	45
Altec Lansing Corp.	44
Amplifier Corp. of America	68
Arnold Engineering Co.	7
Asco Sound Corp.	66
Audak Co.	43
Audio Devices, Inc.	Cover 2
Audio Exchange, Inc.	69
Beam Instruments Corp.	29, 53
Belden Manufacturing Co.	41
Bell Telephone Laboratories	18
Bogen, David, Co., Inc.	47
British Industries Corp.	3
British Radio Electronics, Ltd.	60
Brook Electronics, Inc.	67
Capitol Records, Inc.	69
Carter Motor Co.	58
Chicago Transformer Division	46
Cinema Engineering Co.	12
Classified Ads	72
Commissioned Electronics Co.	68
Crestwood Div., Daystrom Electric Corp.	14
D & R, Ltd.	54
Dubbings Co., Inc.	50
Daven Co.	Cover 3
Electronic Instruments, Co., Inc.	69
Electro-Voice, Inc.	33
Fairchild Recording Equipment Co.	59
General Electric Co.	64
Hartley, H. A., Co., Inc.	76
Harvey Radio Co., Inc.	49
Heath Co.	51, 59
Hollywood Electronics	69
Hughes Research and Development Laboratories	1
Hycor Sales Co.	54
Isotone Acoustic Spiralways, Inc.	62
Jensen Mfg. Co.	38, 39
Kierulff Sound Corp.	69
Kingdom Products, Ltd.	57
Langevin Mfg. Corp.	9
Leonard Radio, Inc.	52
Magnecord, Inc.	4
Minnesota Mining & Mfg. Co.	11
Marantz, S. B.	71
Pacific Transducer Corp.	56
Partridge Transformers, Ltd.	71
Peerless Electrical Products	2
Permoflux Corp.	61
Pickering and Co., Inc.	17
Precision Film Laboratories, Inc.	10
Presto Recording Corp.	31
Prestoseal Mfg. Corp.	74
Professional Directory	69
Rauland-Borg Corp.	60
Reeves Soundcraft Corp.	5
Rek-O-Kut Co.	35
Rockbar Corp.	15
Sigma Instruments, Inc.	6
Simpson, Mark, Mfg. Co., Inc.	69
Sonotone Corp.	13
Stromberg-Carlson	37
TAB	55
Terminal Radio Corp.	63
Triad Transformer Corp.	65
Tung-Sol Electric, Inc.	8
United Transformer Co.	Cover 4
U. S. Recording Co.	69

THESE ARE THE

REASONS

WHY **DAVEN** IS THE
LEADER IN THE
AUDIO ATTENUATOR
FIELD



Greatly expanded production facilities enable Daven to make delivery from stock on a large number of standard attenuator types.



LA-130 Series,
Ladder Network
30 Steps, 1 1/4" Diameter

- 1 "KNEE-ACTION" ROTOR . . . gives positive contact and low contact resistance under all conditions.
- 2 BRASS CASE OF 2-PIECE CONSTRUCTION . . . gives excellent shielding and allows more compact equipment design.
- 3 "LOCK-TITE" DUST COVER . . . designed to withstand severe vibration and at the same time allow easy accessibility.
- 4 ENCLOSED ROLLER-TYPE DETENT MECHANISM . . . gives positive indexing, but does not increase depth of unit.
- 5 LOW-LOSS MOLDED TERMINAL BOARD . . . has high resistance to leakage.

Write for complete catalog data.

THE **DAVEN** CO.

WORLD'S LARGEST MANUFACTURER OF ATTENUATORS

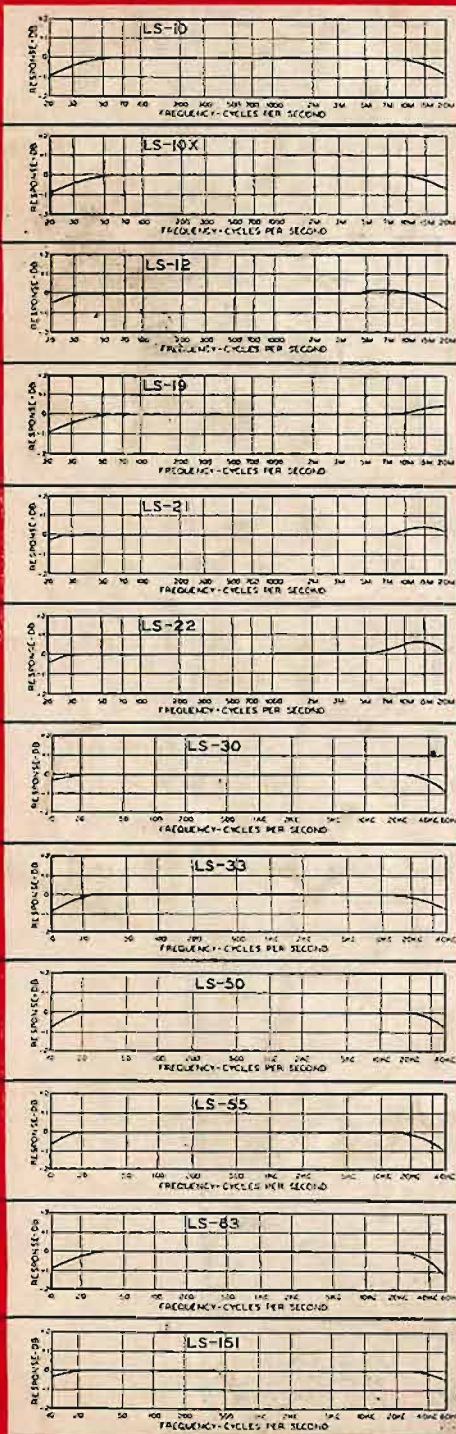
185 Central Ave., Newark 4, N. J.



FOR **Higher Fidelity***

THE Linear Standard SERIES

The ever increasing use of wide range equipment for broadcast service has reached the point where the major limiting factor is the frequency range of the transformers employed. UTC Linear Standard components represent the closest approach to the ideal transformer from the standpoint of uniform frequency response, low wave form distortion, high efficiency, thorough shielding, and dependability. Typical LS units are described below.



INPUT TRANSFORMERS

Case Size	LS-1	LS-2
Length	3 1/8"	4 7/8"
Width	2 5/8"	3 1/2"
Height	3 1/4"	4 3/8"

Type No.	Application	Primary Impedance	Secondary Impedance	± 1 db from	Max. † Level	Relative* hum	Unbal. DC in prim'y	Case No.	List Price
LS-10	Low impedance mike, pickup, or multiple line to grid	50, 125/150, 200, 250, 333, 500/600 ohms	60,000 ohms in two sections	20-20,000	+10 DB	-74 DB	.5 MA	LS-1	\$25.00
LS-10X	As above	As above	50,000 ohms	20-20,000	+10 DB	-92 DB-Q	.5 MA	LS-1	35.00
LS-12	Low impedance mike, pickup, or multiple line to push pull grids	50, 125/150, 200, 250, 333, 500/600 ohms	120,000 ohms overall, in two sections	20-20,000	+10 DB	-74 DB	.5 MA	LS-1	28.00
LS-12X	As above	As above	80,000 ohms overall, split	20-20,000	+10 DB	-92 DB-Q	.5 MA	LS-1	35.00
LS-15X	Three isolated lines or pads to one or two grids	30, 50, 200, 250 ohms each primary	60,000 ohms overall, in two sections	20-20,000	+10 DB	-92 DB-Q	.5 MA	LS-1	37.00

INTERSTAGE AND MATCHING TRANSFORMERS

Type No.	Application	Primary Impedance	Secondary Impedance	Response	Max. † Level	Relative* hum	Unbal. DC in prim'y	Case No.	List Price
LS-19	Single plate to push pull grids like 2A3, 6L6, 300A. Split secondary	15,000 ohms	95,000 ohms; 1.25:1 each side	± 1 db 20-20,000	+12 DB	-50 DB	0 MA	LS-1	\$26.00
LS-21	Single plate to push pull grids. Split pri. and sec.	15,000 ohms	135,000 ohms; 3:1 overall	± 1 db 20-20,000	+10 DB	-74 DB	0 MA	LS-1	26.00
LS-25	Push pull plates to push pull grids. Medium level. Split primary and sec.	30,000 ohms plate to plate	50,000 ohms; turn ratio 1.3:1 overall	± 1 db 20-20,000	+15 DB	-74 DB	1 MA	LS-1	32.00
LS-30	Mixing, low impedance mike, pickup, or multiple line to multiple line	50, 125/150, 200, 250, 333, 500/600 ohms	50, 125/150, 200, 250, 333, 500/600 ohms	± 1 db 20-20,000	+15 DB	-74 DB	.5 MA	LS-1	26.00
LS-33	High level line matching	1.2, 2.5, 5, 7.5, 10, 15, 20, 30, 50, 125, 200, 250, 333, 500/600	50, 125, 200, 250, 333, 500/600 ohms	± .2 db 20-20,000	15 watts			LS-2	30.00

OUTPUT TRANSFORMERS

Type No.	Application	Primary Impedance	Secondary Impedance	Response	Max. † Level	Relative* hum	Unbal. DC in prim'y	Case No.	List Price
LS-50	Single plate to multiple line	15,000 ohms	50, 125/150, 200, 250, 333, 500/600	± 1 db 20-20,000	+15 DB	-74 DB	0 MA	LS-1	\$26.00
LS-52	Push pull 245, 250, 6V6 or 245 A prime	8,000 ohms	500, 333, 250, 200, 125, 50, 30, 20, 15, 10, 7.5, 5, 2.5, 1.2	± .2 db 25-20,000	15 watts			LS-2	35.00
LS-55	Push pull 2A3's, 6AS6's, 300A's, 275A's, 6A3's, 6L6's, 6AS7G	5,000 ohms plate to plate and 3,000 ohms plate to plate	500, 333, 250, 200, 125, 50, 30, 20, 15, 10, 7.5, 5, 2.5, 1.2	± .2 db 25-20,000	20 watts			LS-2	35.00
LS-63	Push pull 6F6, class B 46's, 6AS7G, 807-TR, 1614-TR	10,000 ohms plate to plate and 6,000 ohms plate to plate	30, 20, 15, 10, 7.5, 5, 2.5, 1.2	± .2 db 25-20,000	15 watts			LS-2	25.00
LS-151	Bridging from 50 to 500 ohm line to line	16,000 ohms, bridging	50, 125/150, 200, 250, 333, 500/600	± 1 db 15-30,000	+18 DB	-74 DB	1 MA	LS-1	27.00

The values of unbalanced DC shown will effect approximately 1.5 DB loss at 30 cycles.
 * Comparison of hum balanced unit with shielding to normal uncased type. Q Multiple alloy magnetic shield.
 † 6 MW as ODB reference.

* UTC LINEAR STANDARD transformers are the ONLY audio units with a GUARANTEED uniform response... ± 1 DB from 20 to 20,000 cycles.

United Transformer Co.

150 VARICK STREET • NEW YORK 13, N. Y.

EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y. CABLES: "ARLAB"