

AUDIO


OCTOBER, 1961

50¢

...the original magazine about high fidelity!

CDC





A
CLOSE LOOK
AT RCA'S
"DARK
HEATER"

*and how
it benefits
you*

You are looking at a major advance in tube technology. The filament at the right in this special demonstration envelope is a new RCA "Dark Heater". The "Dark Heater" operates at a temperature about 350°K below that of the 1500 to 1700°K of a conventional heater (left). Yet at this much lower temperature, the "Dark Heater" can produce the same cathode temperature as the conventional heater. Reason: the superior thermal emissivity of the dark coating.

For additional information on the "Dark Heater" call your RCA Field Representative or write Commercial Engineering, Sec. J91-DE, RCA Electron Tube Division, Harrison, N. J.

EAST: 744 Broad Street, Newark 2, New Jersey, HUmboldt 5-3900 • MIDWEST: Suite 1154, Merchandise Mart Plaza, Chicago 54, Illinois, WHitehall 4-2900 • WEST: 6801 E. Washington Blvd., Los Angeles 22, Calif., RAYmond 3-8361.

The cooler operating "Dark Heater" offers many receiving tube advantages to equipment manufacturers, including:

- **Longer heater life**—because of the inherently greater tensile strength of heater wire at lower temperatures.

- **Reduced chance of heater failure**—because the smaller thermal change during heater cycling and the greatly reduced operating temperatures minimize tendency toward recrystallization and burnout.

- **Heater-current stability on life**—especially desirable in maintaining a constant cathode temperature.

- **Reduced AC heater-cathode leakage and hum**—due to elimination of "spike" or pulse leakage currents.

- **Greater safety factor in established heater-cathode voltage ratings**

- **Improved mechanical stability**—cooler operation of the "Dark Heater" minimizes changes in heater shape during life, reducing the possibility of heater damage and heater shorts.

The revolutionary "Dark Heater" is the key to improved performance and longer life for receiving tubes. Now available in an increasing number of RCA receiving tubes, the "Dark Heater" will be incorporated in those RCA receiving types where potential benefits of increased life and reliability can be realized.



The Most Trusted Name in Electronics

AUDIO

OCTOBER, 1961 Vol. 45, No. 10

Successor to **RADIO**, Est. 1917

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SHERWOOD

only for those who want the ultimate in

FM Stereo Broadcast Reception and Stereo Record Reproduction



S-8000 FM/MX 64 Watt Stereo Receiver
16 1/2" x 4" x 14" deep. \$299.50



S-3000 IV FM/MX Stereo Tuner
14" x 4" x 10 1/2" deep. \$160.00



S-5000 II 80 Watt Stereo Amplifier
14" x 4" x 12 1/2" deep. \$199.50



Ravinia Model SR3 3-way
26" x 15" x 13 1/4" deep.
Speaker System \$139.50

Correlaire Walnut Hi Fi Furniture



With FM Stereo broadcasting (multiplex) an established reality, Sherwood proudly offers every component you need for superb stereo reception. Sherwood stereo amplifiers and tuners are pre-eminent in the field, and now—in the S-8000 Receiver—the ultimate in compact reception quality is achieved. The exciting new Ravinia Model SR3 3-speaker system features extremely low intermodulation distortion and unusually flat frequency response. Cabinet is hand-rubbed walnut. The perfect setting for hi fi components is Sherwood's Correlaire contemporary furniture modules—in hand-rubbed Walnut and Pecan. Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Illinois.

For complete technical details, write Dept. 10A.



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The World of Audio
is now a step ahead
because of . . .



VS-8000
WONDER-WORKING STEREO
CARTRIDGE MOVING-COIL TYPE

Where this amazing product is used, no HEAD AMPLIFIER or IMPUT TRANSFORMER is required, for it operates with 5-millivolt output! -- an incredibly high figure? Because its output is high, and because it is of a low-impedance type and, hence, free from inductive "hum" effect, it can be adapted to even a simple turntable.

SPECIFICATIONS

OUTPUT VOLTAGE
.....5 mV, 1,000 cps, 5 cm/sec.
FREQUENCY RANGE.....10-20,000 cps.
CHANNEL BALANCE.....±0.5 db, 1,000 cps.
CHANNEL ISOLATION
.....Over 30 db, 40-12,000 cps.
COMPLIANCE..... 15×10^{-6} cm/dyne.
DC RESISTANCE.....33 ohms.
IMPEDANCE.....35 ohms, 1,000 cps.
LOAD RESISTANCE
.....100 ohms to 100 kilohms.
NEEDLE PRESSURE.....1.5-3 grams.
STYLUS.....0.7 mil, diamond



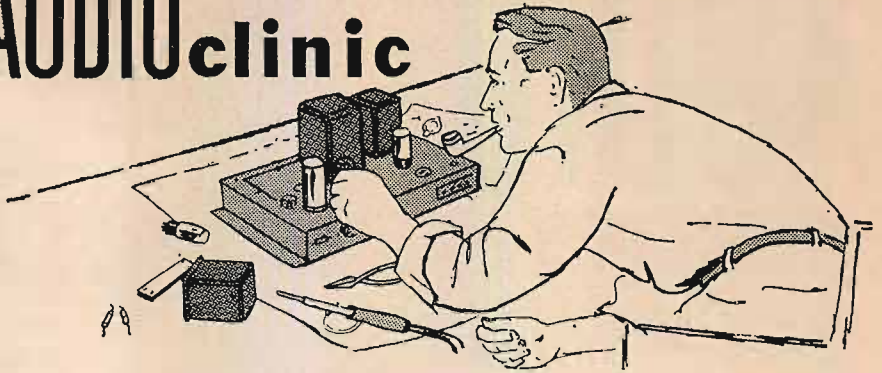
GA-15
PROFESSIONAL STEREO TONE
ARM PERFECT-BALANCE TYPE

The GA-15 tone arm provides a means of directly reading the needle pressure for all cartridges in the weight range of 1-20 grams. Perfect balance, too, can be maintained with this high-performance tone arm having a 4-terminal plug-in arm head. Any type of cartridges can be mounted on this tone arm. Constructed with greater emphasis on its performance than on its visual features, this tone arm is free from arm resonance, that is, resonant vibration.

NEAT

4, 1-chome, Kanda, Hatago-cho.
Chiyoda-ku, Tokyo, Japan
NEAT ONKYO DENKI CO., LTD.

AUDIOclinic



JOSEPH GIOVANELLI*

Amplifiers and High-Frequency Loss

Q. My two tweeters each have an impedance of 8 ohms and, I assume, when connected in parallel the over-all impedance is 4 ohms. Here is the problem. There are losses in the highs when the 4-ohm transformer tap is used to feed signal to the tweeters. If they are connected to the 16-ohm tap, however, there is no apparent fall-off. The amplifier is a 5-watt, home-built unit used only to operate the tweeters. "A reader from San Francisco."

A. When you have your 4-ohm speaker combination connected to the 16-ohm tap of the output transformer you are shorting out some of the feedback. (You are correct in assuming that the effective impedance of two tweeters connected in parallel is, in your case, equal to 4 ohms.) If the feedback loop is frequency sensitive, this is the same as saying that you have made the amplifier flatter by removing some of the feedback. When the speaker is connected to its proper tap, the feedback is restored to its proper level—and so is its effect as a treble-cut circuit.

Have you tried connecting a 4-ohm resistor to the 4-ohm tap and measuring the frequency response of the system under those conditions? You may find that the high-frequency response is attenuated.

The cure for this situation would seem to be to reduce the size of the capacitor placed across the feedback resistor. It is possible that you can completely remove this capacitor if the circuit is stable.

Use of Connectors

Q. I have been troubled with poor phono pin-plug connections in my high-fidelity system because of oxidation and looseness. In building equipment, I would like to find a substitute for these connections to alleviate this condition. R. H. Knoebel, Brookline, Mass.

A. The problem of oxidation on connectors is present regardless of the type of connectors used. I recommend that no matter what kind of connectors are to be used in your equipment that you use some contact cleaner on them before using them for the first time and every couple of months thereafter, especially when such connections are to be removed often. You need not be as concerned with connections which are not removed once the installation has been

made. When dealing with the standard RETMA connectors, it is a good plan to make sure that the outer shell makes a tight fit around the ground terminal. If it does not, oxidation becomes more of a bother. You can make a snug fit merely by squeezing them slightly with a pair of long-nose pliers. The same procedure may be followed for the center pin. I have found, however, that the center pin is subject to less of this difficulty than the outer shell.

You may prefer not to use substitute connectors because they will not match standard RETMA connectors. If you buy a new piece of equipment, it will not be equipped with this substitute plug. You will, therefore, have to refit the new equipment with the substitute connector; perhaps you will have to make up cables with the standard RETMA connectors at one end and the proper alternative connector at the other.

Increasing Headphone Level

Q. I have a pair of crystal headphones which I would like to use with my tape recorder. Can you suggest a voltage amplifier circuit which will increase the volume when using the phones with the recorder. Name withheld, Brooklyn, New York.

A. First of all, I wonder if you really need to build a preamplifier for the output of your recorder. Why not connect the phones to the output of the preamplifier of your music system? Naturally, the output of the recorder would be connected to the appropriate input of the preamplifier. This arrangement will in most cases give you all the gain you require, and then some.

If, however, this is impractical, build up a voltage amplifier for each headphone, using a 12AU7. This will provide you with more than enough gain. I presume that you will power this little unit directly from the power supply of the recorder. Do not connect the 12AU7 to the d.c. filament supply—if such a supply is employed in the particular machine you are using. Utilize instead the a.c. heater source used for the bias tube.

I assume this is a stereo recorder. The circuit for only one channel will be described. Both channels are identical in all respects. The other half of the 12AU7 tube will be used as the amplifier for the other channel.

Circuit: The grid of one half of the 12AU7 is connected to one end of a 0.5

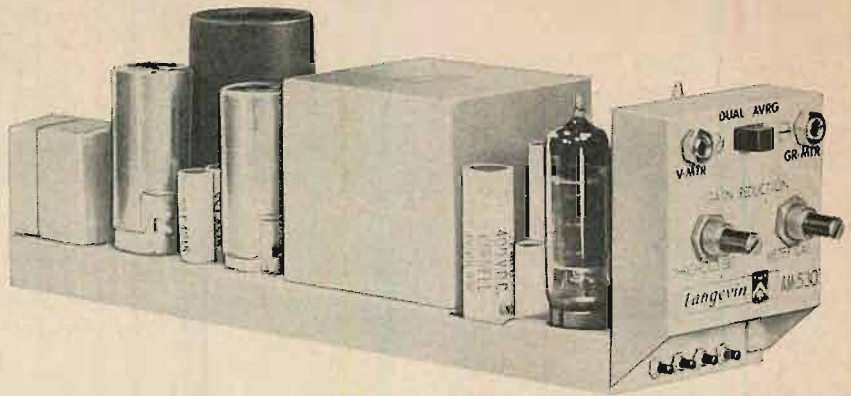
* 3420 Newkirk Ave., Brooklyn 3, N.Y.

(Continued on page 6)

Langevin

MODEL AM-5301 LEVELINE AMPLIFIER

+ 37 dbm OUTPUT (6 WATTS)



INTRODUCTION

This new limiter amplifier is a miniature plug-in unit which acts as an automatic averaging or as a peak level amplifier in TV-Broadcast, Microwave, Recording and Industrial Sound applications. It operates with a push-pull variable gain input stage driving a 2 stage push-pull program amplifier. Silicon rectifiers provide bias to regulate gain of the input stage.

Maximum program variations up to 30 db can be controlled, thus relieving studio personnel of many exacting level adjustments. In recording, this unit allows higher signal-to-noise ratios by loading the tape or disc; thus, the engineer is not required to anticipate overloads. This anticipation results in lower signal to noise and lower maximum levels than those otherwise possible.

APPLICATIONS

EXPANDER-COMPRESSOR — With an average program material level sufficient to produce 15 db of gain reduction, the output signal will be compressed for incoming signals exceeding 15 db, and expanded for incoming signals below 15 db.

AUTOMATIC MASTER GAIN CONTROL — Simply replace the program amplifier by plugging in the Leveline Amplifier; the AM-5301 Leveline Unit replaces directly a program amplifier and can be used as a monitor amplifier of 6 watts.

AUTOMATIC LEVEL CONTROL FOR A REMOTE LINE — The Leveline units permit unattended operation of the remote line.

AUTOMATIC CONTROL OF LEVEL DIFFERENCES BETWEEN 2 OR MORE PROGRAM SOURCES — Controls differences between turntables, projectors, network program and microphone preamplifier sources.

USE AS A "DUCKER" — A program can be automatically lowered the recommended 8 db (one-half loudness) to allow an announcer to override without apparent program interruption.

USE AS A NORMAL PROGRAM AMPLIFIER — Turning off the integral chassis bias limiting control allows operation as a conventional program amplifier.

ELECTRICAL CHARACTERISTICS

Gain: 53 db with 600 ohm input source; Input Source: 125 to 600 ohms balanced or unbalanced; Output Impedance: 150 - 600 ohms; Output Power: +37 dbm when strapped for monitor, +26 dbm strapped for Leveline operation; Output Noise: Unweighted, equivalent to an input signal of -110 dbm or less over the band 20 - 20,000 cps; Frequency Response: ± 5 db 20 - 20,000 cps; Distortion: Less than 1% at +36 dbm operating levels including compression. Less than .5% at +26 dbm; Compression Ratio: Adjustable from 1.6:1 to 5:1 over a 30 db range at input with 4:1 being optimum; Attack Time: 11 milliseconds, adjustable to 100 microseconds; Release Time: For 63% recovery, .5 seconds in "dual" position; 3 seconds in "average" position; Tube Complement: 1 - 12AY7-select (Langevin Model TUS-12AY7), 1 - 6ES8 Variable Gain Input Amplifier (Langevin Model TUS-6ES8), 2 - 6005-5 Star Output Amplifiers (Langevin Model TUS-6005); Bias Rectifier: 2 - Silicon Bias Rectifiers; Power Requirements: 6.3 Volts ac or dc at 1.5 amperes; 300 vdc at 90 ma strapped for monitor; 50 ma strapped for Leveline operation.

MECHANICAL SPECIFICATIONS

Mounting Tray: Langevin Model TRY-5017; Finish: Light gray baked enamel over 18 gauge bonderized (rustproofed) steel; Weight: 4 lbs. net, shipping 5 lbs.; Size: Length 10 1/4 in., width 2 3/8 in., height 3 in.

RECOMMENDED ACCESSORIES

Model MTR-507 Bias Voltmeter
Model TRY-5017 Mounting Tray
Model VR-112 100K Extension Bias Control
Model TK-5301 Tube Kit

ORDERING INFORMATION

MODEL AM-5301 LEVELINE AMPLIFIER, Complete with tubes, weight 4 lbs. net, shpg. 5 lbs. Price, Net, \$158.80.

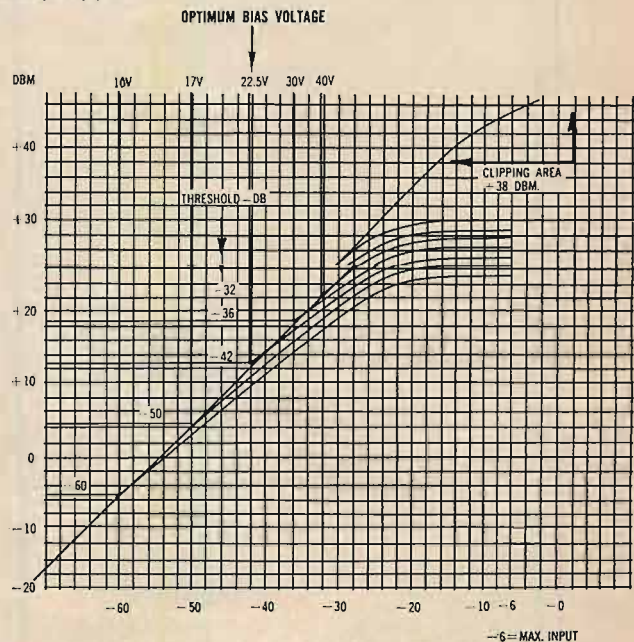
MODEL AM-5301 LEVELINE AMPLIFIER LESS TUBES, same as above but less tubes. Price, Net, \$145.00.

MODEL TK-5301 TUBE KIT for above, consisting of 1 each (Langevin Model TUS-6ES8) 2 each 6005 5 star (Langevin Model TUS-6005) and 1 each 12AY7, select, (Langevin Model TUS-12AY7). Weight, net 1/4 lb. shipping 1/2 lb. Price, Net, \$13.80

MODEL MTR-507 BIAS VOLTMETER, special scale marked for optimum operating point of AM-5301 Leveline Amplifier. Panel size is 1-13/16 in. round opening for rear panel mount, 1 7/8 in. square overall, depth is 1 1/4 in.; reading is 0-70 vdc, weight 3 oz. net, shipping 10 ozs. Price, Net, \$15.00

MODEL VR-112 100K continuously variable moulded composition resistor for panel mount bias limiting control of AM-5301, includes knob but no dial, weight 4 oz. net, shipping 1/2 lb. Price, Net, \$5.00.

MODEL TRY-5017 MOUNTING TRAY for above, with plug socket complete. Price, Net, \$8.25.



"Over thirty-five years of audio progress"

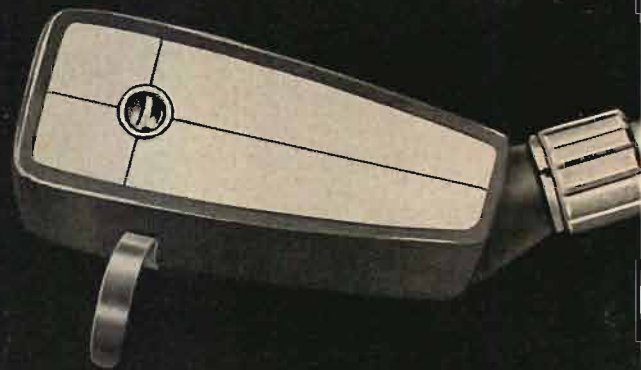


A Division of Sonotec Incorporated

503 SOUTH GRAND AVENUE • SANTA ANA, CALIFORNIA

*You are looking at the brilliantly engineered tone arm
(dynamically balanced and counter weighted)
on Garrard's new automatic turntable*

AT6



This is an automatic turntable in every respect, with the professional features and performance expected by knowledgeable, critical listeners. Yet it provides these advantages in such compact size and with such modest cost that it will suit virtually any music system. It comes to you from the same Garrard Laboratories that developed and are now supplying Type "A", most desired of all record players. All the skill and consciousness of quality that go into the Type "A" will also be found in the new AT6.

The more experienced and discerning you are in high fidelity, the more you will find to appreciate in this superlatively engineered, handsomely designed, newest automatic turntable.



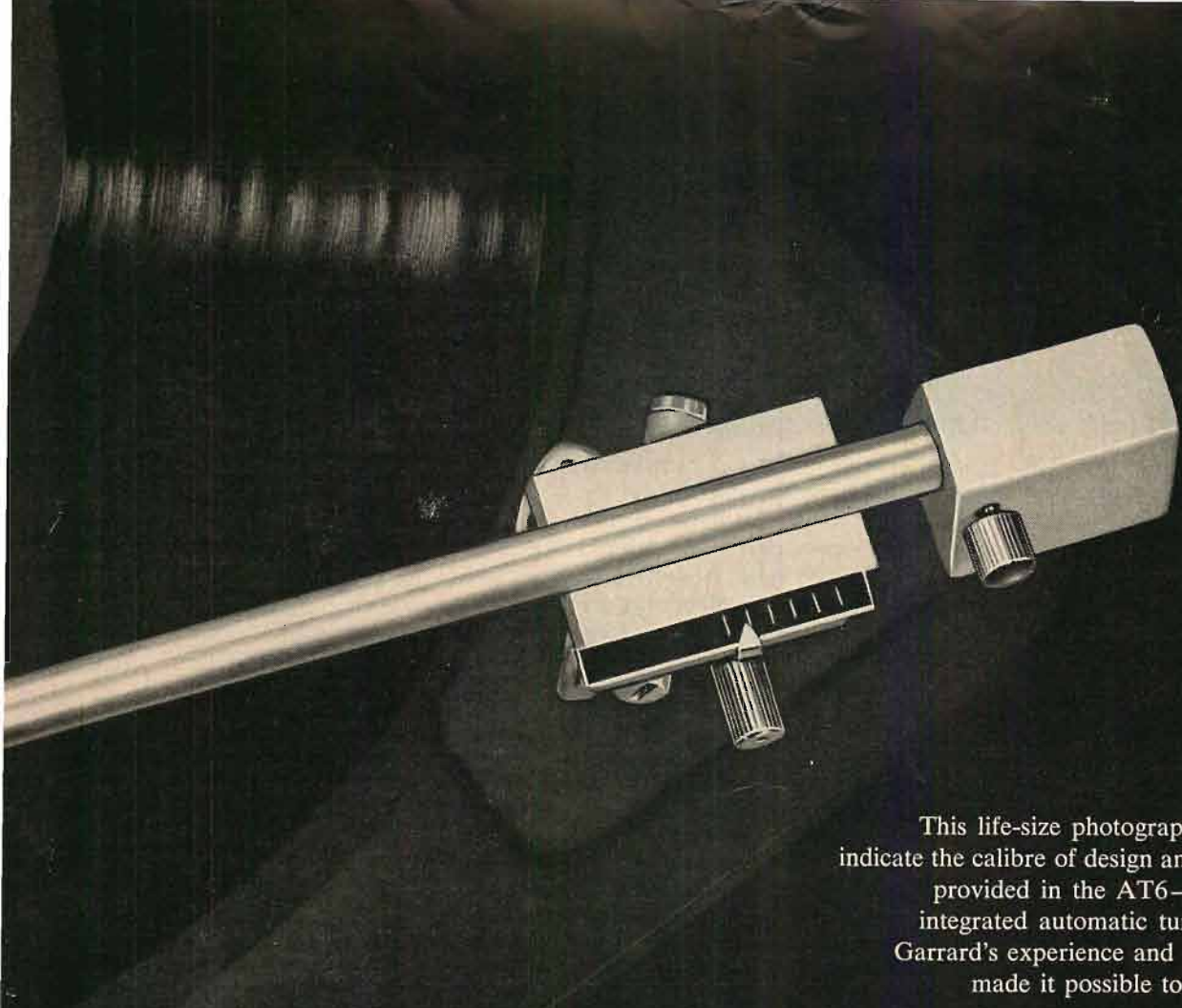
1 The cast aluminum tubular arm of the AT6 is dynamically-balanced, a precision-built to the standards of the finest separately sold tone arms, but comes integrated into the player to insure a perfect installation. This arm is balanced and tracking force adjusted in two easy steps: First...it is set at zero tracking pressure, by moving the counter weight until the arm is level, in perfect equal balance.



2 Then you fix the tracking force desired, on the built-in stylus pressure scale conveniently mounted in upright position at the side of the arm. Setting made with this scale will be more precise than by any separate stylus pressure gauge, and its convenient location insures accurate reading.



3 Once balanced and set, the AT6 arm will track correctly at the light pressure recommended for any cartridge by its manufacturer. This includes those pickups labelled as "professional". It will travel each side of the stereo grooves perfectly, even if the player



This life-size photograph attempts to indicate the calibre of design and engineering provided in the AT6—a completely integrated automatic turntable which Garrard's experience and facilities have made it possible to price at only

\$54.50

intentionally tilted or the record warped or not perfectly concentric.

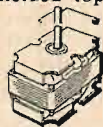


4 You have full choice of the cartridges you prefer for stereo listening since the AT6 shell will accommodate any of them. One example of the detailed care taken by Garrard to insure perfect reproduction... is the bayonet fitting for the shell, which is instantly removable, but rigidly held while playing to avoid any semblance of resonance. And, to facilitate the most professional electrical installation of the cartridge, the shell comes wired with a four-pin fully isolated system, using a fifth separate grounding lead.

5 But tone arm and tracking are only half the story of perfect stereo reproduction. The other half depends upon the turntable-motor combination and how it operates. AT6's turntable is oversized, accurately balanced, and weighted. Torque is high, yet there is no noise, no wow, no waver, not even the most minute interference, by the action of this turntable, with the sound of your records.



6 Responsible for the uncanny silence and perfect speed of the AT6 (regardless of load or voltage changes) is a special motor—a heavy duty version of the four pole shaded type as developed by the Garrard Laboratories. Engineered specifically to match the AT6 turntable and drive linkage, this motor is shielded top and bottom by specially designed plates which eliminate any vestige of magnetic hum.



7 AT6 operates with a center-drop turntable spindle, which is removable. Actually, two spindles are provided: one for automatic play, the other a short spindle for convenience when playing single records. These spindles (and the adapters which are available for 45 rpm large center hole records) are interchangeable.



8 In addition to its professional features, the AT6 rewards you with the luxurious convenience of automatic play when desired. The controls for each type of operation are grouped near each other, but they are separate, instantaneous, and foolproof. You will not find a record



player easier to use, whether as single play turntable, or as automatic intermix changer. Every attention has been paid to convenience, flexibility, and appearance. A few examples: the compact size of the AT6 which makes it fit every installation; the rich fawn/white color scheme which will enhance your entire music system; a snap-in tone arm safety catch to prevent accidents; and even a new transit thumb screw built into the unit plate ready to lock the AT6 in position for safe portability at any time.

The compact AT6 automatic turntable at \$54.50 now joins the Type "A" at \$79.50 as Garrard's dual answers to the stringent record playing requirements of today's music systems. Regardless of price, we predict that you will find in these Garrard automatic turntables, the realization of everything you have wanted in a record player. Let your own eyes and your own searching examination prove this to you. Both models, the other Garrard players, and accessories, are now at your dealers.

Garrard
world's finest

For literature write Dept. GR-11 Garrard Sales Corp., Port Washington, New York.

NO BETTER SOURCE FOR SPECIALIZED
TRANSFORMERS THAN THE EXPERTS AT



PEERLESS

Since 1935, Peerless has been the pioneer—designing and manufacturing transformers of the highest reliability to most-exacting specifications of the electrical and electronics industries. A policy of creative engineering, precision construction and rigid quality control has given Peerless acknowledged leadership—particularly in the design of specialized units. Pioneering in miniaturization, Peerless has also established the industry standards for reliability in sealing and ruggedness of packaging. Products range from units 1/10 cubic inch to more than 20 cubic feet, from fractional voltages to 30,000; from less than 1 cycle to almost a half megacycle; in 1, 2 and 3-phase or phase-changing configurations. Constructions cover the range from open-frame to potted, hermetically-sealed and vacuum-impregnated units. Whatever your transformer needs, Peerless can design to your specification and deliver in quantity. In addition to the units shown here, Peerless has solved these special problems:

- **Miniature Inductance Unit**, 4.85 henrys ($\pm 7\%$) at 150 ma, DC
- **Miniature 400-cycle Filament Power Transformer** for airborne operation
- **Miniature Power Transformer**, 3-phase, 400 cps to 1, 2 and 3-phase
- **Miniature Audio Input Transformer**, low-level input
- **Miniature Hermetically-Sealed Output Transformer**, 400 cps, high level

20-20 PLUS ISOLATION TRANSFORMER (REPEATING COIL) E-204-D

Attenuates longitudinal currents 80 db in balanced circuit in frequency range up to 20,000 cps. Insertion loss 0.4 db. Frequency response: ± 1 db, 5 — 80,000 cps. Electrostatic shield. Astatic balance and electromagnetic shield provide approximately 50 db magnetic shielding.



20-20 PLUS SHIELDED INPUT TRANSFORMER K-241-D

Small size for such superb performance. Frequency response, 1 db: 10 to 25,000 cps. Primary balanced to attenuate longitudinal currents in excess of 50 db. Secondary may be used single-ended or in push-pull. Electrostatic shield between primary and secondary has 90 db electromagnetic shielding. Maximum operating level, +8 dbm.

Whatever your transformer needs, Peerless engineers can design to any military or commercial specification and manufacture in any quantity. See REM for complete catalogue of standard units or write for information to Dept. A-12-PE



PEERLESS



ELECTRICAL PRODUCTS

A DIVISION OF ALTEC LANSING CORPORATION

6920 McKinley Avenue, Los Angeles 1, California

AUDIOCLINIC

(from page 2)

megohm resistor (all resistors are $\frac{1}{2}$ watt). The other end of this resistor is grounded. The "hot" signal lead from the normal output of the recorder is connected to the grid along with this resistor. The "cold" side of the output of the recorder is grounded. The cathode is returned to ground through a 3300-ohm resistor. This resistor is shunted by a 50 μ f electrolytic capacitor, 50v d.c. The plus terminal of this capacitor is connected to the cathode. The plate for this particular half of the 12AU7 is connected to one end of a 50,000-ohm resistor, the other side of which is connected to one end of a 33,000-ohm resistor. The far end of the 33,000-ohm resistor is connected to the main B-plus of the recorder's power supply. The junction of the 50,000-ohm and the 33,000-ohm resistors is connected to the plus side of a 8 μ f electrolytic capacitor, 450v d.c. The ground side is connected to the chassis and ground. The plate also goes to one end of a 0.22 μ f capacitor, 60v d.c. The other end of this capacitor goes to the "hot" output terminal. The other output terminal is grounded.

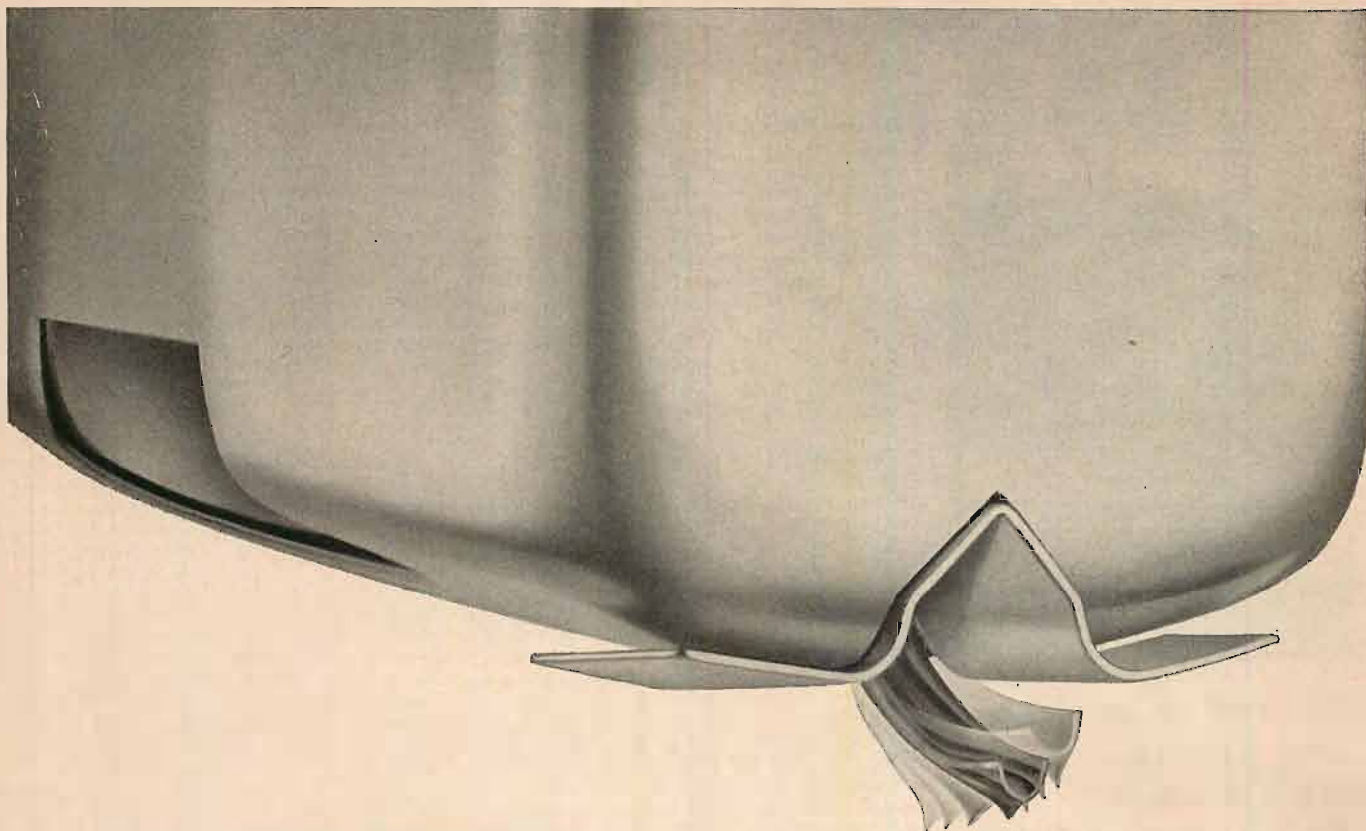
Do not use the output terminal provided by this stage to feed a preamplifier located some distance from the recorder because the high frequencies will be attenuated by the capacitance of the shielded, interconnecting cable. Arrange your jacks so that you can still use the normal output of the recorder to drive the preamplifier or other device if desired.

Storing Recorded Tape

Q. Although I do not own a tape recorder, I have been thinking about the best way to store tapes, so that they would retain a low background-noise level and not be subjected to erasure from magnetic fields in the vicinity. Fred Butterfield, Brooklawn, New Jersey.

A. According to my own experience, the normally encountered magnetic fields do not appear to add to print-through so much as do temperature and humidity. Frankly, I store all my tapes—even masters—on open shelves. My oldest master is about ten years old. I simply cannot detect print-through on it on a scale greater than I noticed when the tape was a few weeks old. If I wanted to be on the safe side, I would store them in an air-conditioned room with the temperature between 60 and 70 deg. Fahrenheit. I would adjust for fairly low humidity. I would want the humidity high enough so that the plasticizer in the tape would not evaporate. Were this to take place, the tape would become brittle and subject to breakage. In addition to this I would wind the tapes "tails up," and would store them in film cans sealed with tape so as to make the cans more or less air tight. (The reason for storing tape "tails up" is that this position will be the one which is normal after playback, and hence the tape will be wound very smoothly. This, in turn, will prevent any possible damage to the edges of the tape. Of course, when playing half-track monophonic tapes and/or quarter-track mono-

(Continued on page 76)



UP, DOWN, SIDEWAYS . . . the important difference in an Audio Dynamics' cartridge can be felt with your fingertips

Put your finger to the stylus tip of an Audio Dynamics' Stereo Cartridge. Move that tip around . . . What you feel is compliance. In Audio Dynamics' ADC-1, it is 20×10^{-6} cms/dyne minimum. This compliance, along with a tracking force of less than one gram and an effective stylus mass that measures less than .5 milligrams, represents a design breakthrough by Audio Dynamics' engineers. Result? Now, for the first time, by using any model ADC cartridge, the following *five essentials of true stereo reproduction* are yours:

Essential #1—Highs Free from Peaks & Distortion

Quality stereo cartridges are designed to suppress undesirable peaks and distortions in the high frequency range. These occur when the stylus mass resonates with the vinyl disc. To suppress resonance, since mass cannot be readily reduced, most cartridges are heavily damped.

Damping, however, stiffens the compliance. This creates problems: (1) High tracking forces are required to prevent mistracking and breakup. (2) The suspension becomes non-linear, resulting in distortion.

In one remarkable stroke, Audio Dynamics' engineers lowered the effective stylus mass to just one-half milligram, eliminating forever the previous plaguing need for heavy damping. This spectacular development makes it possible for the stylus tip to resonate with the vinyl disc at a frequency so high, your ear never hears it. Response is smooth . . . the sound clean and "transparent."

Essential #2—Clean & Well-Rounded Bass Tones

With stylus mass lowered and heavy damping eliminated, high compliance and linear suspension are achieved. This results in tone arm resonance so low it is of no consequence. Only the undistorted recorded bass tones come through.

Essential #3—Record Compatibility

When a stylus is stiffened by damping, a heavy tracking force is required to prevent mistracking and breakup. This

causes distortion and record wear. But high compliance and low stylus mass permit Audio Dynamics' cartridges to track at an extremely low force. Tested by Hirsch-Houck Laboratories the ADC-1 registered a tracking force of $\frac{1}{4}$ of a gram. You can forget about distortion and record wear!

Essential #4—Proper Channel Separation

With resonance removed from the audible range, nothing prevents the stylus from following the groove wall's direction of motion. Audio Dynamics' cartridges attain 30 decibels of separation in the critical 50-7000 cps range. Wandering of sound from speaker to speaker is eliminated.

Essential #5—Reduced Surface Noise

Lack of resonances results in greatly reduced surface noise. Lack of resonances results in greatly reduced surface noise.

The diamond stylus of an ADC cartridge also contributes to this virtue. It has been selected from perfect crystals, super polished and the sides oriented so only the hardest surfaces touch the grooves.

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Experience for yourself the performance advantages provided by Audio Dynamics ADC-1 and ADC-2 stereo cartridges! Hear them at your *dealer* today.

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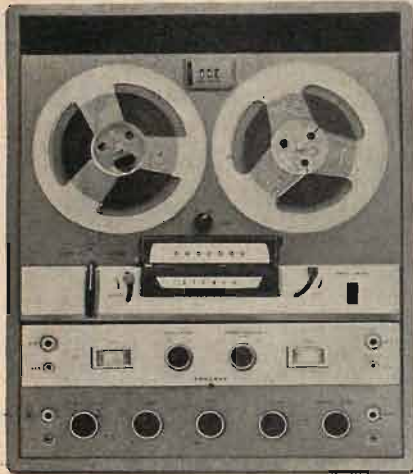
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Price including custom carrying case \$249.50.

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CIRCLE 8A

LETTERS

Missing Data

SIR:
The accompanying diagram is "The Bauer Circuit for Headphone Stereo" as shown in AUDIO, ETC for September. As I am sure you are aware by now, the resistors and capacitor values directly in series with the phones were not indicated. Could you please help me out with these values?
FRED H. STEELE,
611 Flemington Road, S.E.
Huntsville, Ala.

(We did, by mail. And below is a corrected diagram with the required values. Ed.)

Equalization

SIR:
Your editorial on equalization in the April, 1961, issue naturally interested me. As a blind man who is wholly dependent on hearing, caring almost nothing about curve shapes of so many db at so and so cps (although some exact standards are helpful), I am for making our equipment with less gadgets.

Like you, most of my listening is done at what is supposed to be FLAT (12:00 o'clock) on my amplifier dials. When, say, an AM program is lacking in highs I move my treble dial to 4:00 p.m. for more highs.

When I go to a restaurant I add a little salt where salt is lacking, put pepper to introduce hotness into my food; but there is nothing I can do where an overabundance of the two elements has been put in by the cook except to drink some ice water!

As you have said time and time again, I, too, am for flexibility in our music systems so as to allow the fussy audiophile to

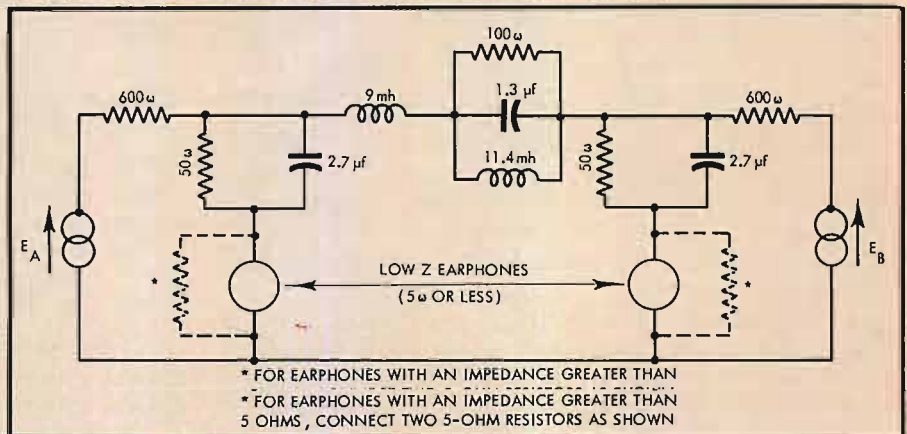
do as he pleases; but at the same time have the equipment so simple, like a fixed-focus camera, that the wife and the music-loving youngster can use it.

The RIAA curve is so far the accepted standard curve of the disc industry. How about having a good standard for all tape machines and tapes? Right now we have at least three different curves. Shall we have a tape compensator like the preamp with 961 possible curves which was on the market some time ago?

FREDERICK T. HAYASHI,
235 Kuahiwai Avenue,
Wahiawa, Hawaii

(Most U.S. and Japanese machines are now standardized to what is known as the NAB curve, and some of the European ones are. There is a philosophy common in Europe which holds that less distortion is obtained in a system if the high-frequency end is not pre-equalized so much in the recording as it is with the NAB standard. We could hardly agree with this philosophy more, BUT it is not the commonly used U.S. curve, and if the instruments are to be used for playing our present "standard" tapes, or if tapes made on these machines are to be played on U.S. machines, the results are not always optimum.

While it is true that the high-frequency distortion may be greater with our present "standard," such distortion is likely to be outside the audible spectrum. It is true, however, that the signal-to-noise ratio is greater with the high-frequency range being equalized in the recording and played back flat, which is the way it is done on U.S. machines. Ed.)



COMPLETE diagram for Bauer headphone stereo.



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CIRCLE 8B

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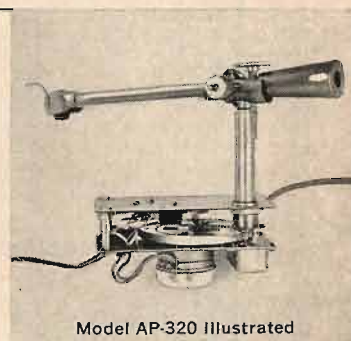
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Auto-Poise only

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Model AP-320 Illustrated

*Pat. Pending

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Export: Morhan Exporting Corporation, 458 Broadway, New York 13

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Light Listening



CHESTER SANTON*

The symbol  indicates the United Stereo Tapes 4-track 7 1/2 ips tape number.

Felix Slatkin: Charge!

Capitol  ZT 1270

It's been some time since I've heard a Capitol four-track reel deliberately aimed at the thrill-seeker. The release of this military-music "spectacular" was more than enough encouragement to renew acquaintance. One feature of this reel is quite apparent at the very outset. Capitol was determined to avoid any possibility of tape hiss in the course of this release. The recording level is just about as high as it can be pegged without running into problems of overload. In the studio itself, there was a hefty amount of dynamite rattling around; sixteen trumpets, all kinds of military drums, six fifes and a half dozen bagpipes. The trumpets furnish the major clue to presence of a high signal on the reel and the fact that these instruments do not get completely out of hand can probably be traced to the fact that Capitol has been doing its own processing of the four-track reels released under that label.

These comments on signal strength do not alter the fact that tape, even with the reduced width of the four-track format, succeeds where the stereo disc begins to falter in heavy going of this sort. Take the lineup of ten assorted drums and a tympani strung out across the stage behind the other instruments. On tape, there is no question about the breadth of their location, the solidity of their ranks and the nature of their mission. Against this backdrop of varied thunder, the intent of the album is established with the boom of cannon as six trumpets sound the charge call on the right and are answered by six trumpets on the left. Percussion alone has its moments in the piece called *Drummer Rave*, with mechanical pad, cymbals holding *Boys* with glockenspiel and cymbals holding the center of the line. *Bugler's Dream* is a fantasy of classical and modern bugle calls that stresses an atmosphere of depth. The fifes have a very good opportunity to shine in their medley of historical airs that takes them past the mikes in marching formation. What they lack in impact, compared with the bagpipes that follow, they more than make up in the jauntiness of their attack. A special arrangement of *When Johnny Comes Marching Home* brings the enterprise to a close with a healthy and widely-spaced flourish.

Mark Laub: Twin Melodies—Solo Organ
Columbia CS 8451

Bona fide theatre organs, working in their normal domain, have been the source of considerable happiness to the audiophile with a good stereo setup. It has not escaped the attention of this column that Columbia has done more than its share in filling the demand for sound of this type. Radio City Music Hall in New York and the Fox Theatre in Detroit have been the scene of benevolent invasions by its recording crews. During this activity in theatres, nothing out of the

* 12 Forest Ave., Hastings-on-Hudson, N.Y.

ordinary was being done in stereo with the electronic organs designed for single-room occupancy. Now the makers of the Lowery Organ, egged on perhaps by the organ fans in Columbia's recording staff, have come forth with an instrument that gives the soloist considerably more control over the direction and placement of sound for two-channel recording. Early in 1960, several stereo recordings of a Lowery organ were issued on the RCA Victor label. In these, Marjorie Meinert played their "Lincolnwood" model, making full use of the percussion and orchestral effects built into that unit. The Victor discs offered a suggestion of deliberate use of counter melody for stereo placement. The guitar and drums used to accompany Miss Meinert tended to mask the organ themes placed in one of the channels. Now, in this Columbia recording, mlked at even closer range, the organ is presented without accompaniment and with full exploitation of the possibilities it offers for stereo treatment. In fact, the manufacturer of the instrument, in a moment of unguarded enthusiasm, has labeled it the Lowery Stereo Organ.

Mark Laub, once a pianist and arranger for dance bands, doesn't hesitate to use every trick of the trade to encourage a dialogue between the sections of the organ. The twelve songs were chosen for simplicity in the basic tune and obvious flexibility in the counter theme. Colorful registrations round out an excellent demonstration of what the organ designer had in mind when he turned his attention to stereo.

X-15, Rockets, Missiles and Jets

Reprise R 6003

Fascination with the sound of aircraft and missiles is not limited to the record industry. Much of the material on this record was collected for a library of "trade" sounds that is maintained by the Los Angeles Division of North American Aviation. The enterprise of the Reprise label in uncovering this cache of flight's sonic by-products will be appreciated by anyone interested in the invasion of space. A brief resume of the sounds of conventional aviation precedes the present era of space flight. The roar of World War II bombers such as the B-25 Mitchell and the faster F-86 Sabrejet of the Korean War merely serve as appetizers for the more bizarre sounds that follow. We are introduced in rapid order to the whine of test chambers that duplicate air pressures three times the speed of sound. Then test sleds are recorded at both the start and the mid point of their run, passing the mikes at a speed of 1800 miles per hour. These tests lead to one of the major attractions on the disc—a sequence of sounds recorded inside the nose cone of an Atlas Intercontinental Missile. The blast of the launch is picked up within the missile. The ambient buzz that begins once the flight is underway is low enough in intensity to enable us to hear the separation of the first stage at burn-out. Then follow the intermittent bursts of the guidance rockets, the separation of the second stage and, finally, that of the nose cone. Hearing this sequence on a regular commercial recording underlines how commonplace some elements of space travel have already become. Another group of sounds, these recorded on the ground, spell out with

more meaning than a photograph can, the difference in power of a wide variety of missiles. The series starts with the relatively small "Corporal" and moves up the scale through the "Nike", "Nike-Ajax", "Minuteman" and reaches a grand finale with the full-throated boom of the "Titan" missile. After such a display of sound, the manned X-15 sounds quite tame by comparison. Its only big moment comes as a B-52 drops it away into flight at 40,000 feet and the craft, which amounts to a winged rocket, moves off on its own.

Mantovani: Italia Mia

London  LPM 70045

The scene is a spacious conference room at the Home Offices of London Records. This is the special room reserved for meetings with the top artists who provide the bulk of the revenue that keeps the label thriving. Already present is the Man of Music and his several teams of managers, arrangers and advisers. On the other side of the table are seated London's representatives, headed by the man currently in charge of the Be Pleasant to Mantovani department. The only major figure absent during this particular conference is the senior arranger charged with the delicate task of unleashing the tumbling "cascades" of the string section. As these things will, a security leak has already occurred. For days, rumors have been flying that, this time, the Old Man is embarking upon something Different—an album of Italian airs that will include melodies from real operatic arias. The team of arrangers assigned to the woodwind section is already nervously eyeing the Leader's impassive face for confirmation that their Division is to play a key role in the proceedings.

Lacking the serene patience of those who stayed throughout the meeting, we can only report that the fruits of the conference have reached full maturity on the London tape called "Italia Mia". Consult it now and you'll relive the hushed moment when the decision was reached to include one of the great Puccini arias—*Vissi D'Arte* from *Tosca*. Other goodies are a theme from Tchaikovsky's "Capriccio Italien" and a quotation from the "Carnival of Venice" that begins with a flute and guitar duo. Lest they be denied access to the next meeting, the engineering staff turned in an excellent job.

Marty Gold: Stereo Action Goes Hollywood

RCA Victor LSA 2381

Stereo Action, somewhat to my surprise, continues to be an undiminished activity in RCA's recording plans. It's quite a temptation to conclude that a fresh batch of neophytes continues to show up on a monthly basis at stereo record counters across the nation. In this particular release, Marty Gold selects some of the better-known movie scores for experiments in moving the sound across the boundaries of the sectors covered by the stereo mikes. In order to facilitate matters for the console engineer, the orchestra was divided into three different groups. No matter how many times the musicians changed position from selection to selection, the miking was kept at approximately the same close range. The results obtained so far in the Stereo Action series would seem to indicate that mikes with a high degree of separate control have to be used in order to get good stereo depth. At this session, the already extensive cluster of mikes laced through the orchestra was enlarged to include two condenser types placed some fifteen feet apart at the back of the hall. Under this setup, several selections come through better than the others. The *Children's Marching Song* from the "Inn of the Sixth Happiness" and the *Colonel Bogey March* from "Bridge on the River Kwai" offer the most obvious opportunities for music in motion.

Olatunji: Afro Percussion

Columbia CS 8434

The increasing interest in Africa has served to accelerate the entertainment career of Babatunde Olatunji, a member of the

(Continued on page 87)

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THE FISHER

AUDIO ETC.

Edward Tatnall Canby

PRETTY CAGEY

A few months back, last August, I was tipped off by friends that there was an upcoming festival of modern music about to begin at Montreal, and I really ought to hear it; and since these friends were about to embark for Europe from Montreal, why didn't I come along and make it a going-away party?

When I found out what the festival was about, I said yes. Even though phone calls to Montreal couldn't uncover any clear idea of the actual programs, I did know that the music was of a certain school, *very* modern indeed, and the prime mover was to be one John Cage. That was all I needed. This was going to be fun! So I went.

It was fun. You've probably heard of John Cage. He's relatively an old-timer, now, maybe in his lateish forties. Back before the war he was already forecasting electronic music with prophetic accuracy. Soon thereafter he became famous by virtue of a sure-fire musical gimmick, the so-called prepared piano, a normal piano beefed up with a vast collection of hardware—bolts, nuts and what-not, inserted at precisely exact points in and around and under the strings, to produce calculated, if slightly unusual effects via assorted plucking, scrapings, hammerings, even via the use of the piano keys. Play a low bass note on a properly prepared piano, for instance, and maybe you'd hear a falsetto thump, or a thin twang. A whole orchestra of new sounds, all right.

Cage has gone far since then, and I don't mean that to be ironic. His ideas on the nature of musical expression—ideas, of course, that he always puts into practice—are as genuinely important, I think, as they are, at present at least, eccentric, as they are, at present at least, eccentric. He is now practically the father of a whole school of international music; you might say he's a young musical Freud among Freudians, a man of really immense influence though, as with the Freudians in Freud's day, many of those who are influenced disagree with him, or disown any connection at all.

Though Cage would seem to be the unofficial leader as I see it, perhaps indeed a good deal of the "movement" with which he is associated in music is, so to speak, concurrent, arising from similar situations and out of kindred minds. Yet the fact remains that a lot of the younger men in this peculiarly *avante garde* area compose "after" Cage. They sound like him. They use techniques like his. This is hardly all coincidence. He got there first.

It was this somewhat vaguely defined group of modernists who were meeting at Montreal. People from numerous countries—Canada, the U. S., Brazil, Argentina, France, Poland, Germany, Japan, in person or through their works, or both. There were "outsiders" in places of honor, Milton Babbitt for instance, who composes for

tape on the RCA Mark II Synthesizer at Columbia in New York. There were the patron saints of modernism represented—old Varèse again, now 75, with his 1958 "Poème Electronique," which I now must have heard dozens of times; Varèse is taken for granted, of course, among these musicians. He started it all, long before Cage himself.

But it was clear that John Cage was to be the stellar attraction. He had two major premieres scheduled, a large work for indefinite numbers of instruments, most of them furnished with contact mikes, and a large-scale ballet danced to more of the same by the Merce Cunningham group. Also, Cage had a lecture scheduled. Four lectures, it turned out to be.

So I saw my friends off on the boat, met a couple of attending musicians who knew Cage, then headed straight for the opening concert of "La Semaine Internationale de Musique Actuelle," a segment of the greater Montreal summer festival. In Canada's alternate language, this Week was termed "International Week of Today's Music."

The larger festival included theatre, movies, the rest of the usual summer offering now fairly common in big cities. I rather guessed that the Montreal city fathers hadn't quite realized what they were getting into when they signed up this particular musical Week, though as good sports they certainly gave no sign of it. This was *avante garde* music with a vengeance. That's exactly why I rushed to hear it. Anything might happen.

Tapes

It did! I wasn't a bit surprised. Like most really radical events, this one was promoted in a peculiarly casual way, as though it were all perfectly standard. I didn't manage to latch onto a program until the second concert (they sell them to you for a dollar), but the tell-tale signs of what I had come for were there, written out in plain type and looking as innocent as any Sunday Philharmonic program.

You could pick out, for instance, an item listed as "Structures Métalliques No. 2," scheduled for the fourth concert and scored for metal structures and tape recorder. (*What?* Well, yes, just that. Why not? If you are wise at such occasions as this festival you'll act as though you weren't a bit unnerved by the idea; *of course*—metal structures! what's unusual about *that*? You just look as deadpan as you can, and wait to see what happens.)

Then there was something called "A Grapefruit in the World of Park," which I missed, grapefruit and all; there was an item for tape called "Steam," which was steam, of course, and a taped "Etude on a Single Cymbal Crash," these last two

being of a relatively old-hat breed. Lots of tape music has already been composed by elaborate re-recording of a single sound.

Tape music everywhere. There was ballet danced to tape, movies with tape, live music and tape—this last is now an active area of experiment, since it takes a lot of cueing ingenuity to synchronize a pre-recorded tape with a simultaneous live performance. You must keep stopping the tape, then re-starting it exactly on cue, via a performer who presides at the Ampex and is in effect a co-conductor of the music. He's a musician, of course.

The tapes rolled on at every concert in this festival almost as a routine element. I'd heard 'em all, stylistically at least. I found this aspect of the festival somewhat too conservative for my mood—I'd come for more exotic things. Tape music doesn't sound modern any more to me; I've heard so much. Half the time, I forget that it is tape. "Etude No. 2," "Psalmus 1961," "Transicion I," "Artikulation," "Ommaggio a Emilio Vedova" (whomever he is), "Etude aux Objets," the tapes boomed out, titled in many languages but all very much *en rapport*, for the biggest thing about these new forms of music is their utterly international quality, without a trace of conscious nationalism. Japanese, Polish, Canadian, French, they all sounded of one "school" and they are just that.

I noted with considerable interest, by the way, that the sound reproduction provided by the Montreal management was excellent throughout the series of concerts, as presented in the theatre of the Montreal Comédie Canadienne. For this music, good sound reproduction is of the essence. Up front in the theatre, just below the stage, was the inevitable battery of dimly lighted Ampexes, amplifiers, rows and rows of dials, looking extremely complicated. And inevitably, too, there were the distributed speakers, up in the back corners of the hall, in the balconies, on each side of the stage. I understand that they were by Wharfedale of England; if so, then congrats to Wharfedale and to Mr. Briggs. I have never heard better sound in a large auditorium. Astonishingly free from distortion, even at top volumes, and particularly nice in the one, single, accidental piece of "real" music that was reproduced from tape, an orchestral recording sent over from Yugoslavia. The sound was just lovely and clean—except, of course, when Mr. John Cage got at it.

Aesthetic Distortion Aesthetic Distortion

As I say, Mr. Cage is an original and eccentric thinker, with strong ideas which are even stronger, however, when put into practice. Cage has now discovered the aesthetic values of electronic distortion, on a grand scale. He induces it, deliberately, out of otherwise highly respectable hi-fi equipment. Nothing by halves with this man!

First, in this festival and in his new works, Cage used the most violent sort of overloading. Terrific amplifier and/or speaker break-up—I really wasn't sure how much of it was each. Second, he has discovered feedback.

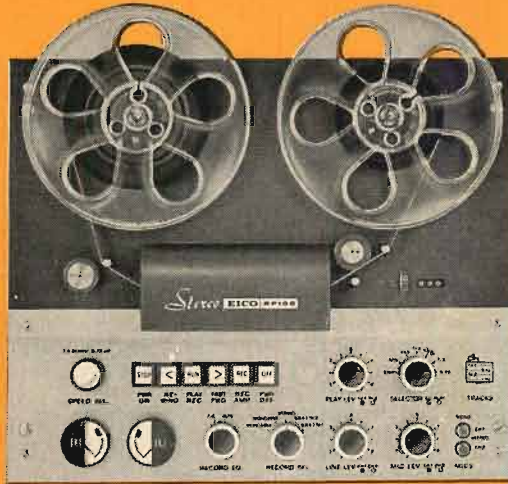
Feedback unlimited, all-out, and through dozens of speakers! Overloading at thousands of per cent distortion. The combination of these two produced such an incredible noise, out of all that equipment, that I didn't really have the energy to wonder *how*. I wasn't supposed to; this was an aesthetic impact, remember.

For his basic building material, Cage used live instruments mostly, but augmented. He put contact mikes on them,

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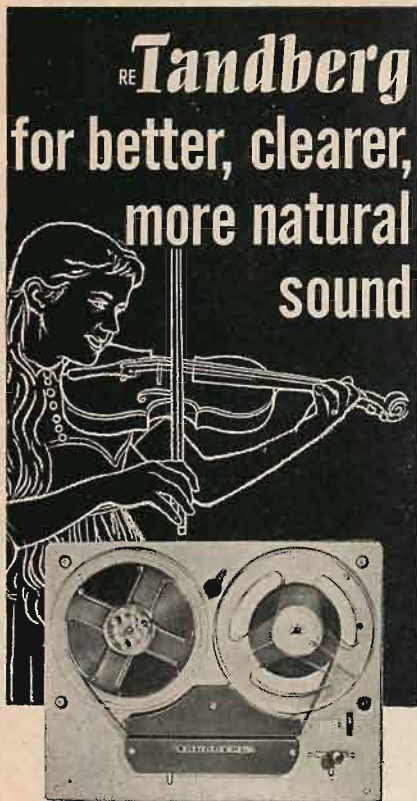
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blowing up a guitar, for instance, to match the volume of a trumpet. Into a grand piano, his *pièce de résistance*, he put a contact mike to end all contact mikes, as a distortion and feedback generator. Out in the hall were more mikes, cut into the same circuit to produce the feedback. (This is how I figured it out, when I had a chance to collect my wits.) The whole of this fed into the huge amplifier-speaker system spread through the theatre.

Mr. Cage's indefatigable pianist, the well known David Tudor, a man who can climb inside a piano without losing a bit of his dignity and often does, sat at the miked-up piano with a control box just to his right, next to the keyboard. When the moment was ripe (that is an accurate description of the Cage technique, as we shall see), the volume control was whomped up to the top, the auditorium feedback mikes were opened, and Tudor would quietly lean across a dozen or so piano keys with all his weight. Such a hellish roar of distorted sound broke forth each time as you can scarcely conceive of, immediately re-distorted still further by the build-up of feedback! It rolled on and on through the theatre like some huge thunder in the mountains—distorted thunder and louder than any I ever hope to hear.

I suppose we went through at least two hundred of these great distorted sound-barrages during the pair of big Cage works. He seems to like the idea and, as I say, Cage doesn't do things by halves. I can imagine the feelings of the sound men who provided the audio for this and other such effects we heard; I know, on the other hand, that I got myself into a pickle when I absent-mindedly observed to one of the musical faithful that I found it rather intriguing to hear so much deliberate distortion, of the very kind that engineers try so hard to avoid. She was highly insulted. *Distortion!* How dare you, sir, or words to that effect. This was art, remember, not distortion.

Oddly enough, you know, I guess she was basically right. It *wasn't* distortion, in her way of thinking. I have to be careful to change my tune when I talk to people about things like this music. For her, the sound is art. For you, maybe, it is pure equipment mayhem. Both of you are right.

The thing about Cage is his uncanny sense of what can be called gaddy publicity, built upon a remarkably sound, orderly body of theory. It takes imagination to carry things to the logical extremes that carry things to the logical extremes that instantly occur to him, given any new idea that happens along.

Take the alternative distortion he used in these pieces—plain squealing feedback, unaided by piano. Just open up the mikes in the hall and let 'er rip, whenever the music calls for it. Such an unearthly howl of anguish you never heard, and my impulse was just as yours would be—to rush over and turn the mike gain down. Oh no! Not this time. The first howl caught me unawares; I thought it was just the usual, a mistake and unintended. But the light began to dawn upon me after the fifth or sixth all-out screech—on purpose! I didn't bat an eye. I never batted an eye during any of these concerts. Serious as a judge. A good plan, for a good deal of what goes on is serious and is not to be put aside as just silly.

Take the John Cage lecture, scheduled for the second afternoon, at 2:30 in a respectable lecture hall on the McGill University campus. There were two lectures each day of this sort and, to read the program, you might think the whole series to be as stuffy and conservative as the dull-

est extra-curricular university lecture. Mr. Cage's talk in Redpath Hall was billed as "Where are we going? And What are we doing?" A reasonably innocent title if one did not know Mr. Cage.

Four Lectures

I had had lunch with Cage and my other friends, and he had mentioned casually to me that, actually, this was to be four lectures in one. By that anybody else would have meant that four subjects were to be covered in the one talk. Not Cage. He meant precisely what he said, as I immediately guessed. So I hastened myself right over to Redpath Hall to see what would happen.

A very small audience. After all, there hadn't been anything but the title, in very small type, in yesterday's paper. Things were just what I had guessed. I wasn't a bit surprised and, indeed, I found the lecture(s) really very worthwhile, though I am not able to give you a run-down on what Mr. Cage said. (If you want the whole thing, it—they—will be published, all four, in four different type faces interlaced, in his new book, appropriately called SILENCE.)

There sat Mr. Cage, ensconced professorially up front at the lecturer's desk. There were two portable tape recorders on the platform, one on each side. Two speakers were set up on each side of the hall, halfway back, and a third was visible at the extreme rear.

Mr. Cage looked at his inevitable stopwatch (virtually everything pertaining to this school of thinking, music or otherwise, seems to involve a stopwatch) started up one recorder, looked at the stopwatch again. Silence. Then, at a precise moment, he rushed over and turned on the other recorder. Silence, except for the faint hiss of blank tape. The reels turned, Mr. Cage sat down.

After awhile, the speaker on my left began to talk. It was, of course, Mr. Cage himself, on tape. He ambled on very pleasantly, out of the left speaker—he is a superb shaper of words and an excellent speaker himself, easy and informal; he can write anything he pleases, frontwards or backwards, and I'll enjoy it. Wonderful feeling for English word-rhythms and phrases, in a musical sort of way.

Presently, a second loudspeaker joined in, casually. Different words, different line of thought; but somehow, I didn't seem to mind hearing both at once. It was like listening to several good conversations at a party, picking up the gist of all of them at the same time. Tantalizing and, therefore, fun.

Mr. Cage himself, the man in the flesh, took up a third line of thought pretty soon, up at the front desk. I could hear him occasionally, during the pauses in the other speakers. The fourth speaker, in the back, soon joined in too; but it was seldom that all four of the speakers, three recorded and one live, were going simultaneously. The lectures were all very relaxed, thoughtful, ruminating; there were frequent long pauses in each, as though for further inner thought. Sometimes only one would be heard for quite awhile, then two. The "entrances" of the silent speakers were effective, after their silences, just like the entrances of musical instruments in an orchestral work—indeed, that was surely the sense of the experiment, an orchestration of spoken ideas, a counterpoint and a harmony, four speech-sources not opposed, but going easily along together.

(Continued on page 56)

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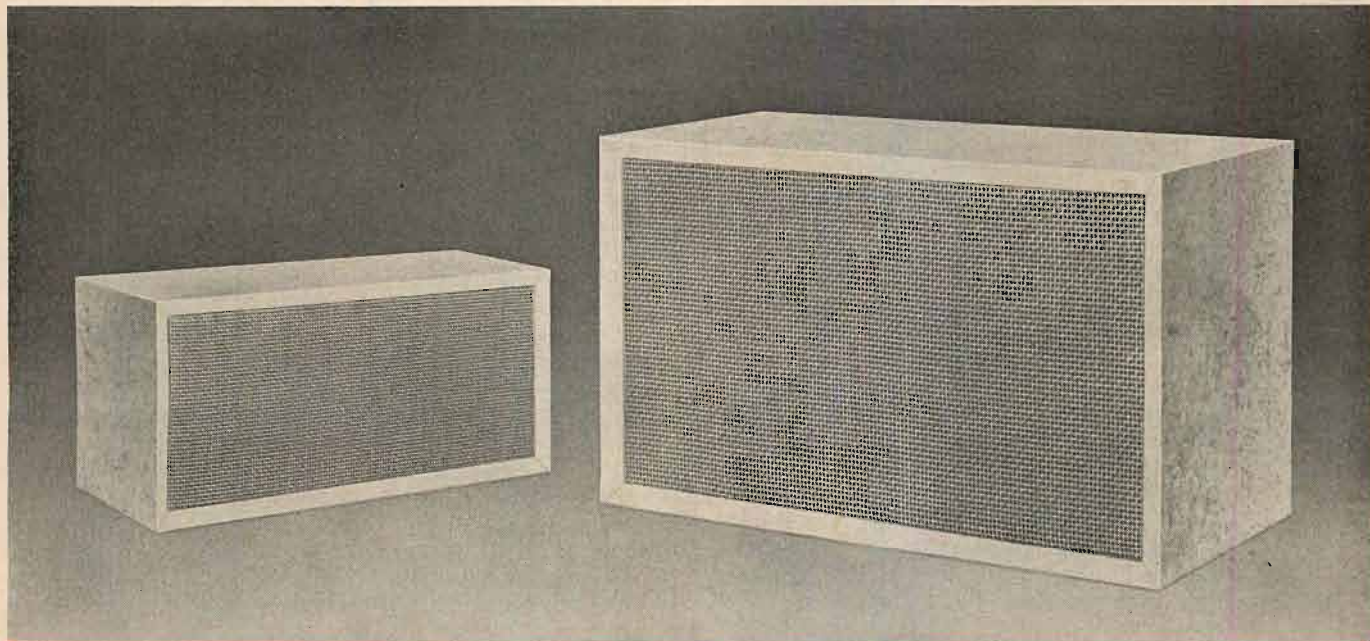
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EDITOR'S REVIEW

THE NEW YORK SHOW

AUDIOFANS throughout the country are most interested in the New York High Fidelity Show, which occupied the entire industry from September 14 to 17—and for several days before and after, setting up and pulling down the exhibits. It appeared to most observers that the introduction of FM Stereo this season had triggered a resurgence of interest in high fidelity, for the attendance from the first day was better than in 1960.

“What’s new at the Show?” was the first question asked by everyone who hadn’t attended, and is likely to be uppermost in the minds of those who were unable to get to New York. Aside from the usual number of new speakers and enclosures, new furniture, new turntables and arms, and new models of tape recorders—along with several new amplifiers—the BIG news centered around FM Stereo. As a well known Philadelphia newspaper proclaims modestly, “Nearly everybody reads the *Bulletin*,” so it might be said that nearly everybody had a stereo adapter and several tuners with adapters built in and one or more complete receivers with adapters built in. And while we suspect that some of the adapters shown in Chicago last May at the Parts Show were simply little chasses with a tube or two and a few transformer cans mounted on them, those shown at the New York Show all worked—they had to, for three stations in the area are now on the air with stereo programs, and the people were clamoring for demonstrations.

So, while the show was an important event to all audiofans, the real question turns out to be, “How well does FM Stereo work?” And we must add that . . .

FM STEREO DOES WORK

Three stations in the New York area went on the air with FM Stereo during the month—WQXR in New York City, long the major “good music” station of the area; WDHA, in Dover, New Jersey; and WLIR, in Garden City, just about a mile south of AUDIO.

The first of these to go on the air was WDHA, which began tests about the middle of August. It was followed by testing from WQXR in the last week of August and regular programming on a limited basis on September 7. WLIR completed its installation of a Standard Electronic’s stereo generator on September 9th, finished studio modifications on the early morning of the 13th, received its FCC authorization later that day, and went on the air with stereo at 6:00 p.m. that evening. Neither WDHA nor WLIR are received too well in midtown Manhattan, since they are located some distance out of the city, so the stereo programs originating from their booths in the Show were fed to two H.H. Scott stereo generators in the building, and the generator outputs were fed to two FM signal generators and thence through coaxial cable around the halls so they could be tapped by any exhibitor who wanted an r.f. signal with which to

demonstrate. Thus there were two stereo programs available continuously for demonstration purposes. WQXR increased its programming during the show hours, which provided another source.

Take it from us—FM Stereo *does* work, both under the demonstration conditions, and off the air. We have been listening to some of the tests, and while we have heard some programs which were less than perfect, as time went on they improved immensely. Separation was not always as good as it might be in the beginning, but even that has been licked. Let us say now that the FM Stereo we have heard so far is greatly superior to FM/AM stereo, and we can say without equivocation that some of the broadcasts are readily comparable with the stereo records themselves as played on home equipment.

One added feature of the Show was the provision of a pooled studio facility which was shared by several New York stations. The studio equipment was installed by Altec and consisted of one of their 250SU stereo consoles, two Fairchild broadcast turntables with arms and cartridges, and an Ampex 354 stereo tape recorder. The two stereo stations which were exhibiting at the Show—WDHA and WLIR—originated some of their programs from this studio, which was one of the attractions of the Show. WRFM and WNCN, both exhibitors but both still monophonic, used it for some of their originations, and WCBS used it to tape a Martha Wright show. The main reason for the facility was to provide a place for round table discussions and interviews of industry figures.

On the whole, we think the show was great—far above last year’s. We think FM Stereo is great. And in the phrase commonly heard in front of the Show building at closing time, our feet hurt. We often wondered if people with wooden legs felt any different than we did, but it was worth it.

SOUND IN THE THEATRE

While that happens to be the title of one of the books AUDIO publishes—and a good book it is, too—our immediate concern is with Sound as it is employed in most New York legitimate theatres. Most of it appears to have originated from a pair of badly overloaded 6L6’s feeding a 6-ounce output transformer and coming out of some Atwater Kent loudspeakers, *circa* 1930.

It is certainly within the province of drama critics to mention the quality of the sound reinforcement used, as it is in so many Broadway productions these days. There is no excuse for some of the poor quality, out-of-perspective, and distorted sound we have heard, and if the drama critics were to include the sound system in their domain as part of the whole, possibly producers would make an effort to improve it. Most audiofans have much better systems in their homes these days.

And, just to get in a plug, the logical place to learn how sound should be used in the theatre is in the aforementioned book.

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STANTON

stereo fluxvalve pickup

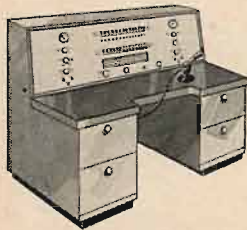
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Miniature Broadcast Audio Cable





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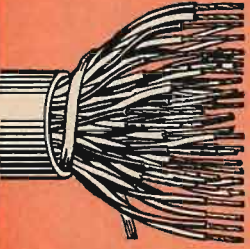
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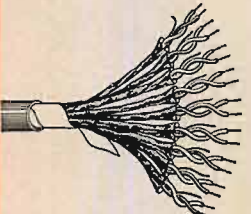
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The "Fidelimatic" Tape Recording System

JOHN WHITACRE *

Tape magazines promise the biggest revolution in radio programming since the introduction of tape recording to broadcasting. Here's how you can build your own fully-automatic tape magazine recorder.

UNTIL RECENTLY, there was one important area of broadcasting where the tape recorder couldn't replace acetate disc recordings. Commercial announcements, or "spots" as they are often referred to, which needed more than one voice, background music, sound effects, or a combination of all three, were still being recorded on discs.

Why? Certainly not because acetate disc recordings offered better fidelity or greater permanence than a tape recording! But . . . discs had one important feature that made them more attractive to the combination announcer-operator. They could be easily cued in a minimum amount of time. In a radio station programming fifteen or more announcements an hour, this means a lot.

While attending a National Association of Broadcasters Convention I saw a new method of tape recording radio commercials. It had everything acetate disc recordings offered . . . plus fidelity and permanence.

After a number of inquiries I dis-

* 2609 Devonshire St., Lansing 10, Mich.
 * 2002 Devonshire St., Lansing 10, Mich.

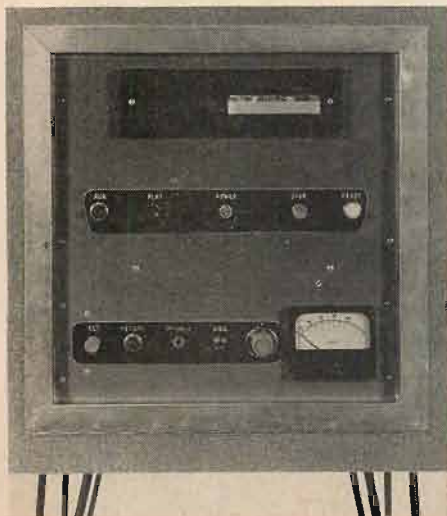


Fig. 1. The "Fidelimatic" tape recording system.

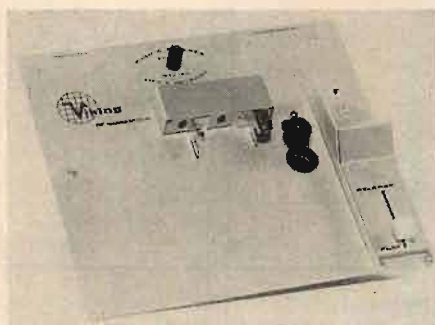


Fig. 2. We modified this Viking Model 35 Continuous Tape Loop Handler to make it pushbutton operated. (Photo courtesy of Viking of Minneapolis.)

covered that Viking of Minneapolis makes a tape-magazine handler. After the magazine is inserted in this machine, it is started by pulling a lever. We wanted one that could be stopped and started by pushbutton switches. Our thought was that we could possibly modify this one. Conley Electronics Corp. manufactures three sizes of tape magazines which work in the Viking machine.

Since the WILS engineering department has built much of its own equipment, I approached the General Manager with the suggestion we be allowed to build a "pilot model" tape-magazine handler. He agreed to let us, if it

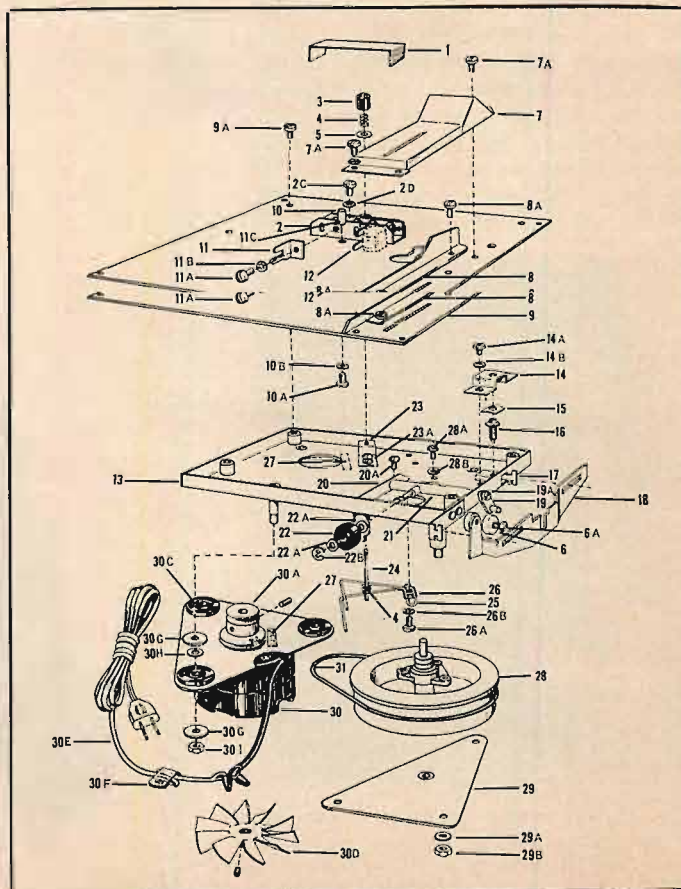


Fig. 3. An exploded view of the handler giving parts locations and numbers. (Courtesy of Viking of Minneapolis.)

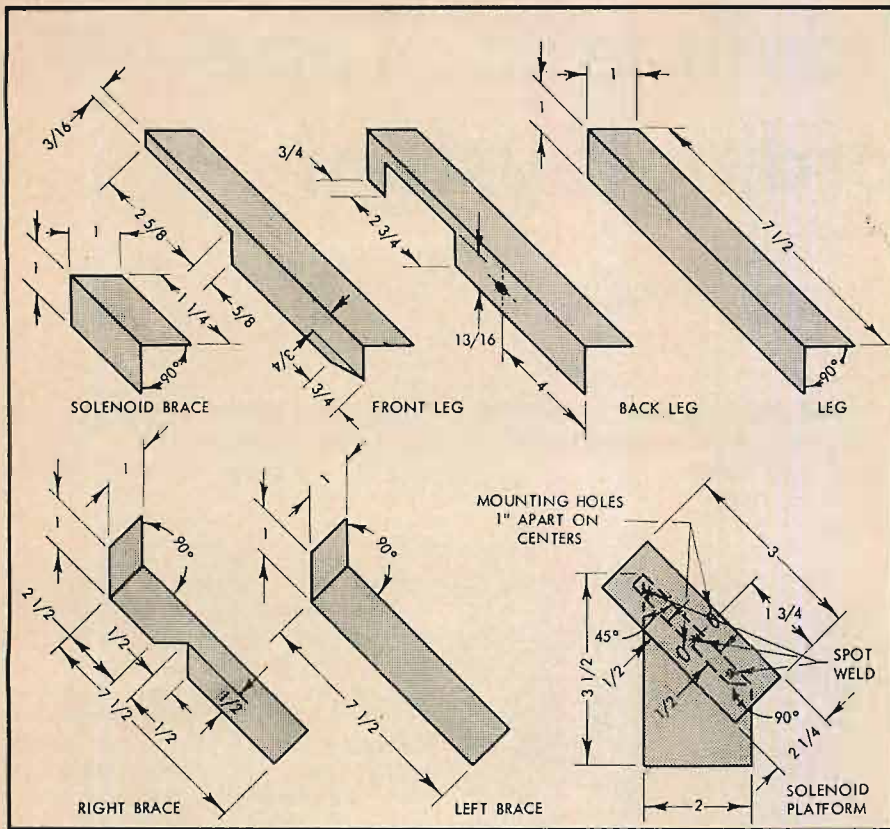


Fig. 4. Dimensions of the legs, braces, and solenoid platform. Elongate the solenoid mounting holes and the linkage mounting hole in the back leg.

wouldn't cost over \$500 and if we could show him a working model in three months.

While waiting for the handler to be delivered, plans were made as to what we wanted in our system. First, it would have to be pushbutton operated so that it could be started and stopped from a remote location. It would also have to be self-cuing so that the operator wouldn't have to remember to shut the machine off after commercials. The N.A.B. standard for magnetic tape re-

ording at $7\frac{1}{2}$ ips was our goal for fidelity.

To achieve our goal we decided to use laminated record-playback heads and, to reduce flutter and wow, a three-sheave motor pulley (instead of the single one normally use on the Viking handler).

There was no room for an erase head on our handler, so we bulk erased all tape magazines before they were recorded.

Figure 1 shows the results of our labors.

Playback Deck

We started with the basic Viking Model 35 handler shown in Fig. 2.

Referring to Fig. 3, remove item 9, the top plate assembly. Put it aside for now. Remove all parts in the speed change assembly. (Our machine operates at $7\frac{1}{2}$ -ips only.) These parts are numbered 3, 4, 5, 23, 24, 25, 26, and 27. Remove all parts in the manual engaging system. They are numbered 6, 7, 14, 15, 16, 17, 18, and 19.

Take the remaining panel assembly to a tinsmith. Have him make the sheet metal legs and braces shown in Fig. 4 using 18 gauge sheet metal. Remove the small bracket on the panel assembly used as a front guide for the engaging lever.

Spotweld the legs and braces to the panel assembly as shown in Fig. 5 and 6.

Have the tinsmith cut the aluminum top plate to size and bend it as illustrated in Fig. 7.

A machine shop can make the solenoid linkage, swing-arm assembly and the solenoid depth adjusting collar. Use the measurements given in Fig. 8 for these items.

It is no longer necessary to have the shop make a three-sleeve pulley because the Viking Model 35 can now be ordered with one on it.

Aluminum angle stock (1" x 1") is

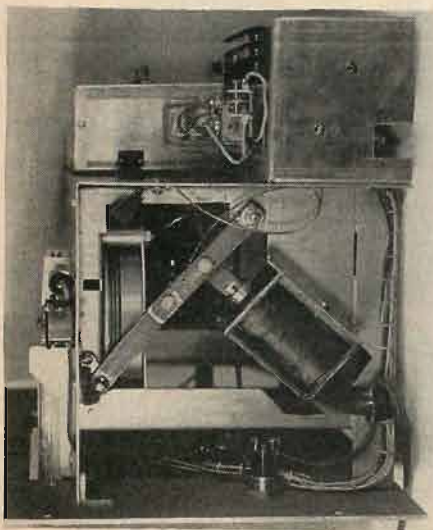


Fig. 5. Here is how the leg and solenoid platform are placed. It shows the correct positions of the solenoid plunger and the linkage when they are properly engaged.

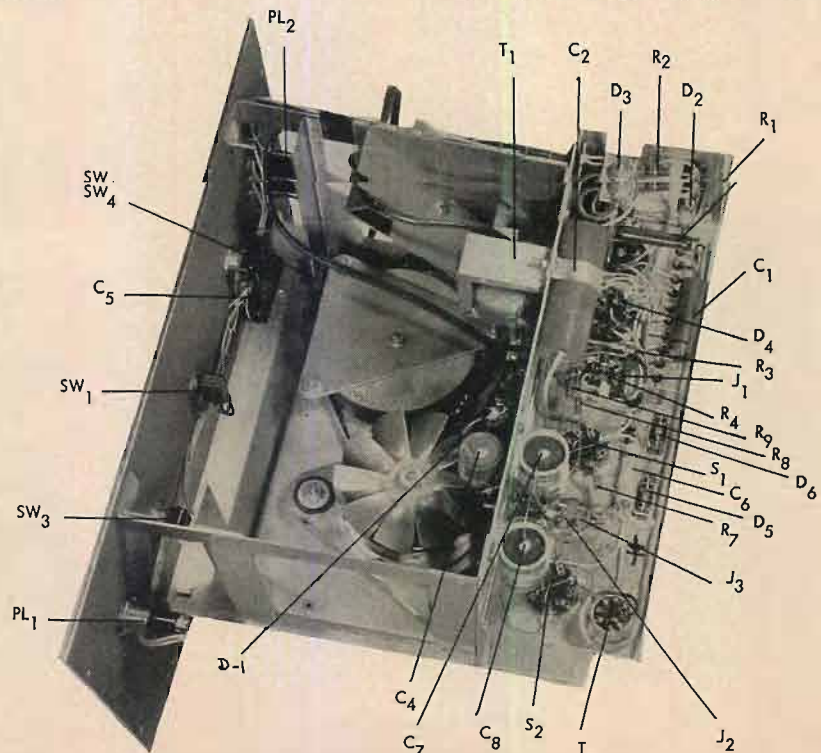


Fig. 6. A view showing the placement of legs, braces, and solenoid platform.

used under the leading edge of the new top plate and secures it to the front panel.

Use number 20 piano wire to make the linkage return spring and 1/2-in.-wide steel packing crate bands to make the magazine holddown as well as the linkage front and rear bumpers.

Rubber weatherstrip is glued to the linkage bumpers with cement as shown in Fig. 9.

Remove all parts mounted on the original top plate and clamp it over the new one as illustrated in Fig. 7. Drill and tap the holes indicated. Before removing make the capstan and pressure roller openings.

Holes for the linkage bumpers are made after you have the linkage operating properly.

Fasten the head assembly, magazine stop pin, modified magazine guide, and the microswitch in place on the new top plate.

Mount the new top plate on the modified panel assembly. Two number 6 machine screws secure the back skirt of the top plate to the new legs on the panel assembly.

Lay out and make the indicated holes and cutouts in the front panel as shown in Fig. 1. The panel is a standard 10 1/2" x 19" rack panel cut down to 15 inches to conserve space.

An engraved plastic strip is employed to identify control functions on the panel. The magazine entrance escutcheon is made of 1/2-in.-thick plastic. Its opening measures 7 3/4-in. long and 1-in. high. The outside measurements are just 1-in. greater than the inside measurements all the way around.

Before mounting the entrance escutcheon on the panel, make the magazine hold-down spring and fasten it to the back side of the panel with a number 6 machine screw.

Mount all the components on the

panel. Fasten it to the top plate and the front legs as shown in Fig. 6 and 10.

Prepare the modified panel chassis for mounting on the back skirt of the top plate. Again, referring to Fig. 6 and 10, cut the chassis to size; punch holes indicated; make the bracket for the zener diode; and mount the chassis to the top plate back skirt with number 6 machine screws.

Mount all parts as shown in the various illustrations. Proceed to wire it as shown in schematic diagram, Fig. 11.

Please take special note of the fact that there is only one chassis "ground" in the entire system. Figure 6 shows a lug secured to the chassis by a screw. This same screw holds one end of the double phono jack (J₂, J₃) to the chassis. This is the *only* chassis ground point.

Program and Cue-sensing Preamplifiers

Figures 12 and 13 respectively show

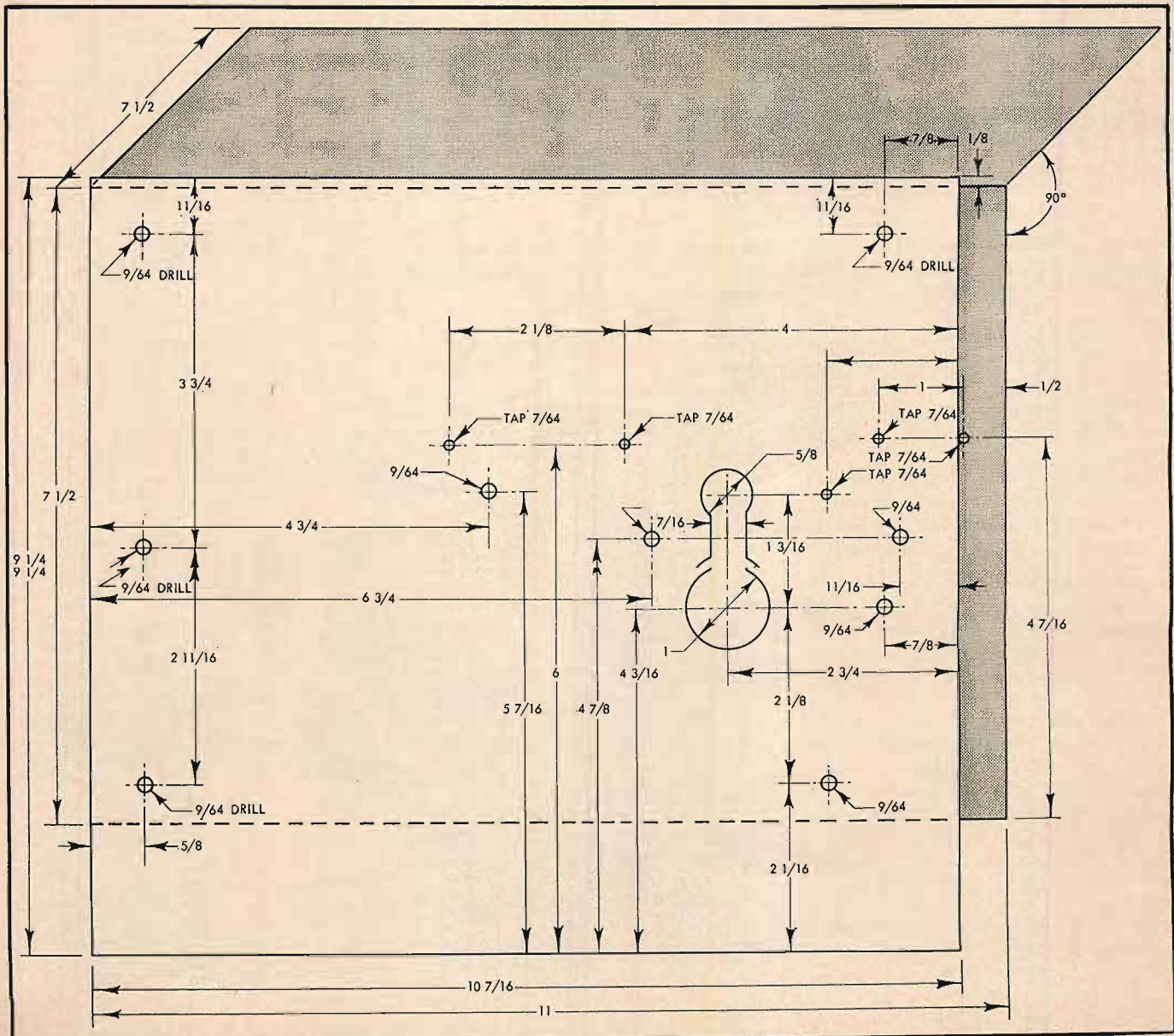


Fig. 7. The new top plate is easy to lay out and work using the old plate as a template.

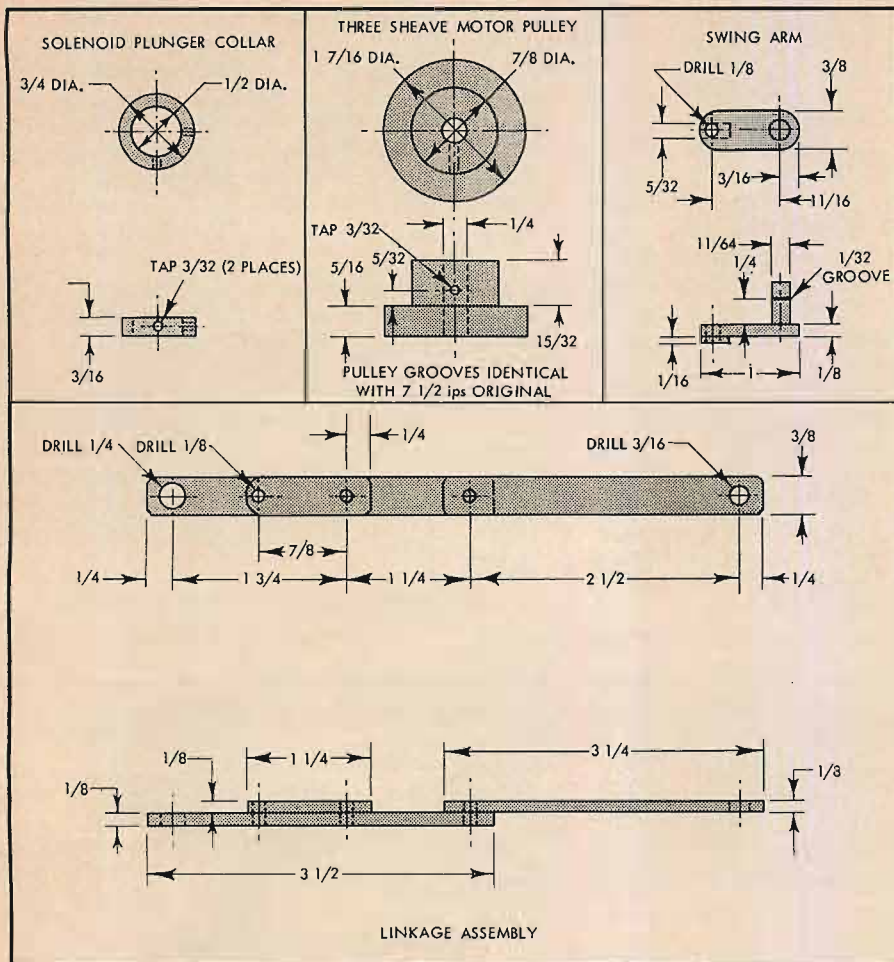


Fig. 8. All the measurements for the linkage assembly, swing arm, solenoid plunger depth adjusting collar, and three-sheave motor pulley.

the pre-amplifier and its schematic diagram. The pre-amplifiers are electronically and physically identical. The completed amplifiers are within 2 db of each other in frequency response and output voltage.

Plug the completed program and cue-sensing amplifiers into their respective sockets on the playback deck and we are now ready to install and adjust the pressure-roller engaging mechanism.

Elongate the mounting holes in the solenoid platform so they are about 3/8-in. long. Do the same with the mounting hole in the back mounting leg. This is shown in Fig. 4.

Put the solenoid on its platform and "finger tighten" the two number 8 machine screws that hold it to the platform. Put the solenoid plunger inside the solenoid. Place a 1/2-in. rubber grommet (split in half) over the plunger. Temporarily adjust the depth adjusting collar on the plunger as shown in Fig. 9.

Screw the new swing arm into place on the roller shaft (item number 21 in Fig. 9). Place a flat washer on the swing arm first, followed by the upper end of the linkage, a felt washer, spring washer, and finally a hairpin retainer.

The lower end of the linkage has a

bushing should let the linkage move freely. The hole in the sleeve bearing must be large enough to pass a number 8 machine screw through it. Cut the bearing off so that it's just a little longer than the thickness of the linkage.

To mount the lower end of the linkage, place a lockwasher over the 3/4-in. long number 8 machine screw. Insert the screw from the inside of the leg. Place the 1/4-in. bushing on the screw, followed by the linkage (which slips over the sleeve bearing), a flat washer, lock washer, and a hex nut. Tighten the combination lightly until final adjustments are made.

Secure the linkage to the solenoid plunger with a cotter key. The plunger depth adjusting collar is set so that the plunger just touches bottom when it is forcefully pushed down against the split rubber grommet.

Final adjustments are made by placing a loaded tape magazine through the entrance escutcheon, using the right side of the entrance as a guide.

Plug the playback deck into a 110 volt ac outlet. Push a tape magazine forward until it closes the microswitch contacts. This action causes power to be applied to the entire machine.

Pressing the PLAY switch will cause the solenoid to be engaged by its plunger.

Here is the adjustment we're looking for: The horizontal portion of the linkage must assume a nearly-straight line when viewed from one extreme pivot point to the other. At the same time, it must be at right angles to the solenoid plunger. When this occurs, the solenoid

1/4-in. hole drilled in it. Make a sleeve bearing out of some brass bushing. Fit it inside the 1/4-in. linkage hole. The

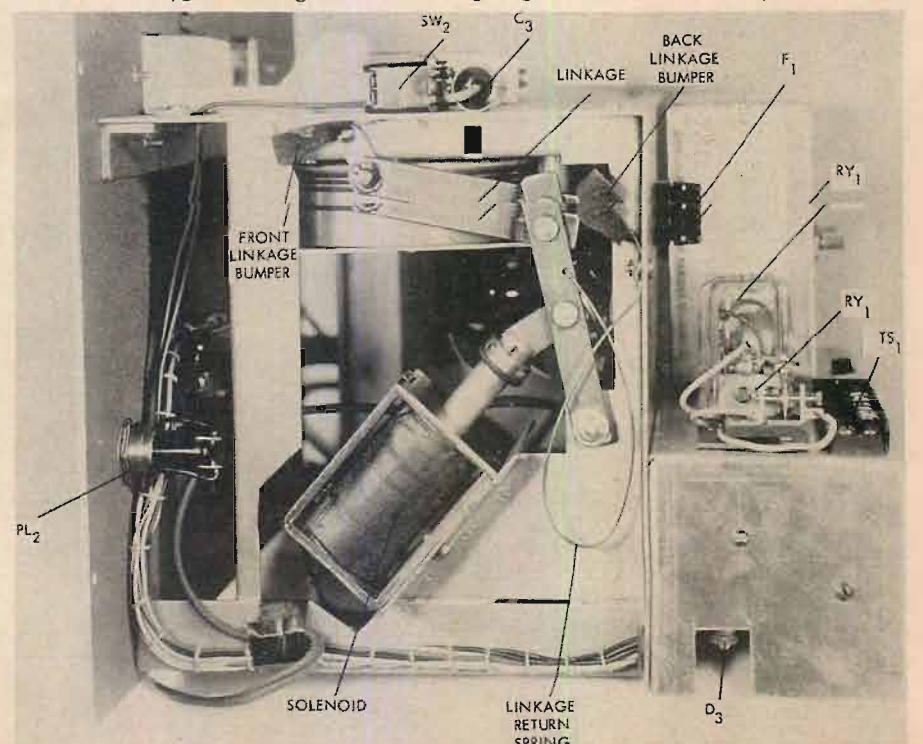


Fig. 9. Another view of the playback deck showing the linkage in an open condition. The shape and placement of the front and rear linkage bumpers can be seen here.

plunger should be nearly bottomed in its coil. The pressure roller will be "dented" against the rotating capstan about 1/32 in.

These critical adjustments are made by alternately adjusting the "back leg" pivot and the position of the solenoid on its platform. When these are correct, adjust the depth collar on the plunger so that it seats "softly," but firmly, all the way into its coil.

The linkage return spring may be made up and installed now. Also, the front and back linkage bumpers can be mounted.

Use only as much tension on the spring as you find necessary to adequately return the linkage in its de-energized position.

Adjust the front linkage bumper so that it helps "deaden" the sound made by the solenoid engaging the linkage.

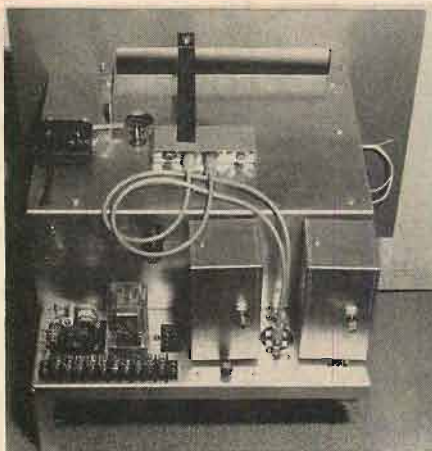


Fig. 10. The completed top panel showing how the various parts are relocated on it.

The back linkage bumper is adjusted to allow the pressure roller to fall completely below the surface of the top

plate. At the same time, it should not let the linkage return too far or it will "hang up."

That completes the playback deck.

Recording Amplifier

There is a great similarity between our amplifier and the one designed by Viking of Minneapolis.¹ We've changed some resistor values, but for the most part this was done to compensate for the heads we used.

Since the amplifier is designed to bridge a 500-ohm program line, operating at a maximum level of zero db, we operate it with the volume control half open.

The transistorized VU meter amplifier² may appear out of place but we think it gives us better calibration stability.

This amplifier also feeds audio volt-

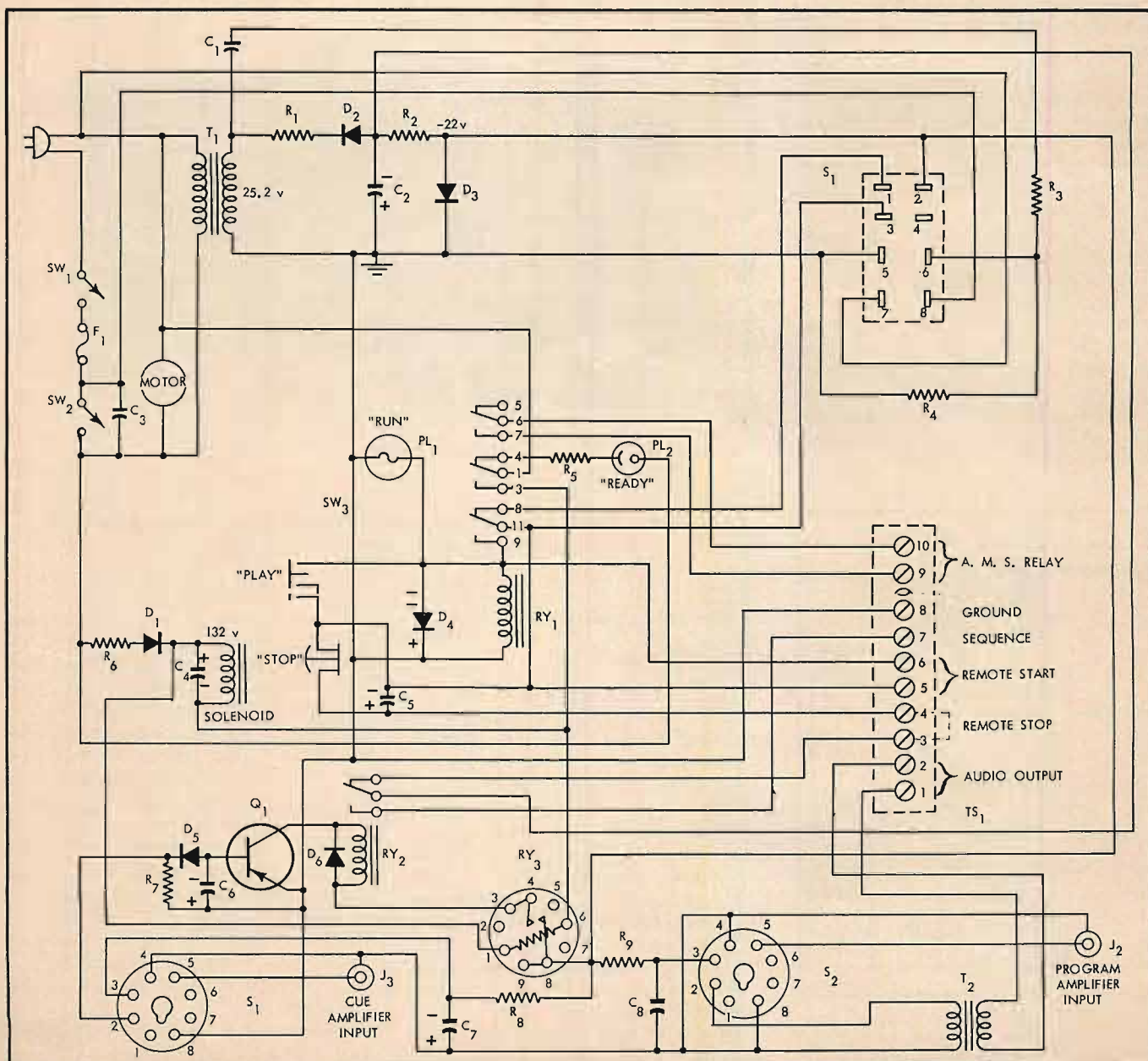


Fig. 11. Schematic diagram of the playback deck. Refer to this often while wiring the deck to avoid making errors.

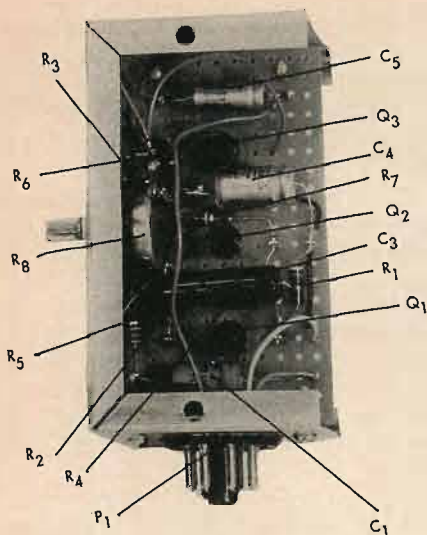


Fig. 12. The plug-in program and cue-sensing amplifiers are identical in appearance and performance.

age to a pair of earphones which may be used for monitoring purposes, if desired.

A relative indication of the bias voltage being applied to the record head is shown on the VU meter by pressing SW_{200} . Voltage divider resistors, R_{26} and R_{27} , were selected for a meter reading of plus 2 VU when the head was properly biased.

Ry_{100} is the cue-tone relay. It places a 60-cycle tone burst on the bottom track of the tape at the beginning of each recording. Immediately after this, it switches the cue head to the input of the cue-sensing amplifier. When the tape magazine completes its cycle, the tone burst will be picked up by the cue head, amplified by the cue-sensing amplifier, sensed by the triggering circuit, and stop the tape motion.

C_{17} (across the coil of Ry_{100}) deter-

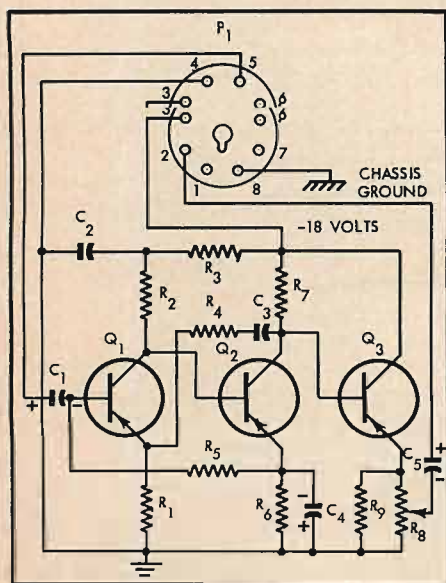


Fig. 13. The playback and cue-sensing amplifiers are easy to construct using the schematic diagram for wiring and Fig. 12 for parts layout.

mines the length of the tone burst placed on the tape.

After a tone has been placed on the tape and Ry_{100} is de-energized, diode D_{100} prevents voltage from the coil of Ry_{200} from holding Ry_{100} engaged.

Ry_{200} is the program relay. It switches the program head from a recording function to a playback function. It also applies B+ to the tubes in the recording amplifier. A set of "holding contacts" are used to keep voltage on the coil of Ry_{200} after the SET switch (SW_{100}) has been released.

PL_{101} is the RECORD indicator lamp. It is illuminated when the amplifier is ready to record.

Figure 14 shows a bias-adjusting potentiometer with a 2-watt resistor going from one end of the control to the ground buss. Disregard these items.

we found the following one worked best: Set the calibration control (R_{19}) to a three-quarter open position. Make a test recording of program material while peaking your VU meter at 100 per cent. Play it back. If no distortion is heard, turn R_{19} counterclockwise a small amount. Make another test recording while peaking the program material at 100 per cent on the meter. Do this a number of times until you can start to hear distortion in the recording. Then advance R_{19} clockwise three VU.

Naturally you will want to use a short length tape magazine for these tests so you won't have to wait long for it to re-cue. I would suggest 70 seconds.

To complete the system you will need a bulk tape eraser.

WILS uses the Conley tape magazine

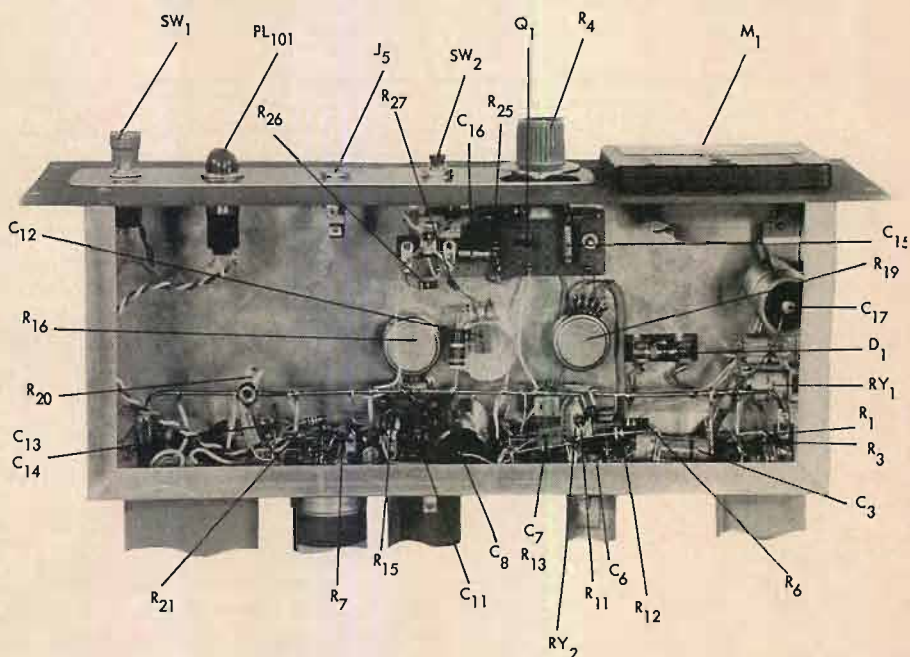


Fig. 14. An under-chassis view of the recording amplifier. Note the ground buss running from one end of the chassis to the other.

They are not shown in the schematic. They are not shown in the schematic diagram and should not be included.

Connecting All the Units

You have now constructed all the units for what we call a "Fidelimatic Tape Recording System." Now let's interconnect our units.

Make up an eight conductor (unshielded) cable about 18-in. long. Terminate it at one end with a female Jones plug. The other end will be terminated into a male Jones plug. This is your power and control cable between the record amplifier and the playback deck.

Four separate 18-in. phono cables complete audio connections between the heads, preamplifiers, and the recording amplifier chassis.

We're now ready to calibrate the audio drive appearing across the record head. After trying a number of methods,

(formerly "Fidelipac"). As seen in Fig. 17, these tape magazines come in three sizes. The largest one, or series 1200, holds up to 1200 feet of 3M's number 151-17 magnetic recording tape. The series 600 and 300 hold 600 and 300 feet respectively. We buy the tape magazines and the recording tape separately and load them ourselves. As inferred, you may buy the magazines already loaded with the amount of tape you specify or you may load them yourself.

A tape magazine loaded with 40 seconds of tape is called a half-minute, or 30 second, commercial announcement size. The 70-second one is used for one-minute commercials. Any number of announcements may be placed on the same tape magazine.

You will find it necessary to use a tape magazine loaded with the correct amount of tape for a given time segment. Using

Harman-Kardon Enters The Sound Field Because...

...the sound industry is on the threshold of an exciting new era of growth. However, the ever-expanding use of sound places new demands upon the operational capabilities of equipment. It calls for new and higher standards of performance. The continued progress of our industry should not be impeded by equipment that is the result of old habits and customs; by equipment that simply does not measure up to the needs of the day and does not consider in toto the soundman's point of view.

The popular priced Commander Series is the first of a line of commercial and industrial sound products to be introduced by Harman-Kardon. In subsequent months additional lines will be presented. This equipment is the result of a new and refreshing approach to practical application requirements. Harman-Kardon brings to the sound field the full resources of a dynamic, successful organization, plus a superb engineering staff steeped in many years of experience in commercial and industrial sound. It is no accident that the Commander Series is in fact "deluxe" equipment at a popular price. This reflects the modern and highly efficient production techniques that have long been used to manufacture equally outstanding values found in Harman-Kardon high fidelity products. They also reflect the remarkable level of performance demonstrated by H-K's universally acclaimed Citation line. As you can see, the ingredients of quality, dependability, and a maintenance of high level of performance—so important in sound work—are not new to us at Harman-Kardon.

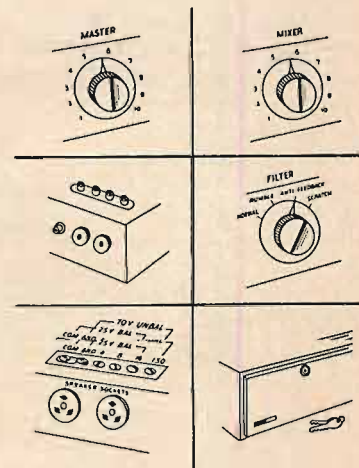
We urge you to carefully consider the new Harman-Kardon commercial and industrial sound equipment. Talk it over with your distributor or write to us for the full story. You'll quickly discover why the new Commander Series will do more, do it better, and for longer.



A SOUND APPROACH to Commercial and Industrial Application... THE NEW COMMANDER SERIES BY HARMAN-KARDON

Flexible. Versatile. Dependable. That's the new Harman-Kardon Commander Series of amplifiers and systems for commercial and industrial sound use. They're ruggedly constructed for continuous duty. They include deluxe features at popular prices. They're designed and manufactured by Harman-Kardon—noted for the quality, reliability and superb performance standards of its high fidelity products, including the highly acclaimed Citation Kits. *In short:* the new Commander Series is built by soundmen—FOR soundmen. Here are some of the exclusive features that make these the best instruments you can buy for the price.

MASTER VOLUME CONTROL: Enables total amplifier output to be varied without disturbing other control settings. **MIXER CONTROL:** Convenient ONE KNOB control permits fading and blending of signal from two channels, in any desired amount. (*DA-35, DA-12*) **MULTIPLE INPUTS:** All at the rear—allow for an unusually high degree of installation and operational flexibility. **ANTI-FEEDBACK FILTER:** Equalizes frequencies most sensitive to generation of feedback "howl" without reducing articulation—thus achieving maximum power output under difficult acoustical conditions. (*DA-12*) **25 AND 70 VOLT OUTPUTS:** Provides two constant voltage systems—70 and the newer 25 volt balanced system—for optimum flexibility and economy in speaker installation. **LOCKING COVERS:** Unique feature on units in this price class—designed to prevent tampering or accidental change of precise control settings. **PLUS:** Magnetic Cartridge Input; Tape Recorder Output; Independent Power Switches; and many other deluxe features.



The Commander Series shown above includes the following: Model DA-12, 12 Watt PA Amplifier—\$75.00 List; Model DA-35, 35 Watt PA Amplifier—\$119.95 List; Model DA-100, 100 Watt PA Amplifier—\$187.50 List; Model DPR-7, Combination Mixer/Preamplifier—\$75.00 List; Model PT-1, Phonograph Top—\$37.50 List; Model LC-1 and LC-2, Locking Panel Covers: Model LC-1—\$8.50 List, Model LC-2—\$9.00 List.

For informative catalog on complete Commander Series write Desk 10B.

Commercial Sound Division

harman kardon

Harman-Kardon, Inc.
Plainview, N. Y.



Fig. 15. A back view of the recording amplifier showing the major components and their positions in the chassis.

a magazine with an excessive amount of unused tape causes unnecessary delay while you wait for it to re-cue.

We have found 40 seconds of tape is the least amount it is wise to put in a magazine. Less than this amount does not allow sufficient friction between the layers of tape. This interlayer friction acts as a holdback tension, without which erratic motion can result.

Operation

Now that you have all the units assembled and interconnections made, lets insert a tape magazine into the playback deck. Make sure you have erased it with the bulk eraser. Push it all the way forward until the READY light comes on. Give the motor five seconds to come up to speed and then push the SET switch.

If you have a source of program connected to the recording amplifier input, advancing the volume control will allow you to see it on the VU meter. If you wish, plug earphones into the PHONES jack and listen.

Press the BIAS switch to verify you have the correct bias voltage going to the record head.

Pushing either the PLAY switch, or a remote start switch, will cause the solenoid to operate. This pulls the pressure roller against the rotating capstan. The tape in the magazine is pinched between the pressure roller and the capstan and moves forward.

The READY lamp is now extinguished and the RUN lamp is illuminated. The solenoid receives voltage when contacts 1 and 3 on Ry_1 are closed. Contacts 9 and 11 hold it closed after the PLAY switch is released. At the moment contacts 8 and 11 open up, voltage ceases to be fed to Ry_{100} in the recorder amplifier. Capacitor C_{17} holds Ry_{100} closed just long enough to permit a 60-cycle tone-burst on the tape. The cue head is then switched from a record function to a playback function.

The SET switch also energizes Ry_{200} , the program relay. It remains closed until the machine is stopped.

Tape motion may be stopped in any one of three ways: Pushing on the machine STOP switch, remote STOP switch, or by letting the tape run until a tone burst passes over the cue head. When the latter happens, the tone is amplified by

the cue-sensing amplifier and fed to the triggering circuit.³ Here the tone is rectified. It appears as a negative voltage on the base of Q_1 . This is like a positive bias on the grid of a vacuum tube. The transistor conducts through Ry_2 , opening its contacts.

Diode D_6 protects the transistor against damage which could occur when the field collapses around the coil of Ry_2 .

An undesirable transient voltage appears in the triggering circuit when the cue head is switched from a record to a playback function. Thermal relay Ry_3

delays the application of voltage to Ry_2 until after the tone burst has been placed on the tape and the head has been switched.

A 60-cycle tone is supplied through capacitor C_1 to the voltage divider network composed of R_3 and R_4 . The resulting voltage becomes our source of audio for the tone burst on the cue track.

C_4 is a 60- μ f capacitor across the solenoid. It not only smooths out the pulsating de voltage for the solenoid, but also is used as a time-delay component.

This holds the solenoid "in" a few

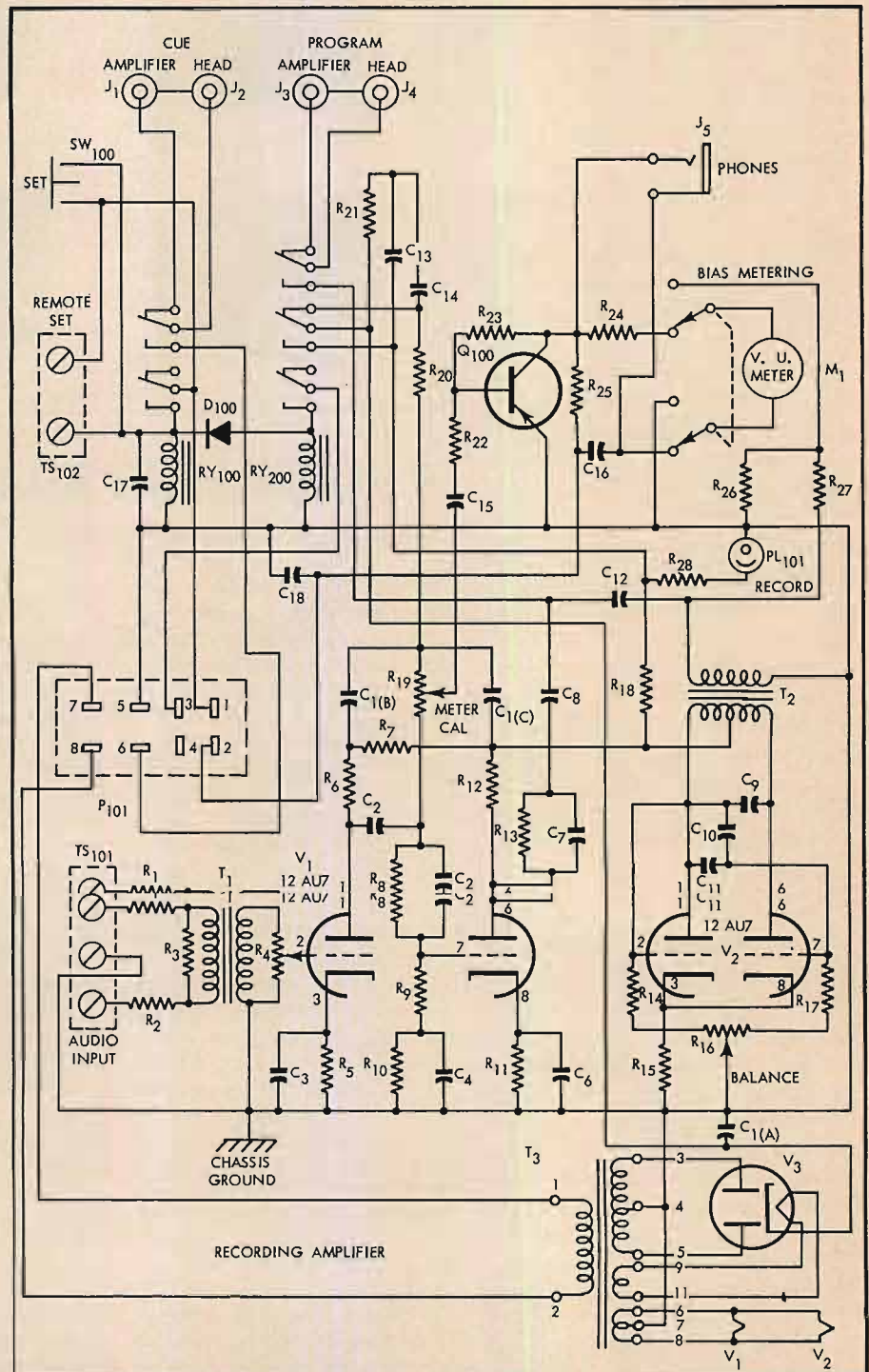
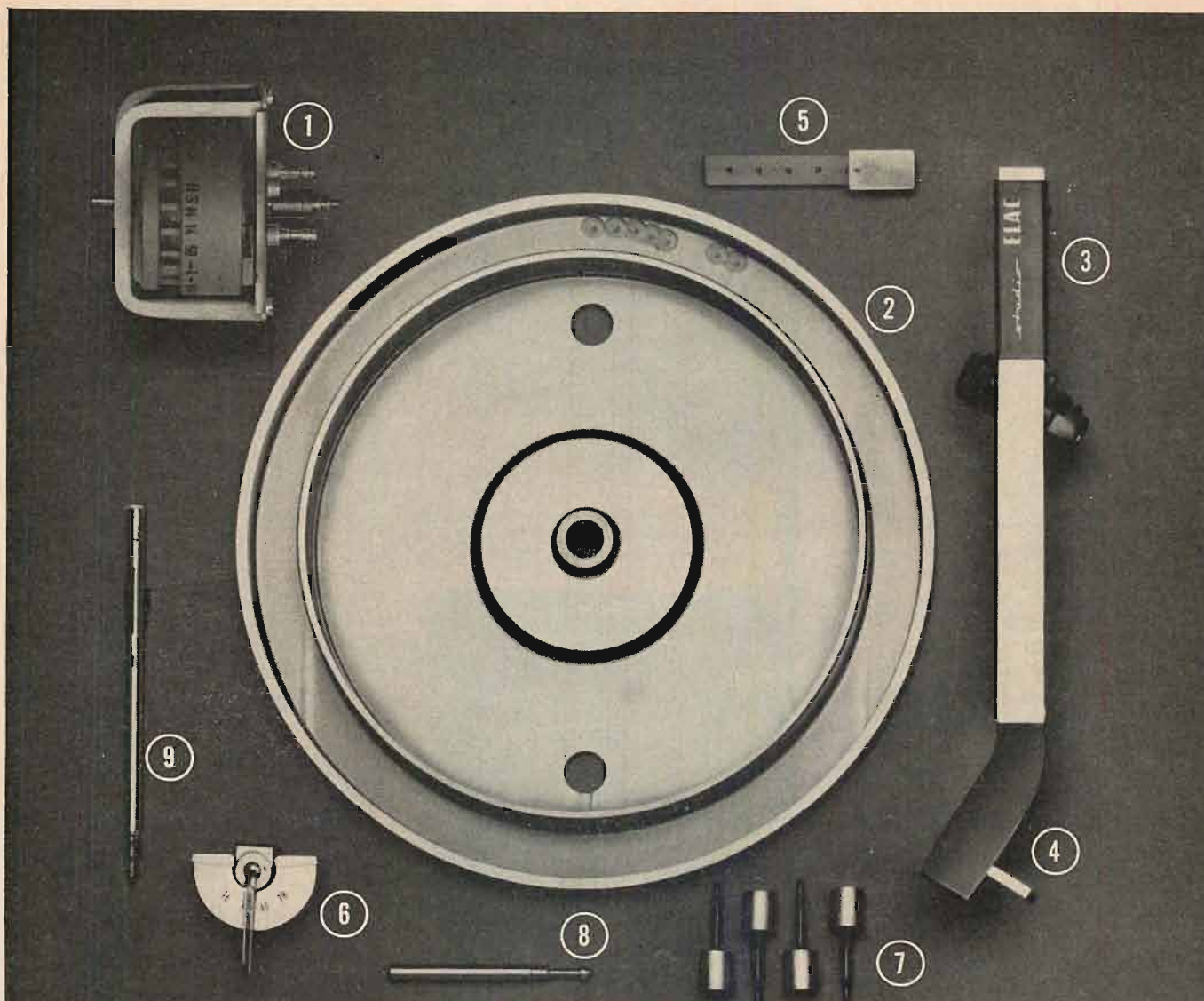


Fig. 16. The recording amplifier schematic diagram should be followed closely while wiring it up. Ground all unused contacts on Ry_{100} and Ry_{200} to prevent them from radiating bias voltage.



INSIDE MIRACORD

the first automatic turntable/record changer designed to meet the uncompromising requirements of stereophonic record reproduction



These are the "guts" of the new MIRACORD Studio Series. Foremost is the hysteresis motor (1). It guarantees constant speed regardless of turntable load or line voltage variation. Another assurance of all-important uniform speed is the one-piece, dynamically balanced, cast and machined turntable (2). This seven pound, 12" platform features the same construction as the finest professional turntables. The scientifically designed, non-resonant tone arm (3) with plug-in head (4) tracks faultlessly at all recommended tracking weights . . . calibrated

from two to six grams. No springs used (5). The 4-speed MIRACORD (6) plays all size records as a conventional turntable or automatic turntable using the *feather-touch* push-buttons (7). By replacing the short spindle (8) with the patented Magic Wand changer spindle (9), MIRACORD provides hours of musical enjoyment.

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* Complete with arm, less cartridge and base.

milliseconds after Ry_1 has removed voltage to it. This delay is sufficient to allow all the tone burst on the tape to get completely past the cue-sensing head.

If the tone signal were left in contact with the head when the tape stopped, each time the operator attempted to start it, the cue-sensing circuit would trip out repeatedly until all the tone was pulled past the head.

Terminals 7, 8, 9, and 10 on terminal board TS_1 are explained as follows: Although the equipment will work well without a ground connection, terminal number 8 has been provided for that purpose.

Terminal number 7 can be connected to terminal number 6 on a second playback deck. When Ry_2 on the first machine trips out, it will momentarily provide a 24-volt pulse to the second machine's START circuit. If two machines are cross-connected, announcements could appear on one machine and a music tape on the other. After you start the first machine, they will continue to alternate until one is turned off.

Terminals 9 and 10 can be used to close a remote indicator lamp circuit and show which unit is being used. Or they may be used to close an auxiliary relay whose wiper contacts are connected to a program buss. Its fixed contacts would be connected to the output of the player program amplifier. By interlocking relay contacts, only the machine being operated would have its audio fed to the buss.

A great deal of time and thought was spent in laying out the chassis and panels to make the equipment easy to maintain. Heads and pressure rollers are easy to reach for cleaning. The plugin, modular, program, and cue-sensing amplifiers are simple to service. Diodes were placed in holders instead of soldering them into the circuit. The record bias voltage is easy to check. Relay contacts are easy to reach for cleaning. Due to the hinged front doors on the cabinets, tubes, transistors, and nearly all other components may be reached without removing the equipment from its cabinet.

Maintenance consists of cleaning and lubricating the heads one a week. The capstans and pressure rollers are cleaned with the head cleaner once a week also.

Every month the heads are demagnetized and the azimuth head alignment is checked. We use an Ampex 7½-ips full-track alignment tape loaded into a tape magazine. A "sprinkle" of powdered graphite should be placed inside the magazine.

Our system has been in *very active* use for well over a year. To date, the only unscheduled service work performed on our four machines has been to replace a silicon diode in the solenoid

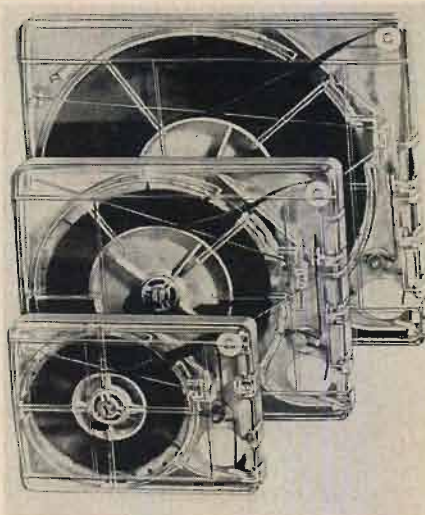


Fig. 17. The Conley Tape Magazines come in three convenient sizes. (Photo courtesy Conley Electronics, Inc.)



Fig. 18. The equipment is housed in a mica-covered plywood cabinet. Its front door drops down part way for convenient weekly maintenance. It opens all the way for major servicing problems.



Fig. 19. Three playback decks can be put in one cabinet. The front door folds down on this cabinet too.

power circuit. It developed a short after only two months operation. Also, one 2N44 switching transistor developed excessive leakage current and was replaced.

The top felt washer around the capstan shaft of two of the puller mechanisms wore out. This allows the flywheel to drop down and rub on the bottom bearing plate.

Believing this would ultimately cause trouble in the rest of our machines, we designed a thrust bearing and put it on all units.

It is made by drilling and tapping a piece of ¾" × 1" brass rod to accommodate a 7/16-in. cap screw. The end of the brass rod is drilled out just enough to let it seat comfortably over the existing Oilite bearing on the bottom plate. Our brass "foreign attachment" is brazed into place on the bottom side of the plate.

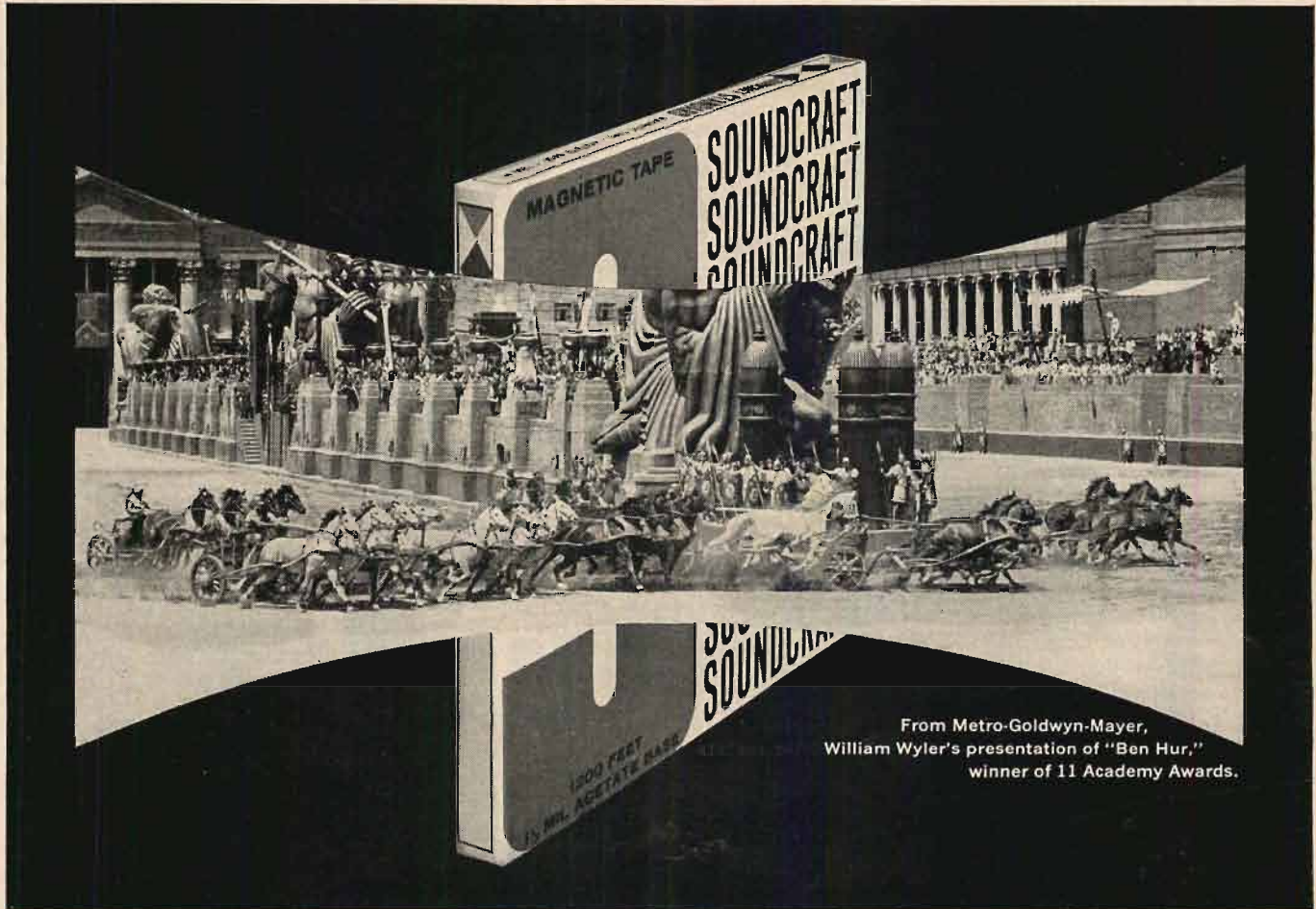
A ¼-in.-thick nylon disc is dropped into the well formed by the brass sleeve over the bearing. A 7/16-in. cap screw, equipped with a locking nut, is screwed into the sleeve until it forces the nylon disc against the bottom of the flywheel shaft. Another half-turn is usually adequate to put the capstan shaft in its original position. The locking nut is then tightened.

Actually this thrust bearing makes our playback deck a quieter machine than it was before the modification.

The Conley Tape Magazine is an amazing device, but like any object employing moving parts, it does develop trouble occasionally. Here are a few suggestions that may help you service them.

If you load your own magazines, don't wind the tape on its reel too tightly. Wind it by using the fast-forward speed of a regular tape recorder. For loading small amounts of tape on a reel, I've found a transcription turntable running at 33⅓ rpm works quite well.

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Remember, this is one instance where you wind the tape on its reel with the oxide coating facing out.

Adjust the pressure pads so they are approximately 1/8-in. from the face of the magazine.

The white plastic pulley located in the front corner of the magazine sometimes comes loose and works its way out of its socket. When this happens, open the cover of the magazine and press it back into place.

When you replace the reel in the magazine after having wound some tape on it, be sure the small nylon washer is in place under the reel. See too that it has adequate lubrication. If not, use a small amount of white phonograph grease of the type sold by most radio supply houses. General Cement manufactures it.

Our "Fidelimatic" system has not been restricted to just recording and playing commercial announcements. Program themes, musical bridges, safety messages, and even short programs are now carried on the tape magazines.

As stated earlier, we used the N.A.B. tape recording standard as our goal. We have been able to consistently maintain an over-all frequency response from 30 cps to 10,000 cps within 3 db of that set forth in the N.A.B. standard.

To check over-all frequency response, we recorded the test tones 15 db below normal program level.

Hum and noise combined, from the over-all system is well below the "white noise" level of the transistor preamplifiers.

By keeping your recording level a few decibels lower it is possible to hold distortion down to 2 per cent. We preferred putting a little more audio on the tape and distortion may sometimes reach 4 per cent on our recordings without being too noticeable.

For those who would like to know if we made Mr. Byrd's deadline of "three months and under \$500" for the pilot model, I'll confess: It took four months to deliver the first working model, but we stayed considerably under \$500! \pounds

NOTES

1. John L. MacAllister, "A Tape System You Can Build," *Radio and Television News*, in four parts, Feb.-May 1956.

2. Paul Penfield, Jr., "A Transistor V. U. Meter," *Audio*, April 1957.

3. Harold Reed, "20-cps Tape Recorder Switch," *Radio & Television News*, April 1959.

PARTS LIST FOR PLAYBACK DECK

- C_1 , 0.5 μf , 200 v
- C_2 , 500 μf , 50 v, electrolytic
- C_3 , 0.5 μf , 200 v
- C_4 , 60 μf , 250 v, electrolytic
- C_5 , 0.5 μf , 200 v
- C_6 , 25 μf , 25 v, electrolytic
- C_7 , 500 μf , 25 v, electrolytic
- C_8 , 500 μf , 25 v, electrolytic
- D_1 , Silicon rectifier, Sarkes-Tarzian M-500
- D_2 , Same as D_1

- D_3 , Zener diode, Motorola 10M22Z5*
- D_4 , Diode, 1N91
- D_5 , Diode, 1N34A
- D_6 , Same as D_5
- F_1 , 3AG, 3 amp (in holder)
- S_1 , Socket, Cinch-Jones (S-308AB)
- J_2, J_3 , Double phono jack assembly
- PL_1 , Pilot lamp socket with green jewel and #313 pilot lamp
- PL_2 , Pilot lamp socket with clear jewel and NE-51H lamp
- Q_1 , Transistor, 2N44
- R_1 , 7.5 ohms, w.w., 10 watts
- R_2 , 100 ohms, 1 watt
- R_3 , 470 ohms, 1/2 watt
- R_4 , 100 ohms, 1/2 watt
- R_5 , 56,000 ohms, 1/2 watt
- R_6 , 25 ohms, w.w., 10 watts
- R_7 , 470 ohms, 1/2 watt
- R_8 , 1200 ohms, 1/2 watt
- R_9 , 1200 ohms, 1/2 watt
- Ry_1 , Potter-Brumfield KRP-14D, 24 volt dc relay (3PDT)
- Ry_2 , Sigma 4F8KS-SIL sensitive relay (SPST)
- Ry_3 , Amperite 115N05-T thermal time-delay relay
- S_1, S_2 , Octal sockets
- Sw_1 , SPST toggle switch
- Sw_2 , Microswitch 11SM1 (with spring removed)
- Sw_3 , A.H. & H. 80541 pushbutton switch (Momentary make, normally open circuit)
- Sw_4 , Same as Sw_3 , except normally closed circuit
- T_1 , Stancor P-6469 transformer
- T_2 , United Transformer Co. Model 0-20
- TS_1 , Cinch-Jones 10-140 barrier strip
- Solenoid, Model D-70 (Anderson Controls, Inc., Franklin Park, Illinois)
- 11 contact relay socket
- 1N34A diode holders
- Silicon diode holders
- Transistor sockets
- 9-pin miniature socket for thermal relay
- Bud CB-1371 panel chassis
- Bud PA-1106G aluminum rack panel
- Viking Model #35 Continuous Tape Loop Handler equipped with a Viking H-35B head assembly
- Solenoid-linkage assembly
- Engraved front panel label strip
- Cartridge entrance escutcheon
- Cartridge hold-down spring material
- Front and rear linkage bumpers
- Linkage return spring
- Bakelite mounting board for Sigma relay
- 18-in. phono cables (4)
- 7 1/2" x 7 1/2" x 11" aluminum panel to be made into a top plate
- Mica washers (to be used between the zener diode and chassis) (2)
- Assorted small hardware such as machine screws, nuts, washers, etc.

PARTS LIST FOR PLAYBACK AND CUE-SENSING AMPLIFIERS. (ONE AMPLIFIER)

- C_1 , 25 μf , 25 v
- C_2 , Same as C_1
- C_3 , .005 μf , 200 v
- C_4 , 100 μf , 12 v
- C_5 , 10 μf , 12 v
- P_1 , 8-pin octal plug (Amphenol 86RCP8)
- R_1 , 47 ohms, 1/2 watt
- R_2 , 15,000 ohms, 1/2 watt
- R_3 , 1500 ohms, 1/2 watt
- R_4 , 12,000 ohms, 1/2 watt
- R_5 , 330,000 ohms, 1/2 watt
- R_6 , 3300 ohms, 1/2 watt
- R_7 , 10,000 ohms, 1/2 watt
- R_8 , 5000 ohms, audio taper potentiometer
- R_9 , 4700 ohms, 1/2 watt
- Q_1 , 2N508 transistor
- Q_2 , Same as Q_1
- Q_3 , 2N322 transistor
- Bud CU-3003 Minibox

USECO current terminals (2000-B)
Pre-punched bakelite board (Keystone #1736)
Cinch-Jones #2H3 transistor sockets (3)
Small hook-up wire

PARTS LIST FOR THE RECORDING AMPLIFIER

- C_1 , A, B, and C 20/20/20 mfd. @ 450 volts can type electrolytic capacitor
- C_2 , 0.1 μf , 450 v
- C_3 , 25 μf , 25 v, electrolytic
- C_4 , 0.047 μf , 400 v
- C_5 , 25 μf , 400 v, silvered mica
- C_6 , .01 μf , 400 v
- C_7 , 100 μf , 400 v, silvered mica
- C_8 , 0.5 μf , 400 v
- C_9 , 500 μf , 400 v, silvered mica
- C_{10} , .001 μf , 400 v
- C_{11} , 500 μf , 400 v, silvered mica
- C_{12} , 100 μf , 400 v, silvered mica
- C_{13} , .01 μf , 400 v
- C_{14} , .01 μf , 400 v
- C_{15} , 2 μf , 10 v, electrolytic
- C_{16} , 2 μf , 25 v, electrolytic
- C_{17} , 500 μf , 25 v, electrolytic
- C_{18} , 500 μf , 25 v, electrolytic
- R_1 , 6800 ohms, 1/2 watt
- R_2 , 1200 ohms, 1/2 watt
- R_3 , 6800 ohms, 1/2 watt
- R_4 , 500,000 ohms, deposited carbon potentiometer
- R_5 , 2200 ohms, 1 watt
- R_6 , 100,000 ohms, 1/2 watt
- R_7 , 10,000 ohms, 1/2 watt
- R_8 , 1 megohm, 1/2 watt
- R_9 , 100,000 ohms, 1/2 watt
- R_{10} , 220,000 ohms, 1/2 watt
- R_{11} , 2200 ohms, 1 watt
- R_{12} , 100,000 ohms, 1/2 watt
- R_{13} , 47,000 ohms, 1/2 watt
- R_{14} , 22,000 ohms, 1/2 watt
- R_{15} , 1800 ohms, 2 watts
- R_{16} , 100,000 ohms, deposited carbon potentiometer
- R_{17} , 22,000 ohms, 1/2 watt
- R_{18} , 2200 ohms, 1/2 watt
- R_{19} , 250,000 ohms, deposited carbon potentiometer
- R_{20} , 30,000 ohms, w.w., 10 watts
- R_{21} , 100 ohms, 1/2 watt
- R_{22} , 4700 ohms, 1/2 watt
- R_{23} , 1 megohm, 1/2 watt
- R_{24} , 3600 ohms, 1/2 watt
- R_{25} , 3900 ohms, 1/2 watt
- R_{26} , 1000 ohms, 1/2 watt
- R_{27} , 100,000 ohms, 1/2 watt
- R_{28} , 270,000 ohms, 1/2 watt
- D_{100} , Silicon rectifier, Sarkes-Tarzian M-500
- Q_{100} , 2N105 transistor
- J_1 and J_2 , Double phono jack assembly
- J_1 and J_2 , Double phono jack assembly
- J_3 and J_4 , Double phono jack assembly
- J_5 , Single phone jack (headphones)
- PL_{101} , NE-51H lamp and holder with a red plastic jewel
- Ry_{100} , Potter-Brumfield MG-17D (24 v dc)
- Ry_{200} , Potter-Brumfield MG-17D (24 v dc)
- M_1 , Simpson Model 142 V.U. meter
- Sw_{100} , Momentary SPST push-button switch (red button)
- Sw_{200} , Switchcraft Type 1006 DPDT switch
- T_1 , UTC Type A-11 audio transformer
- T_2 , Viking Type D-501 oscillator transformer
- T_3 , UTC Type HA-122 power transformer
- TS_{101} , Cinch-Jones 3-140 barrier strip
- TS_{102} , Cinch-Jones 2-140 barrier strip
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- V_1 , 12AU7
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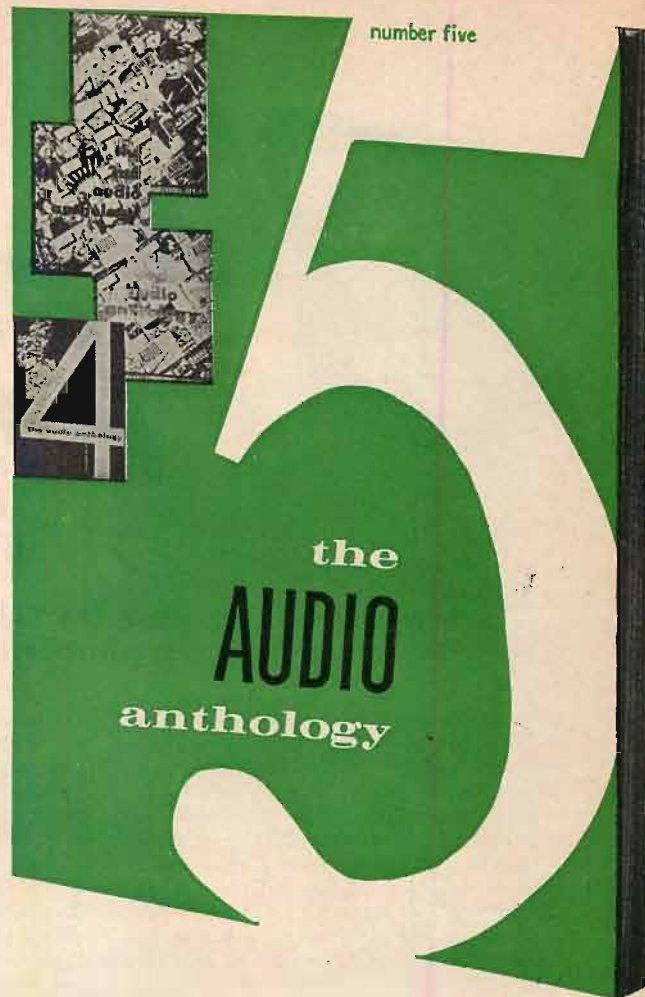
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The Tape Guide

HERMAN BURSTEIN *

Beginning with this issue, The Tape Guide is being reactivated as a question and answer department. Send your questions direct to Mr. Burstein at the address given below.

In this issue and in issues to follow, we shall try to answer basic questions on tape recorders and recording. Readers are invited to send their queries directly to the writer at his home address. While all questions will be answered by mail, those of a fundamental nature and most apt to be of widespread interest will also be answered in these pages.

Please do not ask us to evaluate the merits of specific tape machines. For this kind of information, we ask you to refer to the Equipment Profiles appearing in another department of this magazine.

If you experience troubles with a specific machine, we strongly suggest that you write to the manufacturer rather than us. Every tape recorder is quite individualistic in its approach to transporting the tape from one reel to another, and the manufacturer is by far the one eminently suited to answer questions concerning the mechanism he makes.

Please enclose a stamped, addressed envelope. Letters which include such an envelope, through some occult force, rise to the top of the pile and get answered first.

Q. I am building a tape amplifier, and in this connection want to know how high is the impedance of a high-impedance tape head?

A. The typical record-playback head employed in home tape machines has an inductance of about 500 millihenries. At a bias frequency of 50,000 cps, the impedance would be about 160,000 ohms. The impedance would be proportionately greater or smaller at higher or lower bias frequencies. Thus the impedance would be about 320,000 ohms at a frequency of 100,000 cycles. In the audio range of 20 cps to 20,000 cps, the impedance would vary from about 65 to 65,000 ohms. If the tape head is designed specifically for playback, its inductance is likely to be about 1000 millihenries and therefore the impedance figures given above would double. These impedances have to be taken into consideration in designing an amplifier which can

provide sufficient amounts of bias current and audio signal current for recording purposes.

When using a record-playback head for recording, it is necessary to obtain constant current through the record head at all audio frequencies (before taking equalization into account), thereby achieving flat response in terms of the magnetic field applied to the tape (as contrasted with the signal impressed on the tape, which undergoes severe treble losses). To obtain constant current, a resistor is placed in series with the driving tube and the record head. To serve its purpose of preventing treble loss, the constant-current resistor must, in combination with the other circuit resistances (principally the driving tube), swamp (exceed) the impedance of the tape head at all audio frequencies. Allowing for the plate resistance of the driving tube, it works out that a constant-current resistor of about 33,000 to 56,000 ohms is usually adequate. If the tape head is specifically designed for recording, it is apt to have much less than 500 millihenries inductance, probably under 100 millihenries. Then a constant-current resistor is usually not necessary, because the plate resistance of the driving tube is sufficient to swamp the impedance of the record head.

Q. I would like to construct a tape bias oscillator. Can you please supply a schematic of one that will provide high-quality performance.

A. I think your best course would be to model the oscillator after one of the high quality tape machines on the market. Schematics can be obtained from manufacturers and service agencies. In building a non-commercial design, one of our problems would be to obtain a suitable oscillator transformer, which is not a stock item. But if you model the oscillator after a commercial tape machine, you can probably obtain the required transformer from an authorized dealer or service agency. I suggest that you pick a design which employs a push-pull arrangement for least distortion. The lower the distortion in the bias waveform, the less noise will be produced in recording by the bias frequency. Another prob-

lem that you will encounter is whether your bias oscillator is suited to the tape heads you plan to use. If you have reason to believe that the record and erase heads you are using have impedances similar to those in the commercial machine whose oscillator you are copying, chances are that you will have no problem. But if the head impedances differ substantially, it may be best to apply to the manufacturer of your heads for an oscillator design capable of supplying the proper amounts of oscillator current to each head.

Q. I am building a tape amplifier and would like to know if it is advisable to split the equalization between record and playback; that is, use the same amounts of compensation in each mode. This would enable me to simplify the design considerably, compared with having to incorporate different equalization in each mode.

A. For best results in terms of good frequency response, low noise, and low distortion, it is not a good idea to split the equalization between record and playback. Treble boost should be applied mainly or altogether in recording, because treble boost in playback emphasizes noise and hiss of the playback amplifier. Bass boost belongs mainly or altogether in playback, because bass boost in recording tends to overload the tape.

Q. I am considering the purchase of a portable, single-speed tape recorder of the pocket or brief-case type for confidential work. Some of these machines operate at 3¼ ips and others at 1½ ips. Which do you advise?

A. For economy of space, weight, and cost relative to recording time, a unit that operates at 1½ ips of course has the edge; it provides twice as much recording time per foot of tape compared with a unit whose speed is 3¼ ips. The slower machine will be satisfactory if its duties are limited to reproducing speech in intelligible fashion. But if the requirements are more exacting, such as faithful reproduction of music, then it appears that your choice, considering the present state of the art, is 3¼ ips. AE

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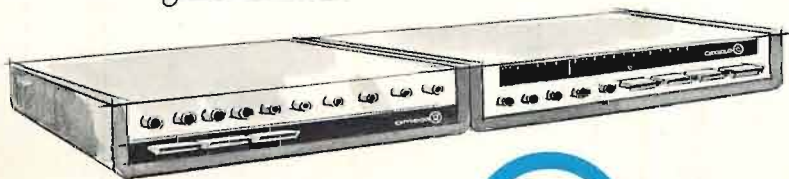
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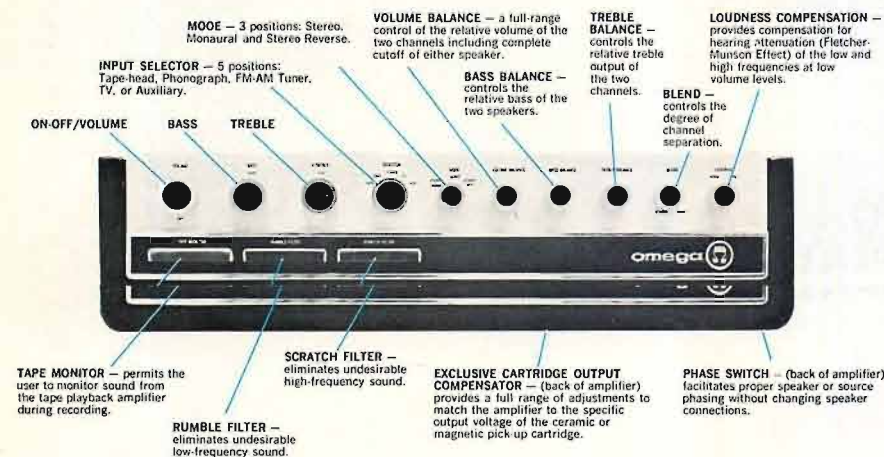
first — transistors have an indefinite life and do not deteriorate as do tubes.

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A Feel for Transistors

L. GOELLER*

Reduced prices, off-the-shelf availability, and special properties make transistors desirable in many audio circuits. All that remains is for the designer to develop the "feel." Here's how . . .

ALMOST EVERYONE SEEMS to approach transistor circuits with fear and trembling. This attitude is doubtless induced by the relationship between transistors and solid-state physics, a subject of considerable complexity. It is apparently not generally realized that solid-state physics—and indeed all physics beyond Ohm's Law—can be avoided entirely while designing quite satisfactory audio-frequency transistor circuits. Only three basic rules are needed:

1. If the transistor is going to work at all, its base is at almost the same voltage as its emitter. This applies to both d.c. (bias) voltages and a.e. (signal) voltages.
2. The currents in the base, emitter, and collector leads are related by the three symbols α , β , and γ as summarized in Fig. 1. It is convenient to remember that α is nearly unity and β is nearly equal to γ and numerically equal to 20 or more.

* 2 Marsha Terrace, Parsippany, N. J.

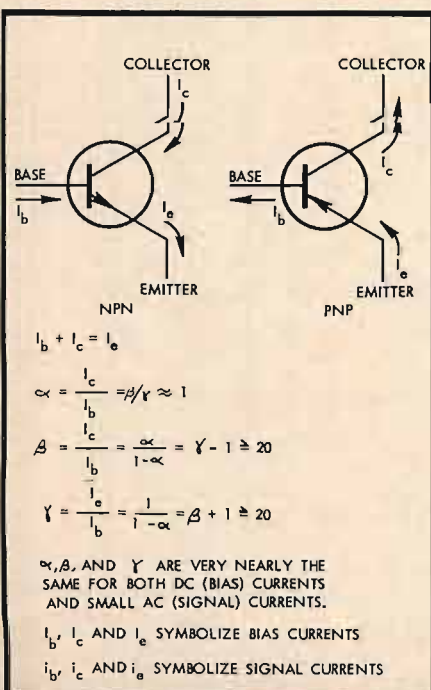


Fig. 1. Relationships between α , β , and γ .

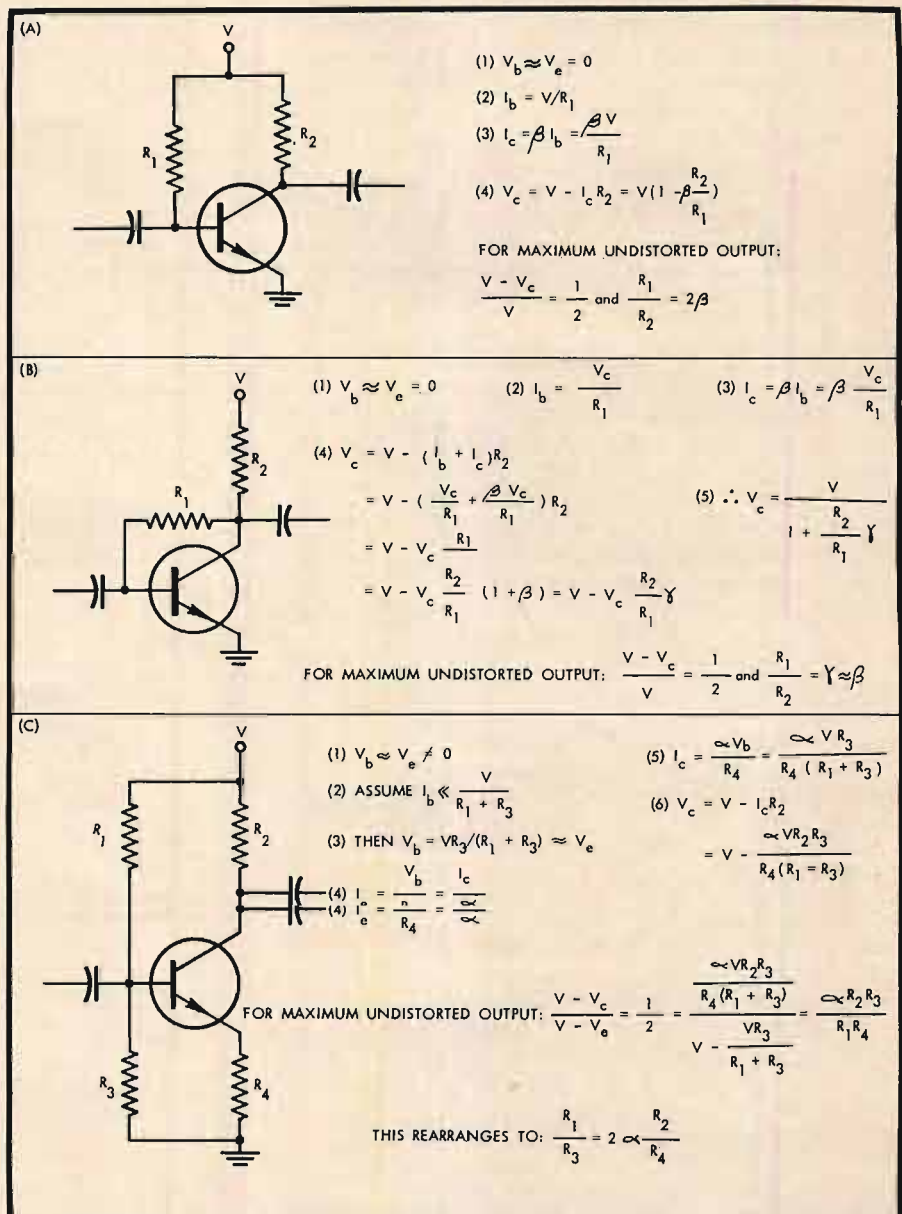


Fig. 2. Bias circuits: (A) simple, (B) better, (C) much better.

3. The resistance between the base and emitter leads is very low and corresponds to a forward-biased diode. The resistance between the base and collector is very high and corresponds to a back-biased diode.

Biasing

With these three rules and a firm

grasp of Ohm's Law, a surprisingly complete knowledge of transistor audio amplifiers can be deduced. As an example, consider the typical bias circuit shown in (A) of Fig. 2. If the voltage at the base is equal to the voltage at the emitter, and the emitter is grounded, it follows that the current in R_1 is obtained by dividing R_1 into V . The collector cur-

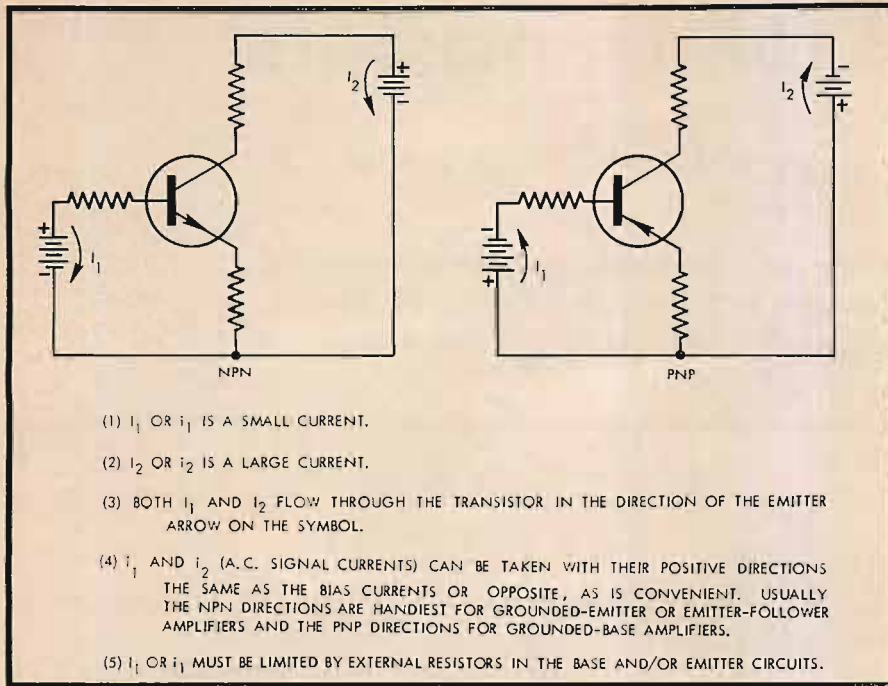


Fig. 3. Current direction rules.

rent is β times as large as the base current and flows in R_2 . The voltage at the collector is the supply voltage, V , minus the IR drop in R_2 . Thus, if we are given (or can measure) β for the given transistor, we can choose values of R_1 and R_2 to provide the proper bias.

This brings up two points of digression. First, if β in ten supposedly similar transistors is measured, the largest β will probably be about five times the smallest. Under such circumstances, R_1 and R_2 would have to be changed for every transistor replacement. Fortunately, as we shall see, there are better biasing circuits which do not depend upon variations in β .

The second item is the little problem of what bias is a good bias. In discussions of vacuum-tube circuits, statements about "choosing the most linear part of the operating characteristic" are often observed. A similar statement for transistors might be made, but, since transistors are relatively linear over a wide operating range, a more specific meaning must be attached. We simply do not want the transistor to be saturated or cut off during any part of the signal cycle. That is, we don't want the collector current to be so large that the drop it produces in the load resistor is larger than the supply voltage, and we don't want it so small that it fails to flow at all.

This is a situation seldom encountered in vacuum tube work. With a 200 volt supply and a signal of 2 volts rms at the plate, there is little fear that the signal voltage will overpower the bias. The same 2-volt signal at the collector of a transistor would, however, mean a

peak-to-peak swing of nearly 5.7 volts. If the supply voltage happened to be 6 volts, a popular value in transistor work, nonlinear operation could be avoided only if the collector d.c. voltage in the absence of signal were adjusted to one half the supply voltage in the circuit shown in (A) of Fig. 2. Then the positive and negative swings would both remain just short of trouble. The general conclusion we can draw is this: the collector should be biased to a value halfway between the emitter and supply voltages in resistance-coupled amplifiers.

It should now be a simple matter to follow a similar analysis through for (B) of Fig. 2. This circuit is interesting because, if we adjust R_1 and R_2 for the maximum undistorted output as discussed above, the collector voltage will be only half as sensitive to variations in β as the circuit of (A). Proof of this is left as an exercise for mathematics professors.

The ratio R_1/R_2 has been related to β in these two examples. Successful biasing, however, requires particular values for these resistors and the proper polar-

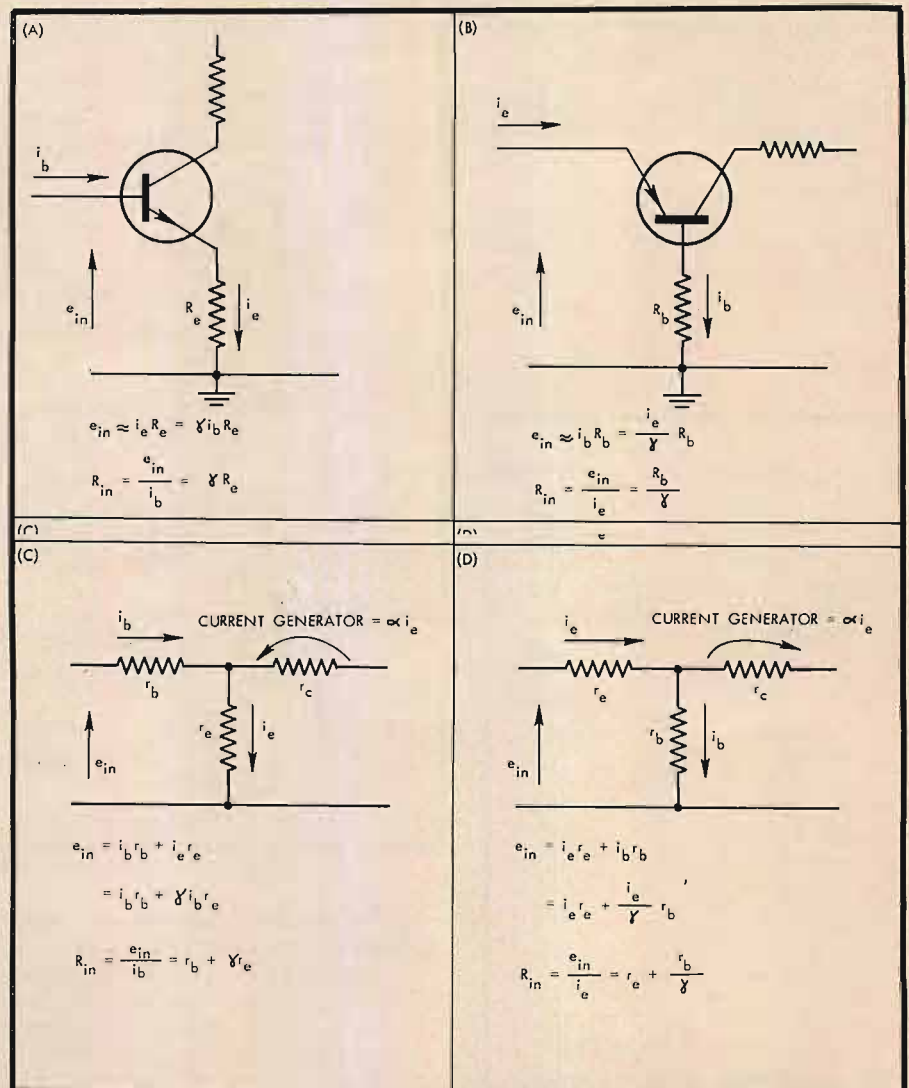
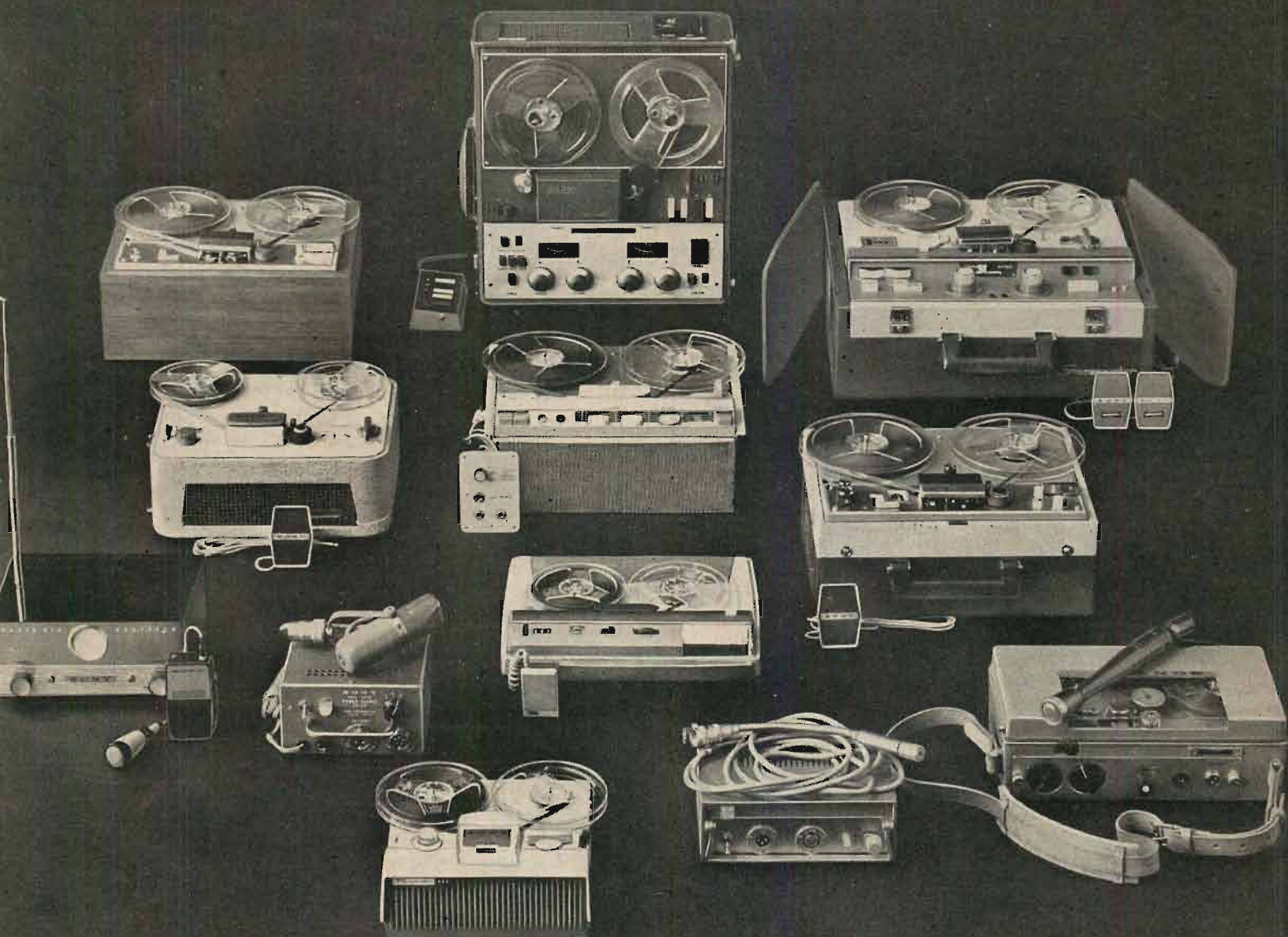


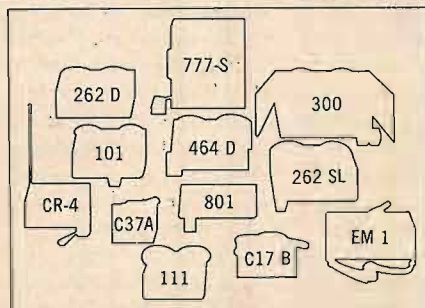
Fig. 4. Input impedances: (A) and (B) first approximations, (C) and (D) better approximations.



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ity for the bias supply. Considering the latter first, Fig. 3 summarizes the current direction rules. Base and collector current combine to form emitter current and emitter current flows in the direction of the arrow on the emitter lead in the transistor symbol. In a PNP transistor the arrow points in; it points out for a NPN transistor. The base current is small; the collector current is large. Base current controls collector current. To rephrase this for emphasis, the collector current is very nearly as large as the emitter current; the difference between them is the base or control current which is usually less than 5 per cent of the emitter current.

The actual sizes of R_1 and R_2 in Fig. 2 are determined by the signal currents involved and also by leakage currents which are often an unpleasant transistor by-product. For the time being a rule-of-thumb can be offered: for supply voltages between about 6 and 20 volts, R_2 should be somewhere between 1000 and 20,000 ohms and R_1 should be on the order of β times as large.

The circuit of (C) in Fig. 2 can now be attacked. If we make the assumption, which will be justified later, that $V/(R_1 + R_2)$ is much greater than I_b , or about the same size as I_c , the analysis is easy. V_e is just about equal to V_b and V_b is fixed by the voltage divider. Therefore, the current in the emitter is V_e/R_e . This same current flows through R_2 , or, to be more exact, αI_e gets there. It follows that V_e is fixed by α and the four resistors. Since α varies from about 0.95 to 0.999, its variation is of negligible importance. The factor β is derived from α as indicated in Fig. 1. The two values of α given above correspond to β 's of approximately 20 and 1000. This illustrates the importance of depending on α rather than β for bias stabilization.

Input Impedance

Now that the transistor is biased properly, new data must be obtained if an amplifier is to be designed successfully. In particular, input and output impedances are required. Here we come to the main difference in transistor and vacuum-tube theory. A vacuum tube has very nearly infinite input impedance. At audio frequencies, it presents no loading to the previous stages, and is not loaded by the stages which follow. In contrast, transistor input impedances are quite low. The output impedance of the driving stage and the input impedance of the following stage affect the behavior of the stage under consideration. It is this basic situation which causes 99 per cent of the troubles encountered by individuals oriented to vacuum tubes.

Since the low input impedance is the factor which causes the trouble, let's look at it in terms of Ohm's Law. Con-

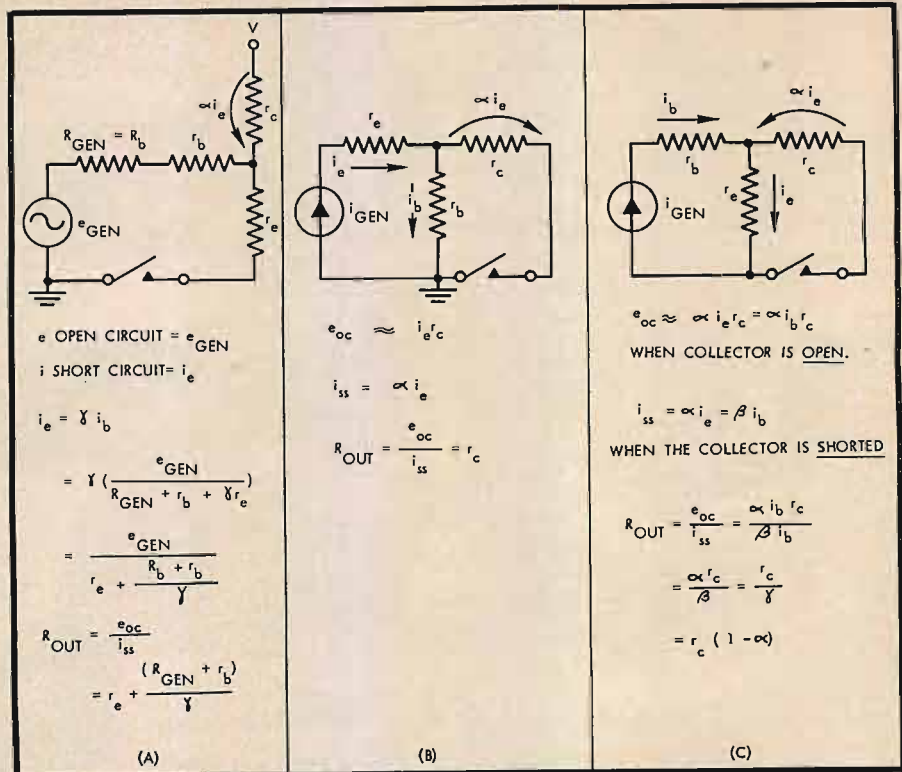


Fig. 5. Output impedances by the open-circuit short-circuit method: (A) emitter follower, (B) grounded base, (C) grounded emitter.

sider the circuit of (A) in Fig. 4. Suppose i_b flows into the transistor. e_{in}/i_b is the input impedance. But e_{in} is given by the voltage drop across R_e . This, we know, is $i_e R_e$, or $\gamma i_b R_e$. To a first approximation, therefore, the input impedance looking into the base of a transistor is γ times the impedance in the emitter circuit.

If we look into the transistor between the emitter and ground in the grounded base configuration of (B) in Fig. 4, we can apply the same technique. $e_{in} = i_b R_b$ and $i_b = i_e/\gamma$. Thus, the impedance looking in at the emitter is the base resistance divided by γ while the impedance looking in at the base is the emitter resistance multiplied by γ .

Unfortunately, things are not quite this simple. Suppose, for instance, the circuit of (A) in Fig. 2 is encountered, and no resistance is present in the emitter lead. The resistances internal to the transistor must now be examined. They are small, but sometimes they are dominant. The circuit of (C) in Fig. 4 shows the transistor internal resistance and how it is divided between the base and the emitter. If we proceed as in (A) of Fig. 4, $r_{in} = e_{in}/i_b = r_b + \gamma r_e$. Similarly, the procedure in (B) gives $r_{in} = e_{in}/i_e = r_e + r_b/\gamma$. Usually, r_b is of the order of 100 ohms or so. r_e is about 25 ohms, and can be approximated fairly accurately for small a.c. signals by $26/I_e$ where I_e is the d.c. bias current in ma when the transistor is operated at room temperature.

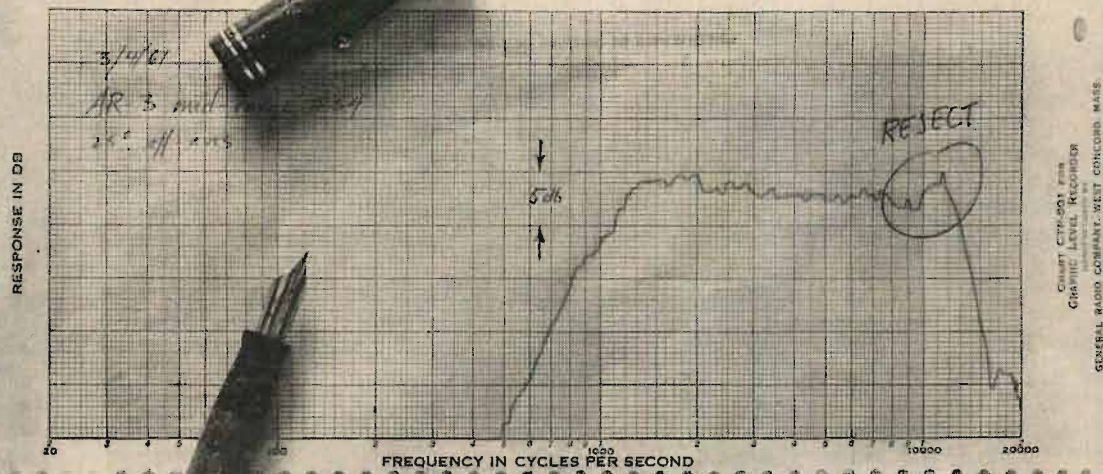
If both internal and external resistors are present, as is usually the case, there is no reason why they can't be lumped together in calculations (following the usual rules for series or parallel circuits as the case may be).

Note that for the first approximation the collector circuit has not even been considered. This is usually an excellent approximation, and can be justified by the fact that the collector resistance is on the order of 1 megohm or so. Thus, the collector circuit is effectively decoupled from the input circuits.

Output Impedance

So far, Ohm's Law has given the input impedance of the transistor in a simple and straightforward manner. But how about the output impedance? It must be obtained in a slightly different manner. The technique is called "the open-circuit short-circuit method," and is often better applied on paper than on actual circuit elements.

Consider a black box with two wires coming out of it. We know that inside the box a generator exists within a network of resistors. First, measure the open-circuit voltage. This gives an equivalent voltage generator. Then, measure the current which flows when the output leads are shorted. This current is obviously limited by the internal resistance and the generator voltage. Define a new resistance which is given by dividing the open-circuit voltage by the short-circuit current. If this resistance is



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Although this curve does not depart from the ideal by more than 2 decibels at any point, the sharp peak at 11,500 cycles is evidence of transient distortion.

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AR speakers are priced from \$89 to \$225. They may be heard at AR Music Rooms, on the west balcony of Grand Central Terminal in New York City, and at 52 Brattle Street in Cambridge, Massachusetts. No sales are made or initiated at these showrooms.

Literature, including a list of AR dealers in your area, is available for the asking.

ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge 41, Massachusetts

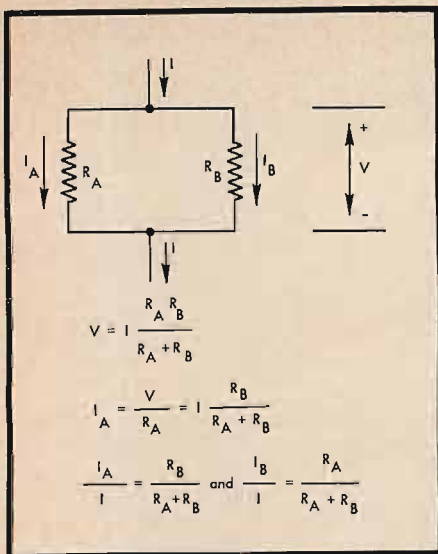


Fig. 6. Current divider.

placed in series with the open-circuit voltage generator, we have a simple functional representation of the whole circuit. Alternatively, we could use a current-generator approximation (based on the short-circuit current) in parallel with the same resistance.

If we try this idea on the emitter-follower circuit, we can get a check on its validity. We already know the impedance looking into the emitter; the output impedance should be the same. Consider the circuit of (A) in Fig. 5. If we open the emitter, the voltage at the base is e_{gen} . If we short the emitter, the current is $i_e = \gamma i_b$. Further, $i_b = e_{gen}$ divided by $(R_b + r_b + \gamma r_e)$. R_{out} must be, therefore, $\frac{R_b + r_b}{\gamma} + r_e$. This checks with our

previous result. The conclusion we must draw is this: The output impedance of the emitter follower is roughly the generator impedance divided by the current gain, γ .

Now we can attack the collector impedance. This is the most difficult of the pedance. This is the most difficult of the lot, but the open-circuit short-circuit method provides an excellent approximation. There are two configurations: grounded base, with the signal inserted at the emitter, and grounded emitter with the signal inserted at the base. The first is the easier of the two. From the circuit of (B) in Fig. 5, the open circuit voltage is $\alpha i_e r_c$. There is also a very small voltage due to the base current in r_b , but it can be neglected. The short-circuit current is simply αi_e . Thus, the output impedance is nothing but r_c . This is usually a very high value, on the order of 1 to 10 megohms. It can be seen that the grounded-base transistor acts very much like the ideal current source described in the textbooks.

For the grounded-emitter stage, the circuit of (C) in Fig. 5 is required. The open circuit voltage is $\alpha i_e r_c$ as before. But

there is an important difference. If the external collector circuit is open, the emitter current and the base current are the same. Therefore, we must remember that the open-circuit voltage is $\alpha i_b r_c$. The short-circuit current is $\alpha i_e = \beta i_b$, since i_b is not the same as i_e when collector current flows. The output impedance is

$$R_{out} = \frac{e_{oc}}{i_{sc}} = \frac{\alpha i_b r_c}{\beta i_b} = \frac{r_c}{\gamma} = r_c(1 - \alpha)$$

This is much lower than the output resistance of the grounded-base stage, but much higher than that of the emitter follower. This approximation is not as good as the one for the grounded-base configuration since the voltage drops in the base and emitter resistors are effectively larger. However, the approximation is good enough for most purposes.

The Amplifier Stage

The input and output impedances of the transistor alone are not enough to permit satisfactory circuit design. The transistor must always be embedded in a biasing circuit, and the biasing circuit will always have some effect on gain. To see what happens, consider the current-divider circuit of Fig. 6. A current I flows in the parallel combination R_A and R_B . As the calculations show, the ratio of current in one resistor to the total current is as the other resistor to the sum of the resistance. By dividing the numerator and denominator of the left-hand side of the equation by the numer-

ator, a slightly more useful form is obtained:

$$\frac{I_B}{I} = \frac{1}{1 + (R_B/R_A)}$$

This points out clearly that most of the current will flow in R_B only when R_B is much smaller than R_A . If R_B is the load and R_A is a bias resistor, the moral of the story should be clear.

As a specific example, the circuit of (A) in Fig. 2 is reproduced in Fig. 7, along with the equivalent circuit for a.c. signals as derived before. If we consider the output circuit first and assume the impedance of the coupling capacitor is small compared with the sum of the load and source impedance, the circuit reduces to three resistors in parallel driven by a current generator. We are interested in the part of the current available, βi_b , which we can get into the load.

At this point, there is usually a strong temptation to call R_2 the load resistor, by analogy with vacuum tube circuits. Nothing but trouble will result unless the temptation is strongly resisted. R_2 is a bias resistor. The load is the next stage or a loudspeaker or some such.

Thus, the output impedance of the grounded-emitter stage, as opposed to that of the grounded-emitter transistor, is R_2 in parallel with $r_c(1 - \alpha)$. This is the impedance the load sees looking back

(Continued on page 95)

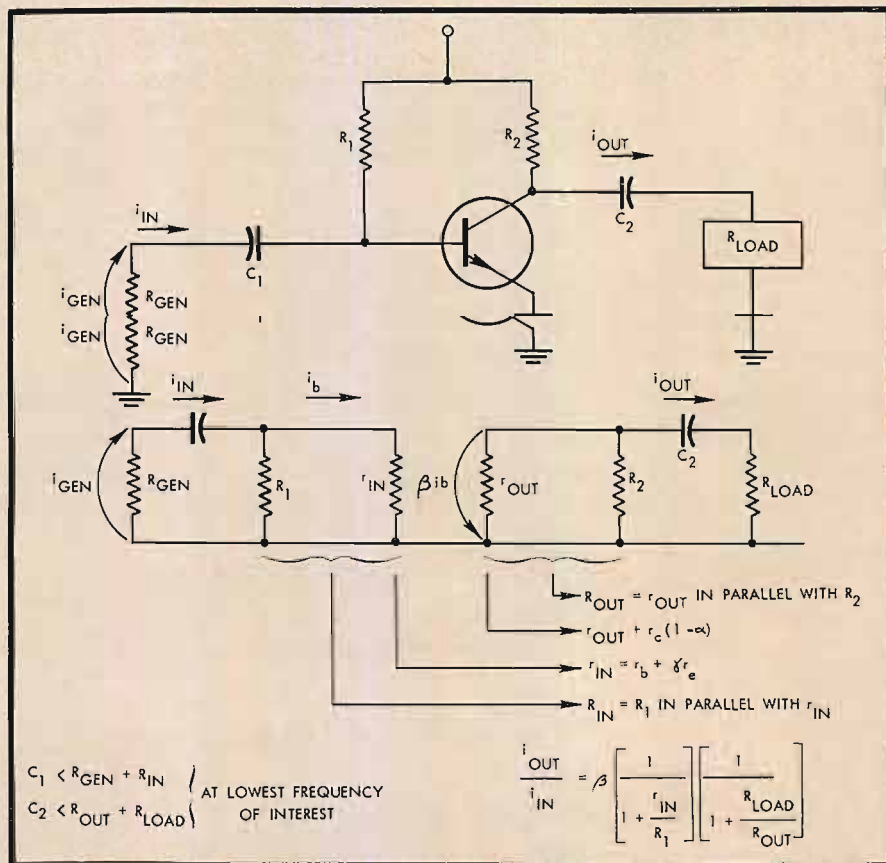
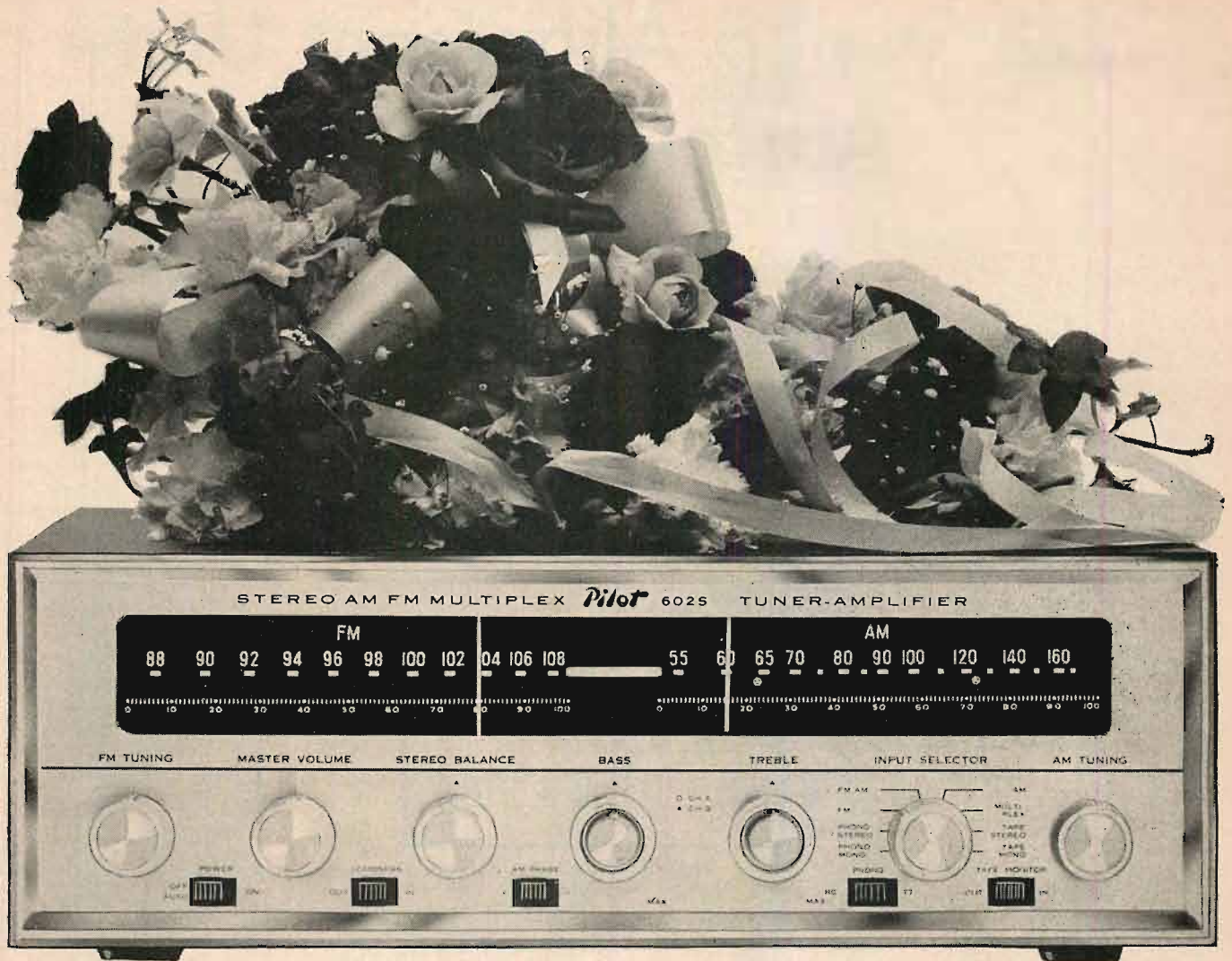


Fig. 7. Calculations for simple amplifier.



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FM Sweep Alignment Unit— Austerity Model

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AFTER SUCCESSFULLY assembling a commercial 3-in. oscilloscope kit, the writer had a hankering for a sweep generator with which to align the intermediate frequency transformers and discriminators of my FM tuner. The "Junk-box Alignment Unit" (AUDIO, December 1960) provides data that can be plotted to provide a frequency response curve, but with a sweep generator, the frequency response curve appears directly on the oscilloscope screen.

It was decided to make the width of sweep 10.2 to 11.2/mc, which is 500 kc on each side of the 10.7-mc center frequency; this should be more than ample

to check the response curve of any FM tuner. By restricting the required sweep to this range it is possible to omit much of the switching that is required in commercial sweep generators that are de-

signed to cover a number of bands. It is unnecessary also to obtain the sweep frequencies by using both a fixed-frequency oscillator and a tunable oscillator to produce a beat frequency; a single oscillator tunable over a frequency range somewhat greater than 10.2 to 11.2 mc is sufficient.

A considerable amount of literature, both books and magazines, was read, to learn as much as possible about the construction of sweep generators. One type utilizes a small loudspeaker "skeleton" connected to the 6.3-volt line which changes the inductance of the sweep circuit by moving an iron slug in or out of a coil at a rate of 60 cps. Another variation of this moves a plate or plates of a capacitor to change the capacitance of the circuit at the 60-cps rate. Use of either of these methods presented too many mechanical difficulties for a tyro constructor. A sweep generator based on a reactance tube is mechanically simpler, but looks rather complicated electronically. Then information appeared about the new voltage-variable capacitors; this looked like a simple and practical method of sweep-tuning an oscillator. After I obtained such a unit experimentation started on an empirical basis. The original intention was to use the "Junk-box Unit" as a marker generator for the sweep generator; but later I decided to build a duplicate marker generator on the same chassis with the sweep generator.

My junkbox supplied the metal case, chassis, power unit, 12AU7 and 12AV7 tubes, and a number of odd parts from a discarded commercial r.f. generator. Because the junkbox contained only a single-gang capacitor of suitable capacitance range, the marker generator is connected as a Hartley oscillator; otherwise it is essentially the same as the "Junk-box Unit." The only required parts that were not available in the junkbox were the Varicap (PSI, V-20) a new 8- by 10-in. aluminum panel to fit the r.f. generator case, and, as a later addition, a 10.7-mc crystal and its socket.

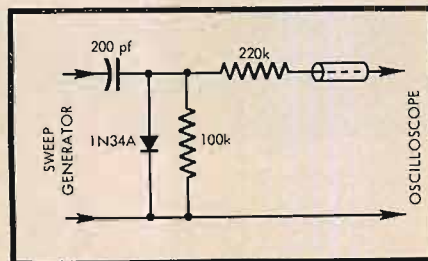


Fig. 2. Schematic diagram of demodulator probe.

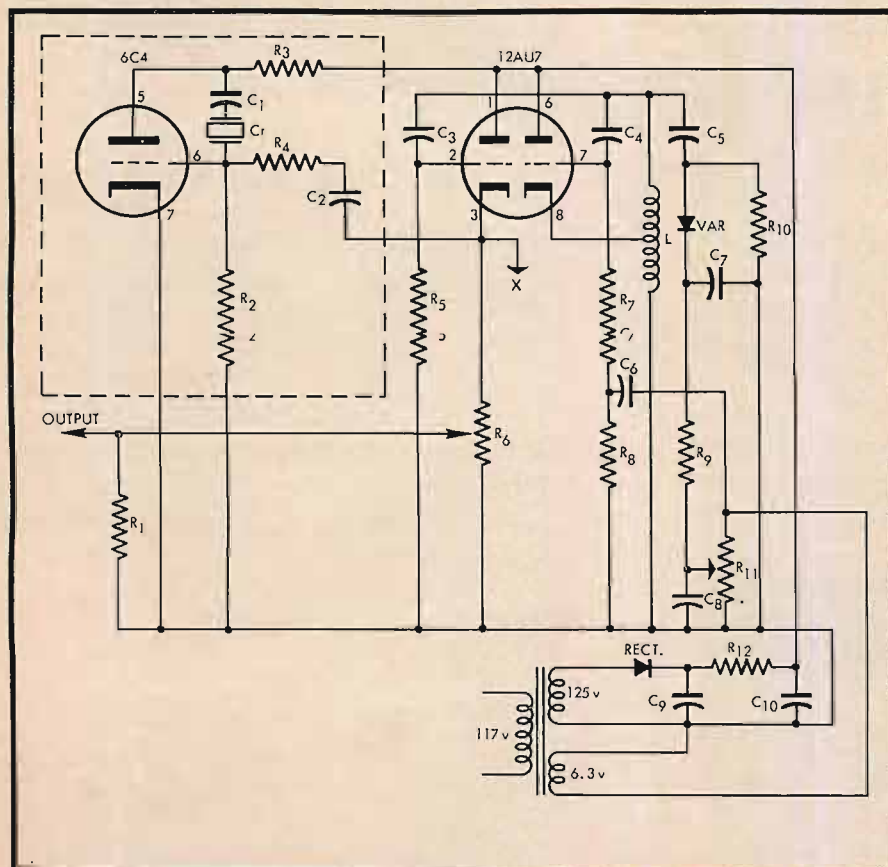


Fig. 1. Schematic diagram of sweep generator and 10.7 Mc fixed marker oscillator.

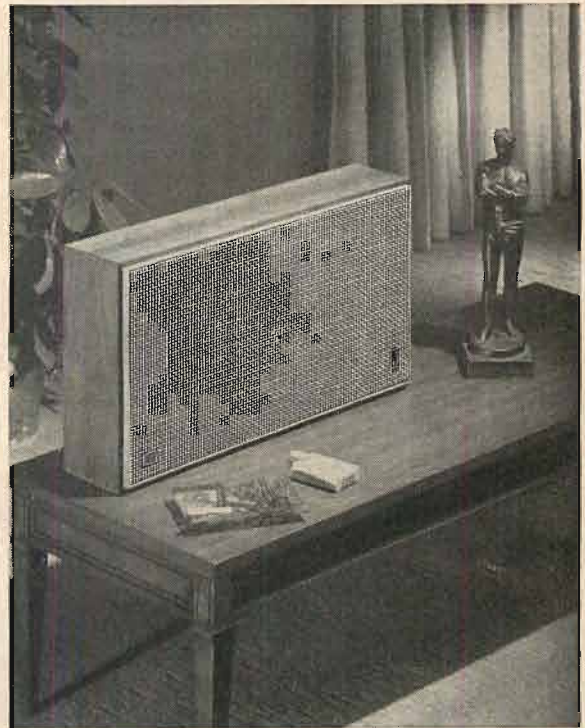
* P. O. Box 160, Times Square Station, New York 10, N.Y.

Jensen's New 3-P Speaker Systems

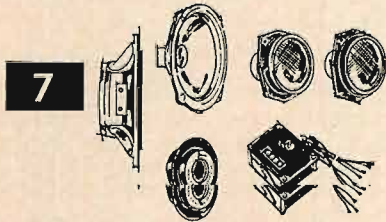
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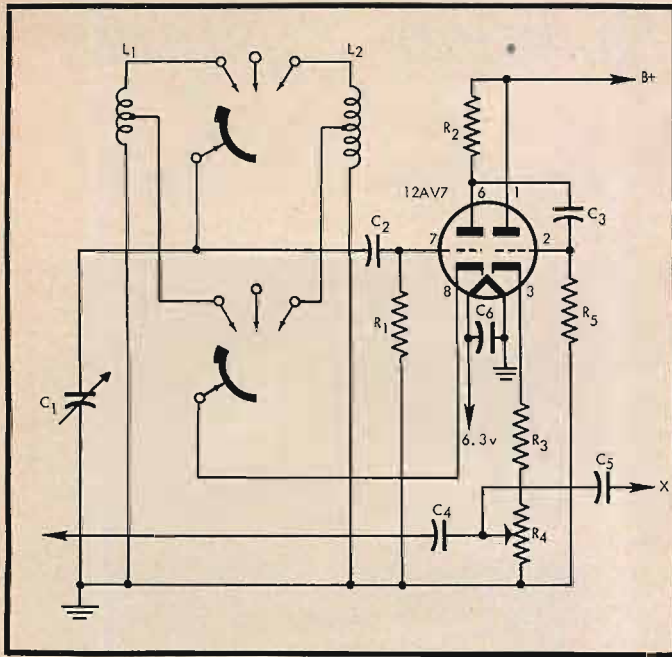


Fig. 3. Schematic diagram of variable marker generator.

Sweep Generator

Figure 1 is a schematic diagram of the sweep generator plus the 10.7-mc crystal oscillator; the dashed lines enclose the portion of the diagram that pertains to the crystal oscillator. One triode section of the 12AU7 tube is used as the sweep oscillator; the other section is connected as a cathode follower for the sweep output. Output voltage is controlled by potentiometer, R_6 , and output is through a 50-ohm concentric cable, terminated by the 51-ohm resistor, R_7 , at the panel connection, and by another 51-ohm resistor at the output end of the cable.

The oscillating circuit comprises inductor L , the Varicap, and the fixed capacitor C_5 . The values of L and C_5 determine the maximum range through which the Varicap can vary the resonance frequency of the circuit. The inductance frequency of the circuit. The inductor L was wound with No. 26 enameled wire on a slug-tuned coil form of $\frac{3}{8}$ -in. diameter, with enough turns (37) to provide a sweep range greater than the desired 10.2 to 11.2 mc. The tap is at 20 turns from the ground end, but that is by no means critical. With the oscillating circuit completed, it was found that the flatness of the output was determined primarily by the value R_{10} . Various values of R_{10} were tried, until a nearly flat output was indicated on the oscilloscope screen; 8200 ohms was found suitable, although that value is not critical. Using that value of resistance, the slug of the coil was adjusted slightly until the pattern on the oscilloscope screen showed the fixed 10.7-mc marker in the center of the pattern.

The desired width of sweep is obtained by adjusting the potentiometer, R_9 . The value of R_9 is not critical but

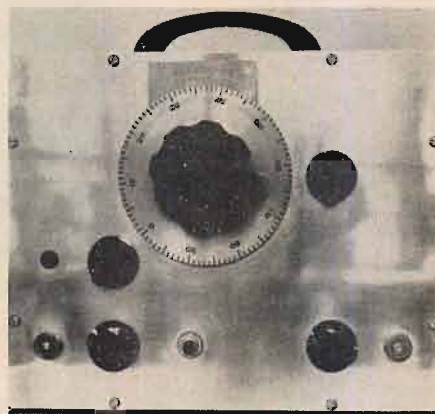


Fig. 4. Front view of sweep generator.

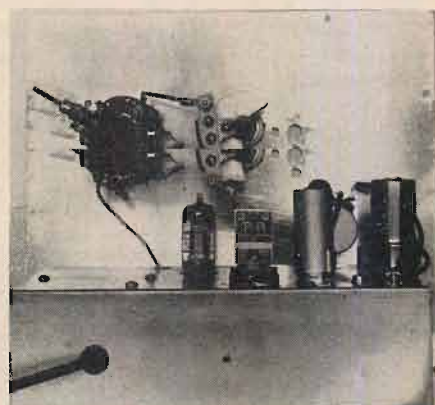


Fig. 5. Rear view of generator.

should be high enough so that it does not impose undue current drain on the 6.3-volt filament transformer; the 900-ohm load shown draws only 7 ma.

Plate voltage on all tubes is about 90 volts.

The sweep of the sweep generator and the sweep of the oscilloscope must be in phase. The writer's oscilloscope provides an internal sinusoidal sweep that is brought into play by setting the

"sweep selector" to LINE; then correct phasing is effected by use of the oscilloscope SYNC/PHASE control. If the oscilloscope that is to be used with the sweep generator lacks the internal sinusoidal sweep, a separate phasing device must be used, or one must be incorporated in the sweep generator structure. In the initial setup of the sweep generator it was found that a double marker appeared. Finally a literature reference was found that showed a network similar to the one which comprises R_7 , R_8 , and C_6 . Addition of this network produced a single marker pip, and at the same time produced return-trace blanking.

In the preliminary testing, the sweep generator was connected to the oscilloscope through a demodulator probe, because the frequency response of the oscilloscope extends only to 5.5 mc. Figure 2 is the diagram of the modulator probe that was used. If no probe is available, a similar network can be made for the purpose.

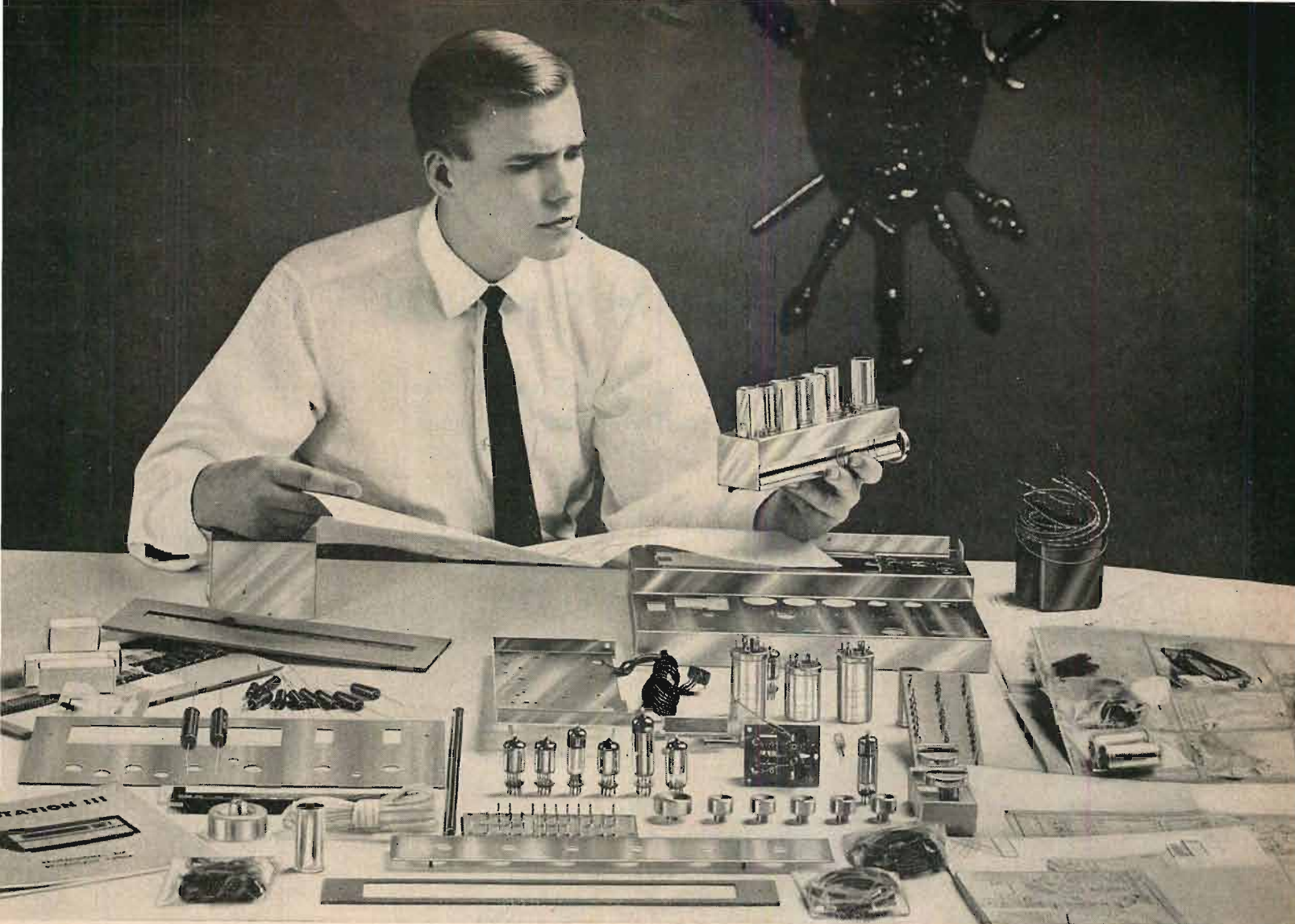
Fixed 10.7-Mc Marker

The fixed-frequency 10.7-mc crystal marker oscillator is coupled to the sweep oscillator through R_1 and C_2 . If the coupling is too tight, the 10.7-mc pip is so large that it distorts the oscilloscope pattern, and the smallest capacitor available, 2.2 pf, still produced excessive coupling. Insertion of resistor R_4 in series with a C_2 of 10 pf reduced the size of the pip to usable proportions. The value of R_4 was determined by cut-and-try; perhaps a variable resistor for R_4 might offer some advantages.

Variable Marker Generator

This is a Hartley continuous-wave oscillator (Fig. 3) that is used to put a marker on the response curve at any desired point over the range of 10.2 to 11.2 mc. It is coupled to the sweep oscillator at the point marked X on both diagrams. In Fig. 3, the inductor L_1 covers the 10.2 to 11.2 mc range; inductance L_2 covers a range of 29 to 36 mc, so that the third harmonic covers the FM range of 88-108 megacycles. The center position of the 2-circuit, 3-position rotary switch is left blank, so that it is possible to view the response curve on the oscilloscope screen with only the fixed 10.7-mc center marker in place. With the switch in this position, the sweep width and output, and the controls of the oscilloscope (connected to the sweep generator through the modulator probe) are adjusted to give a symmetrical curve of desired height and width. Then the switch is turned to the 10.2 to 11.2 mc position, and the output of the marker generator is adjusted to produce the smallest marker

(Continued on page 89)



Can You Afford 15 Hours to Build The World's Best FM/Multiplex Tuner?

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The qualities that make Citation III the world's best FM tuner also make it the world's best FM/Multiplex tuner. The multiplex section has been engineered to provide wideband response, exceptional sensitivity and absolute oscillator stability. It mounts right on the chassis and the front panel accommodates the adapter controls.

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problem of IF alignment and oscillator adjustment are eliminated.

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The Citation III FM tuner-kit, \$149.95; wired, \$229.95. The Citation III MA multiplex adapter—factory wired only, \$89.95. The Citation III X integrated multiplex tuner—factory wired, \$319.90. All prices slightly higher in the West.



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Audio Engineering Society

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Monday, October 9

9:30 a.m. STUDIO EQUIPMENT

- R. A. Isberg, University of California, Chairman
- A New Universal All-Purpose Audio Equalizer**
Stephen F. Temmer, Gotham Audio Corporation
- A Universal Recording Console**
A. B. Clapper and J. C. Cunningham, Universal Recording Corporation
- Transistorized 3-Channel Mixing Console, for Simultaneous FM Multiplex and AM Broadcasting**
Philip C. Erhorn, Audiofax Associates, Inc.
- An Adventure In Graphic Equalizer Design**
Arthur C. Davis, Langevin, Division of Sonotec, Inc.
- A New Automatic Control for Maximum Audio Level**
A. Kaiser and B. B. Bauer, CBS Laboratories

1:30 p.m. PSYCHOACOUSTICS

- J. Donald Harris, U.S. Naval Medical Laboratory, Chairman
- The Practicing Audiologist—Audio's Poor Relation**
R. William Stanmyre, Syracuse University
- Equipment Used in Testing Hearing of the Mabann Tribe in the Sudan, Africa**
Moe Bergman, Hunter College
- The Influence of Organic Pathology on Hearing-Aid-Gain Requirements**
The Influence of Organic Pathology on Hearing-Aid-Gain Requirements
Donald M. Markle, Seton Hall University
- Principles and Techniques of Measuring Hearing by Bone Conduction**
Cecil K. Myers, U.S. Naval Medical Research Laboratory
- The Measurement and Effect on Intelligibility of Transient Distortion**
Jack Curtis, The C. W. Shilling Auditory Research Center, Inc.
- Intensity-Duration Trading Relationships in Human Auditory Fatigue**
Paul Herman, The C. W. Shilling Auditory Research Center, Inc.
- Relations Among Aftereffects of Acoustic Stimulation**
Patricia A. Kelsey, The C. W. Shilling Audio Research Center, Inc.
- Speech Reception and the Electroacoustic Responses of Hearing Aids**
Dean Clack, The C. W. Shilling Auditory Research Center, Inc.
- The Symbiosis of Psychoacoustics and Engineering**
J. Donald Harris, U.S. Naval Medical Research Laboratory, Groton, Conn.

7:30 p.m. MUSIC

- Edmond G. Dyett, Jr., H. H. Scott, Inc.
- Further Progress with Colorless Artificial Reverberation**
M. R. Schroeder, Bell Telephone Laboratories, Inc.
- Aid to Music Composition Employing a Random Probability System**
Harry F. Olson and Herbert Belar, RCA Laboratories
- Control Console for Multi-Speaker Presentations of Electronic Music**
Peter Mauzey, The Electronic Music Center of Columbia and Princeton Universities
- Musical Aspects of Synthetic Reverberation**
John Kellner, the Aeolian-Skinner Organ Co.
- Instrumentation Needs for Research in Musical Acoustics**
Andrew G. Pikler, U.S. Naval Medical Research Laboratory
- Doppler Type Organ Tone Cabinet**
W. V. Machanian, The Wurlitzer Co.

Tuesday, October 10

9:30 a.m. LOUDSPEAKERS

- John Preston, RCA Laboratories, Chairman
- A Two Speaker, Acoustically Coupled, Single Enclosure Stereo System**
J. H. Riggs, The Wurlitzer Co.
- Loudspeaker Enclosure Walls**
Peter W. Tappan, Warwick Manufacturing Corp.
- The Open Back Speaker**
Saul J. White, Audax/Rek-O-Kut Corp.
- On the Transient Response of Ideal Crossover Networks**
J. Robert Ashley, Sperry Rand Corp.
- Considerations of Speaker Size vs. Cabinet in Low-Frequency Reproduction**
Victor Brochner, University Loudspeakers Inc.
- Distortion Measurements of High-Frequency Loudspeakers**
Philip Kantrowitz, Sonotone Corp.

1:30 p.m. OCEANOGRAPHY AND UNDERWATER SOUND

- Lawrence A. Gregory, Hudson Laboratories, Columbia University, Chairman
- Sound—The Test Probe to Sense the Ocean**
Lawrence A. Gregory, Hudson Laboratories, Columbia University
- Some Low-Frequency Water-Borne Sound Generators**
Peter Weber, Hudson Laboratories, Columbia University

Hydrophones—The Acoustic Sensing Devices for the Deep and Shallow Oceans
Edward O'Neill, Hudson Laboratories, Columbia University

The Absolute Calibration of Hydrophones for Deep Sea Use
Leslie Mike, Hudson Laboratories, Columbia University

Auditory Problems in Sonar Work
George Retholtz, U.S. Naval Medical Research Laboratory

Instrumentation in Oceanographic Research—Hydrophone Instrumentation
T. C. Pappas and H. Sonnemann, Hudson Laboratories, Columbia University

Instrumentation in Oceanographic Research—Signal Processing
Julius Woolf, Hudson Laboratories, Columbia University

Reverberation in Rooms and in the Sea
R. J. Urick, U.S. Naval Ordnance Laboratory

The Remote Measurement of Physical Parameters of the Ocean by Means of Acoustic Telemetry
Wm. Branscomb and I. Weisman, Hudson Laboratories, Columbia University

Advanced Processing Techniques for the Resolution of Acoustic Signals from the Ocean
Ross Williams, Hudson Laboratories, Columbia University

7:30 p.m. MICROPHONES AND EARPHONES

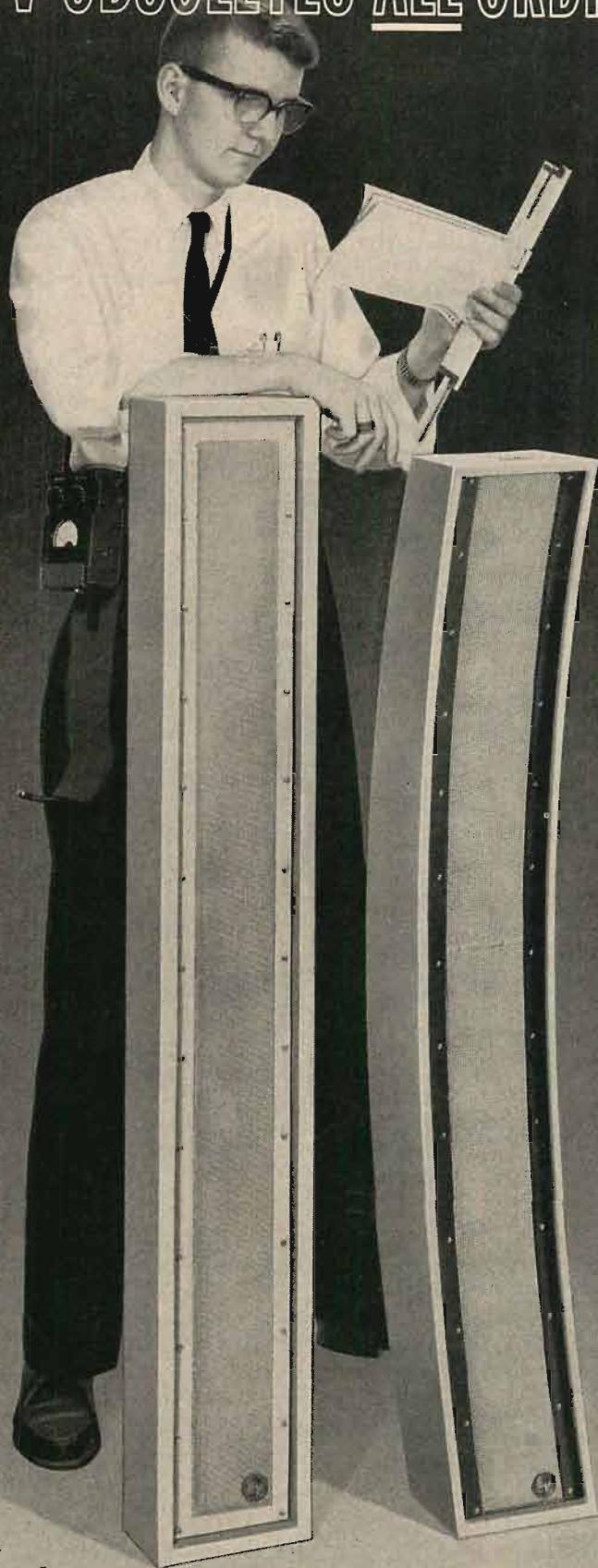
- Robert W. Carr, Shure Bros, Inc. Chairman
- A New Stereophonic Ribbon Microphone**
E. R. Madsen, Bang and Olufsen
- A New Stereophonic Ribbon Microphone**
E. R. Madsen, Bang and Olufsen
- Design and Performance of a new Sound Measurement Microphone**
Austin Brouns, Shure Brothers, Inc.
- Standardizing the Measurement of Microphone Characteristics**
Lee P. Hagey, Electro-Voice, Inc.
- Some New Techniques in Ceramic Microphone Design**
G. Sioles, A. Schwartz, B. B. Bauer, CBS Laboratories
- Design Criteria Leading to the Development of a New Condenser Microphone**
Stephen F. Temmer, Gotham Audio Corporation
- A High Quality Electrostatic Earphone**
A. M. Sessler and J. E. West, Bell Telephone Laboratories, Inc.

Wednesday, October 11

9:30 a.m. SOUND REINFORCEMENT—I

- B. M. Oliver, Hewlett-Packard Co. Chairman

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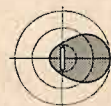
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Thursday, October 12

9:30 a.m. DISC RECORDING AND REPRODUCTION

Improvement of Feedback Stability of Public Address Systems by Frequency Shifting

M. R. Schroeder, Bell Telephone Laboratories, Inc.

A Simple Frequency Shifter to Improve Feedback Stability in Public Address Systems

A. J. Prestigiacomo and D. J. MacLean, Bell Telephone Laboratories, Inc.

An Artificial Vibrato for Entertainment Use

F. K. Harvey and D. J. MacLean, Bell Telephone Laboratories

Influence of Transmission Error on Formant Coded Compressed Speech Signals

S. Joseph Campanella, D. C. Coulter, R. Irons, Melpar, Inc.

A Cordless Voice-Assist System for a Small Auditorium

D. E. Thomas and F. K. Harvey, Bell Telephone Laboratories, Inc.

High Quality Language Laboratory

W. F. McAllister, Elliston, Hall, McAllister & Stockwell

An Electronic Sound Absorber

John C. Bleazey, R.C.A. Laboratories

1:30 p.m. AUDIO INSTRUMENTS

Richard H. Ranger, Rangertone, Inc. Chairman

Sonalarm—A New Concept in Monitoring and Control Systems

E. G. Dyett, Jr., H. H. Scott, Inc.

Acoustic Stimulus Generator for Psychological Research

John A. Cooley, National Institute of Mental Health

A Modern Wave Analyzer

B. M. Oliver, Hewlett-Packard Company

A New All-Transistor Sound Meter

T. W. Pickett and E. G. Dyett, Jr., H. H. Scott, Inc.

A Transistorized Tone Burst System for Transient Response Testing of Loudspeakers

Maurice J. Whittemore, Jr., Delco Radio Division, G.M.C.

A New Transistorized RC Oscillator

David S. Cochran, Hewlett-Packard Company

A New ASA Standard Sound Level Meter

D. Bruce Langmuir, H. H. Scott, Inc.

A Transistorized Wow and Flutter Meter

Grant Laughlin, Fairchild Associates Inc.

Development of a Low Loss, High Precision Permeameter for the Evaluation of High Energy Permanent Magnets

David W. McGann, U.S. Magnet and Alloy Corp.

7:30 p.m. SOUND REINFORCEMENT—II

F. K. Harvey, Bell Telephone Laboratories, Inc. Chairman

A Curved Line Source for Sound Reinforcement

William Dill, Electro-Voice, Inc.

Performance Characteristics of Loudspeaker Arrays

James F. Novak, Jensen Manufacturing Co.

The Linear Column "Line" Speaker

V. J. Skee, Electronic Applications, Inc.

Sound System Specifications

David Kaye and David L. Klepper, Bolt, Beranek and Newman

Sound Survey by Engineering Sound Contractors

Donald B. Davis, Altec-Lansing Corporation

Gilbert F. Dutton, Electric & Musical Industries, Ltd. Chairman

Absolute Calibration of Phonograph Records

Arnold Schwartz, CBS Laboratories

Suspension of a Westrex 3-C Stereo Cut-terhead Without Advance-Ball

Lew Whittier, Olmstead Sound Studios, Inc.

Problems Concerning the Influence of the Vertical Tracing Angle on the Reproduction Quality of Stereo Records

E. R. Madsen, Bang and Olufsen

Advanced Photomicrographic Method for Studies of Groove Topography and the Effects of Stylus Tracing

John M. Faeg, Fabric Research Laboratories

Automatic Disc Mastering Channel

John Mosely, Scully Recording Instruments Corp.

The Quest for an Ultralightweight Phonograph Pickup—II

F. V. Hunt, Harvard University

The Design and Performance of the EMI Integrated Stereo Pickup and Arm

P. J. Pyke, Electric and Musical Industries, Ltd.

1:30 p.m. TAPE RECORDING AND REPRODUCTION

Benjamin B. Bauer, CBS Laboratories, Chairman

A New Thin Construction Instrumentation Quality Sound Recording Tape

Edward Schmidt, Reeves Soundcraft Corp.

Applications and Limitations of the New Magnetic Recording Model

C. D. Mee, CBS Laboratories

Some Studies on the Reduction of Head Wear Caused by Magnetic Tapes and a Test Device for Measuring the Relative Head Wear on a Simulated Head.

Albert L. Tufano and Guiles Flower, Jr., Dictaphone Corporation

A Talking Clock

Richard H. Ranger, Rangertone, Inc.

Absolute Method for Aligning Magnetic Recording Track Using Electrical Technique

F. Slaker, W. Guckenburger, F. Comerci, CBS Laboratories

The Measurement of Flutter

John G. McKnight, Ampex Audio Co.

Approaches to Wide-Band, High-Resolution Magnetic Recording

J. G. Woodward, RCA Laboratories

A High Performance Master Tape Recorder with Novel Operating Features

V. J. Skee, Electronic Applications, Inc.

Automated Modal Sequencing Operation of High Speed Tape Duplication Equipment

Sanford Fisher

Friday, October 13

9:30 a.m. AMPLIFIERS

Daniel R. von Recklinghausen, H. H. Scott, Inc. Chairman

Design of a 100-Watt Stereo Power Amplifier for a Console Phonograph

Edward M. Lanzara, General Electric Co.

Use of Leakage Inductance in Audio Design

Norman H. Crowhurst

The Relationship of the Measurements of an Amplifier and its Listening Quality

Murray Barlowe, Harman Kardon, Inc.

Design Aspects of Transistor Power Amplifiers

Robert F. Chase, Clevite Transistor

A Low Noise Transistor Amplifier

William T. McKay, Transitron Electronic Corp.

A High Current Regulated Power Supply for High Power Transistorized Audio Amplifiers

William R. Coakley, Transitron Electronic Corp.

Transistor Preamplifier Power Supply Requirements

Walter Ira Weiss, Transistor Devices, Inc.

1:30 p.m. FM-STEREO MULTIPLEX

Norman Parker, Motorola Inc. Chairman

Criteria for Compatible AM-FM Stereo as an Interim Method for Compatible Multiplex Stereo

Floyd K. Becker, Bell Telephone Laboratories, Inc.

Audio Considerations for Stereophonic Broadcasting

R. W. Burden, Burden Associates; S. E. Frohock, Nemo Audio Associates

The New FM-Stereo Broadcasting System—How to Understand the FCC Specifications and Generate the Composite Signal

A. Csicsatka and R. M. Linz, General Electric Co.

A Doubler Adapter for FM-Stereophonic Reception

R. L. Miller, General Electric Co.

Multiplex Stereo FM Tuners and Adapters

Daniel R. von Recklinghausen, H. H. Scott, Inc.

Transistor Front Ends for FM Tuners

T. C. Lawson, Philco Corporation

A Compatible FM Multiplex System for Stereophonic Television Transmission

William S. Halstead, Multiplex Development Corp., Richard W. Burden, Richard W. Burden Associates

A Multiplex Stereo Generator

Daniel R. von Recklinghausen and T. W. Pickett, H. H. Scott, Inc.

An FM-Stereo Modulator for Use with FM Signal Generators

John P. Van Duyne, Boonton Radio Corp.

7:30 p.m. STEREOPHONICS

M. R. Schroeder, Bell Telephone Laboratories, Chairman

Compatible Monophonic Reproductions from Stereophonic Disc Records

H. F. Olson, RCA Laboratories; H. E. Roys, RCA Victor Record Division

The Assessment of Two-Channel Stereophonic Reproduction Performance in Studio Monitor Rooms, Living Rooms, and Small Theatres

Gilbert F. Dutton, Electric and Musical Industries, Ltd.

Phasor Analysis of Some Stereophonic Phenomena

B. B. Bauer, CBS Laboratories

Compatibility Problems in Two-Channel Stereophonic Recordings

F. K. Harvey, Bell Telephone Laboratories Inc.; Edward H. Uecke, Capitol Records

Practical Stereo Reverberation for Studio Recording

John Davis, Capitol Records, Inc.

Stereophonic Earphones—II

B. B. Bauer, CBS Laboratories

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Patent Loss by Prior Use or Sale

ALBERT WOODRUFF GRAY*

"Public use" of an invention for more than a year forfeits the inventor's right to a patent.

LAW EMBODIED IN A COMMENT once made by Justice, later President Taft, destroyed in a recent case the patent monopoly of the Armour Research Foundation of the Illinois Institute of Technology and its licensee, the Minnesota Mining & Manufacturing Co. in magnetic recording tape material with the dismissal of the action for infringement brought by those organizations against C. K. Williams & Co. and others for the use of that invention.

"Any practice by the inventor and applicant for a patent," Justice Taft asserted, "through which he deliberately and without excuse postpones beyond the date of the actual invention the beginning of the term of his monopoly and thus puts off the free public enjoyment of the useful invention, is an evasion of the statute and defeats its beneficent aim."¹

This statute, as it is today, provides that a person shall be entitled to a patent unless the invention was in public use or on sale in this country more than a year prior to the date of the application for a patent in the United States.²

In April 1946 the Minnesota Company had consulted the Armour Research Foundation in relation to its interest in this magnetic recording tape, for which later a patent was issued. Subsequently the patent application that in this suit was claimed to be infringed, was filed, but filed on July 25th of the following year, approximately fifteen months after the incident in which this material had been submitted for consideration to the Armour Research Foundation.

Later, but over a year prior to the filing of the patent application, Armour had supplied the Minnesota Company with ten pounds of the material. The court, in its application of this law to the circumstances, said:

"Whether the use of an invention is public or private does not necessarily depend upon the number of persons to whom its use is known. If an inventor, having made his device, gives or sells it to another to be used by the donee or

purchaser, without limitation or restriction or injunction of secrecy, and it is so used, such use is public. The patented oxides and their use as a magnetic tape recording media were in public use more than one year prior to the application for patent."³

When the appeal of the Armour Research Foundation was decided recently, affirming this decision, the appellate court emphasized an exception that has been introduced by the courts in the application of this statute.

It had been argued on this appeal that the transaction between Armour and the Minnesota Company has been merely an experimental use and not the public use prohibited by the patent statute, no money had changed hands and no commercial dealings were involved.

"The question is not without difficulty," said that court, "While a public use more than a year prior to the application date would defeat a patent, an experimental use would not." To this the court added the conclusion that, "There was sufficient creditable evidence to support the conclusion that the use of these oxides was a public use."

Interpretation of this phrase, 'public use' as used in the patent law was made very recently in a case before the United States court in California. Involved in that controversy were jet propulsion parts sold for use in government contracts prior to the filing of the application for a patent for this equipment. There, in ruling that such a sale invalidated the patent, it was asserted by the court,

"Restricted or secret sales do not result in 'public use.' This protects the inventor against having a sale for experimental purposes turned by others without his consent into a public use.

"However, as stated in an old case: 'Any attempt to use it for a profit and not by way of experiment for a longer period than two years before the application, would deprive the inventor of his right to a patent.'⁴

When a suit for infringement was brought some years ago against the

R. C. A. Victor Company for an alleged infringement of the patent of a variable electrical resistor, issued in October, 1933, the defense was interposed that this patent device had been in public use and on sale in numerous instances more than two years prior to the filing of the application for the patent. At that time the statutory prohibitory period was two instead of the present one year.

Two and a half years before the application of the inventor was filed, switches of this type had been manufactured for the Simplex Radio Company of which this patentee was then president.

"The clear inference from this testimony," said the court holding the patent on which this action had been based, to be invalid for prior use, "is that his company after it had ordered and received some seventy-five snap switches for use in combination with variable resistors, must have installed a number of these combinations in radio receiving sets prior to the application for this patent."

The federal appellate court, when this decision was affirmed, made the comment "While it is true that to establish public use or sale the evidence must be convincing beyond a reasonable doubt, it has been held that a single sale of an article more than two years prior to the application for the patent is all that is required by the statute."

To this was added the further statement, that, "A number of decisions are to the effect that the statute does not require a completed sale but that placing on sale is sufficient."⁵

Nor is the protection of the patent owner from infringement by others denied only for a sale or a "public use" more than a year prior to the application for the patent. By the courts this section of the patent law has been interpreted with no intermediate shades.

Improvement for a method for manifold had been offered for sale to a Stock Yards Company in Chicago. Later, when application was made by the inventor of this method for a patent, opposition was offered by another inventor of a similar method on the ground that

(Continued on page 92)

* 112-20 Seventy-Second Drive, Forest Hills, N.Y.

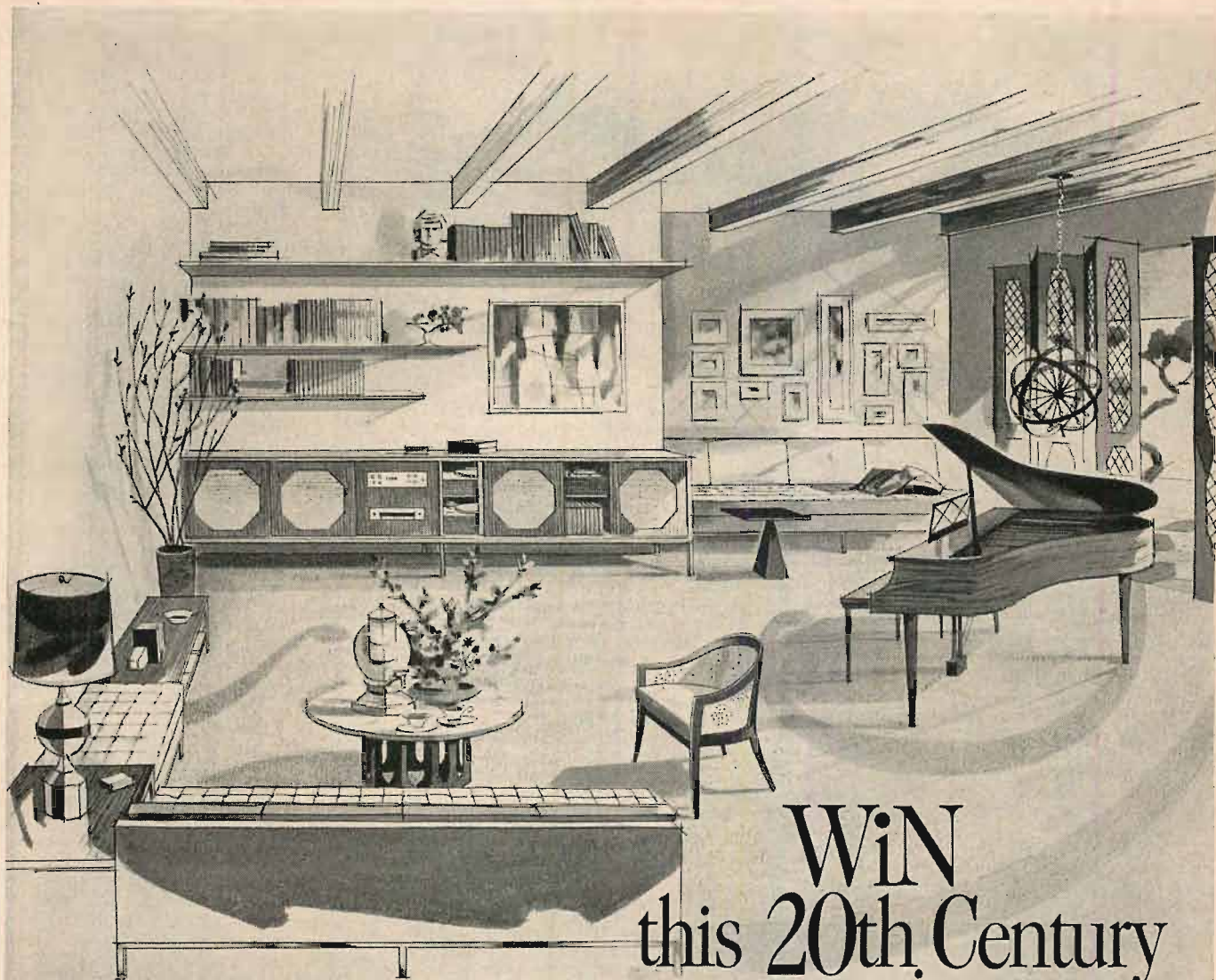
¹ Woodbridge v. United States, 263 U.S. 50, Nov. 12, 1923.

² 35 U.S.C.A., Sec. 102(b).

³ Armour Research Foundation v. C. K. Williams & Co., 280 Fed. 2d 499, August 30, 1960.

⁴ Piet v. United States, 176 F.S. 576, September 8, 1959.

⁵ Maibohm v. R. C. A. Victor Co., 135 F.S. 901: 89 Fed. 2d 317, April 6, 1937.



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by Shure... piano by Baldwin... carpeting by V'Soske*

... fabrics by Boris Kroll, hi-fi/stereo amplifiers and preamplifier by Marantz, automatic turntable by Garrard, turntable by Thorens, speaker systems by Acoustic Research, FM/AM Multiplex tuner by Sherwood, tape player by Ampex, Stereo Dynetic Phono Cartridge and Tone Arm by Shure, PLUS \$5,000 cash to add a new room to your home or remodel an existing room from original plans by internationally renowned interior designer Marion Heuer, A.I.D.

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All this to introduce you to the breathtaking sound (and elegant appearance) inherent to modern component stereo in general, and the new Shure M33 and M77 Stereo Dynetic Phono Cartridges in particular.

No purchase is required; you simply listen to a Shure cartridge demonstration at your hi-fi dealer's showroom and describe your reaction to its singular sound recreation qualities (in 25 words or less). If your statement wins (we don't expect an overabundance of entries, so your chances are rather good), you can begin building your music room. Should the winner have purchased a Shure cartridge as a result of the demonstration (a consummation devoutly to be wished), a magnificent \$1,000 RCA Victor stereo record library will also be supplied, as are all other awards, by Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois. Contest ends February 28th, 1962.

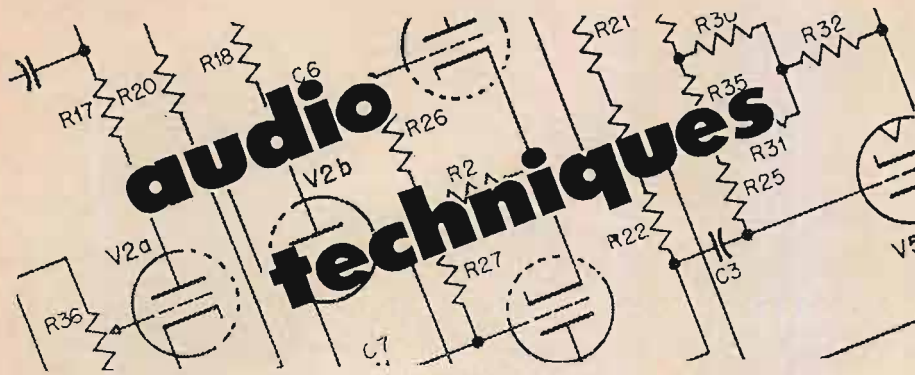
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M33 for 1-3 gm. tracking, \$36.50; M77 for 3-5 gm. tracking, \$27.50.





JOSEPH GIOVANELLI*

Speaker Performance at Low Cost

I found that Sears Roebuck now sells one-inch Fibergles batts for about \$3.00 per sheet. (I believe the size of these is about 4 by 6 feet.) The Fibergles is the long-staple variety, spongy without being shreddy.

I bought two of these sheets and had plenty to cut into squares for my nine-cubic-foot infinite baffle. I have always been plagued with too heavy a bass and the use of this material did the trick. The bottom is now solid without being boomy. *A. Menick, Canoga Park, Calif.*

Fibergles is a well-known damping material for loudspeaker cabinets. A less-known material with much the same characteristics is common rockwool insulation. On occasion this may be obtained very cheaply from house wreckers or from carpenters.

However, an article in *AUDIO* several years ago stressed the superiority of acoustical felt over Fibergles as an acoustic damping material. After reading this article I opened one of my cabinets and replaced the rockwool lining with a woolen blanket and several wool scarves. The improvement in bass quality and quantity was extreme. I have since lined the cabinet with a coarse felt commonly used for rug pads with even better results. *George L. Walker, Valhalla, N. Y.*

Many of my friends are poor high school students like myself. I have found a practical, cost-cutting project for us. Using the formula from one of *AUDIO's* articles on the bass-reflex enclosure, excellent performance may be obtained from a double cardboard champagne case as a baffle for the speaker. Even single cardboard boxes work. I have built some which held a ten-inch speaker.

These boxes can also be used for quick experiments. All construction can be done with a knife, a ruler, and a compass.

The double cardboard boxes are more desirable than the single-layer variety for two reasons. They are sturdier, facilitating speaker mounting. Also, they have less parasitic, sympathetic vibration. *George L. Walker, Valhalla, N. Y.*

Further Notes on Dewarping Records

Apropos to your column in October, 1960, *AUDIO*, here is another way to dewarp records, which requires little in the way of apparatus. All you need is an oven, a cooking thermometer, some newspaper, two pieces of heavy plate glass 13 in. square, and a couple of husky mail-order catalogs. (In my locality most people have electric stoves.)

* 3420 Newkirk Ave., Brooklyn 3, N. Y.

Here is all you do. Place the stove's oven rack one-third of the way up from the bottom, and cover it with several layers of newspaper. The two pieces of plate glass are then placed on top of this along with the cooking thermometer. Turn on both the top and bottom elements in the oven until the thermometer indicates approximately 125° F. Remove the top piece of plate glass so that a recording can be placed on the remaining glass plate. When this is done, put the still-hot plate glass over the recording. It makes a nice sandwich. On top of this vinyl-glass sandwich, arrange the two mail-order catalogs so that their weight is evenly distributed over the surface of the glass. Put the thermometer back on top of the pile and close the door. Now you are in business. By now the temperature has probably dropped to about 90° F. Turn on the lower element for only a few minutes until the thermometer indicates approximate 100-110° F. Then turn it off quickly, turning it on again only when the temperature has dropped back to 90° F.

The basic idea is to subject the recording to as constant and as evenly distributed weight and heat as possible. By careful checking, the oven can be kept between 90° and 100° F. If your stove has a handy "see-through" window and inner light, so much the better.

It won't hurt anything if the temperature does go slightly higher for a minute, but I have found that the lower temperatures work very well. It seems a common-sense procedure to use as little heat as necessary—thus lessening the risk of groove deformation. It goes without saying that the glass in contact with the recording must be clean and free from scratches.

To clean the glass use Bon Ami, followed by washing in a warm detergent. The record to be dewarped should have no dust in the grooves. If the warp is not so severe as to prevent tracking with a Dust Bug, this is highly recommended prior to dusting the record carefully with an old linen handkerchief, slightly dampened.

This procedure will dewarp even the most severely warped records in about an hour and a half to two hours. In any case the record should be checked at the end of an hour and a half to see how it is getting on. It may be necessary at this time to turn it over, and to add more weight if stubborn portions keep popping up.

A record is successfully dewarped if it lies flat with no bulging anywhere. After removing it from the oven, allow the record to "rest" overnight before playing it or replacing it in its dust jacket. Be sure that during this rest period no more dust is attracted to the grooves. Before inserting the record into its dust jacket, make sure that the jacket is not too snug a fit

and that it is itself not warped. A dust jacket having these characteristics can cause warping of records.

There is one cardinal rule to follow with this method. NEVER leave the kitchen for an instant without turning off the oven. If it is necessary for you to turn off the oven and the temperature drops below 90° F., it won't be fatal to the results. It will simply prolong the dewarping process by a few minutes.

To date I have used this method with stereos and LP's only. I don't know how 78-rpm shellac discs would fare as I haven't tried to dewarp them.

Since warps of long-standing are harder to remove than new ones, check all your incoming records and treat any that cannot be taken back to the dealer. In fact, treating them may be a lot easier than taking them back. *Mrs. Susan Chappell, Winnipeg, Canada.*

How to Play Off-Center Recordings

There are few things more exasperating than those recordings which are correctly centered on one side, and "swingers" on the other. What can one do with them? To people with changers the following suggestions will not help much I fear.

In my own case I use a Garrard 301 with an ESL tonearm and Shure M3D cartridge. The following method works out well for me with little complication. No doubt this method could be adjusted to other arms and turntables. I can write only from my own experience.

Obtain a piece of plastic foam from the fancy-goods department of your local department store. It comes in several revolting colors and thicknesses and is used, I believe, for making place mats and toys for babies.) For Garrard 301 you will need a piece one quarter inch thick and large enough to cut to the size of your turntable mat. Using the turntable mat as a template, cut the foam rubber to size and make a center hole in it for the spindle. Now just place this right over your present mat and put on the record. You will notice that the record no longer fits the spindle as now you are in the region where the spindle starts to taper to its rounded top. Thus, there is a very loose fit for records which are not too badly off-center, this is enough to allow a slight adjustment of the record with relation to the spindle. In other words, you may find that if you push the record to the northwest as far as it will go before being stopped by the spindle this spot may prove to give minimum arm swing. This fact should be then noted on the record jacket or label.

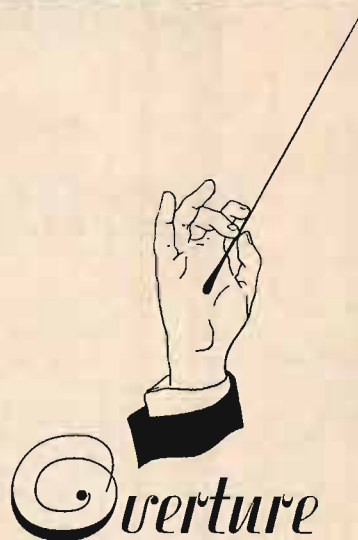
My method may not cure severe off-centering. The only thing to do for that is to raise the plastic turntable mat still higher until it all but clears the spindle and thus allows for freer movement. At this point watch the angle the stylus enters the groove and what effect this has on playing weight. Needless to say, records must be very flat as you are now relying solely on traction between the foam plastic and the record to hold it in place. This is fine for my light-weight arm. I have had no trouble with slippage. It is odd how this method will really clean up the sound.

Mrs. Susan Chappell, Winnipeg, Canada.

Note

I have not tried the suggestions presented in this column, but all are interesting and worthy of consideration.

(Continued on page 96)



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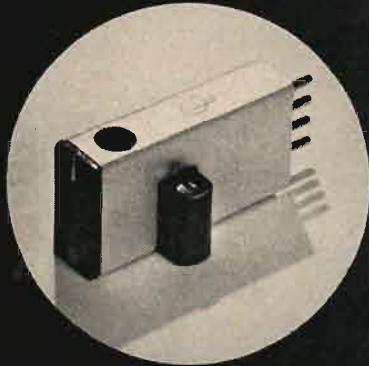
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Speaker Power

PAUL W. KLIPSCH*

One virtue of high efficiency in a loudspeaker is reduced distortion at high listening levels.

TO PRODUCE MUSIC REALISTICALLY, Massa¹ (Chart 72) states that peak sound pressures of the order of 100 dynes per square centimeter are required, corresponding to approximately 115 decibels intensity (dbi)². To produce such a pressure in a 3000 cubic-foot room with a reverberation time of 0.8 seconds requires approximately one acoustic watt of speaker output. (Massa, Charts 70, 72).

A cone excursion of 0.21 in. at 50 cps is found to produce 0.35 rms frequency modulation distortion which produces an intolerable harshness.³ Kellogg⁴ in 1931 proposed limiting the diaphragm excursion to 1/16 in. to limit distortion. This seems prophetic in view of the fact that that frequency modulation distortion was not a part of audio technology and terminology until 1943.⁵

To produce one acoustic watt at 32.7 cps with diaphragm excursion limited to 1/16 in. requires a piston radiating into hemispherical space (infinite flat baffle) of about 60-in. diameter. (Massa, Chart 64.) For the same frequency and 1/16-in. total motion, a 14-in. piston working into a horn throat of 84 square inches is required (Massa, Chart 78).

Typical horn loudspeaker efficiency ranges from 10 to 50 per cent. One loudspeaker of reference quality may be considered to exhibit 16 per cent efficiency so that approximately 6 watts are needed from the amplifier. A 30-watt amplifier of high quality would be operating with an ample margin of surplus power.

Typical direct radiators range from 1 to 8 per cent efficiency. One model of

good quality exhibits about 4 per cent efficiency. With this unit, to deliver one acoustic watt requires 25 electrical watts output from the amplifier. Practically it has been found that lesser power levels are desirable. This particular speaker utilizes a 15-inch drive unit with 0.7 kg² per watt pull factor.

Direct radiators which are operated in tightly-enclosed-back air chambers have to be weighted to reduce their resonant frequency. A 12-in. cone-type speaker will have about 10-in. effective diaphragm diameter; the air-mass loading it will be only about 10 grams (one side only; other side assumed to be facing the acoustic capacity of a box). (Massa, Chart 55.) The mass of the piston and voice coil may be expected to be another 10 grams or a total of 20 grams. For a box of 1.7 cubic feet or about 2900 cubic inches, and a 10-in. piston with a total load of 20 grams, the resonant frequency will be 100 cps. (Massa, Chart 59.) To reduce the resonance to 33 cps requires increasing the effective mass by a factor of 3² or 9 and the efficiency is reduced by the same factor. Typical 12-in. direct radiators with pull factors from 0.1 to 0.4 kg² per watt exhibit 1 to 2 per cent efficiency. Hence such a weighted-cone direct radiator should be expected to afford an efficiency of from 0.1 to 0.2 per cent, the lower value applying to one commercial speaker tested. Thus to produce one acoustic watt would require a rather ridiculous 1000 watts of amplifier power. Practically, input power exceeding about 30 watts raises the distortion from fine to gross levels so one must be content with some 30 milliwatts acoustic output. One could multiply the number of speakers and amplifiers but, then, even the apparent advantage of bulk and cost disappear.

The higher the efficiency of a loudspeaker, the lower the distortion. In the absence of weight-loading, the distortion may be expected to be inversely as the square of the efficiency. In the case of weighted diaphragms, the major penalties are the power required to accelerate the extra weight and the resulting looseness of coupling between the electrical power and the air being moved.

Transient response has to do with peak power output available with linearity (freedom from amplitude distortion)

(Continued on page 88)

* Hope, Arkansas.

¹ Frank Massa, "Acoustic Design Charts," Blakiston, Philadelphia, 1942.

² Levels of 110 to 120 decibels intensity are usually encountered in various recording sessions.

³ Paul W. Klipsch, "Subjective Effects of Frequency Modulation Distortion," *Jour. Audio Engr. Soc.*, Vol. 6, No. 2, April, 1958, p. 143.

⁴ E. W. Kellogg, "Means for Radiating Large Amounts of Low Frequency Sound," *Jour. Acous. Soc. Amer.*, Vol. 3, No. 1, July, 1931, pp. 94-110.

⁵ G. L. Beers and H. Belar, "Frequency Modulation Distortion in Loudspeaker," *Proc. IRE*, Vol. 31, No. 4, April, 1943, pp. 132-138.

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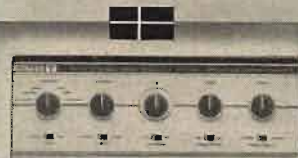


ALTEC 312A FM TUNER
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OR



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SPECIFICATIONS:

ALTEC 359A MULTIPLEX ADAPTER—Self-powered. Sensitivity: 0.25 to 5.0 volts, peak-to-peak. Separation: better than 30 db, 50-15,000 cycles. THD: less than 1% at normal input levels. Dimensions: 5½" H x 5½" W x 9½" D.

ALTEC 312A FM TUNER—Max. Sens.: 2 mv (equivalent to 1.0 mv, ref. 72 ohm antenna). Quiet. Sens.: 2.9 mv for 20 db (equivalent to 1.45 mv, ref. 72 ohm antenna). Freq. Response: ± 2 db, 20-20,000 cps. Distortion: less than 2% @ 100% mod. & @ 1 v output. Dimensions: 5½" H x 15" W x 9" D.

ALTEC 309A AM/FM STEREO TUNER—FM—Max. Sens. & Quiet. Sens.: Same as 312A above. Freq. Response: ± 1 db, 20-20,000 cps. AM—Max. Sens.: 3.2 mv. Loop Sens.: 35.0 mv per meter. Dimen.: 5½" H x 15" W x 10¾" D.

ALTEC 353A STEREO AMPLIFIER-PREAMPLIFIER—Inputs: 14, stereo or mono. Outputs: 6, stereo or mono. Matricing network for 3-channel stereo & auxiliary speakers. Power Output: 100 watts, stereo prog. pk.; 50 watts, rms, contin. Freq. Response: ± 1 db, 20-20,000 cps @ 25 watts; ± 0.5 db, 10-30,000 cps @ 1 watt. Distort.: Less than 1% THD @ 25 watts, 1000 cps ea. channel; less than 1% THD @ 20 watts, 30-15,000 cps ea. channel. Dimen.: 5½" H x 15" W x 11¼" D.



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AUDIO ETC

(from page 14)

After all, who hears every last separate note in a Beethoven symphony?

Of course, nobody in the slightly dumfounded audience knew how long all this was going to last. Knowing Mr. Cage through my description, you can guess. As long as it took. I didn't remember to notice but it must have been at least an hour. Nothing by halves, as I say.

There were a number of complete silences, when all four speakers just happened to fall into silent contemplation together. At the first of these there was a considerable muttering and stirring in the audience, as though to leave. But Mr. Cage was like the conductor who holds up his baton for attention; he just sat, not moving a muscle, and the would-be leavers subsided back into their chairs again. I wouldn't say they were exactly hypnotized, nor that they were afraid, but the fact is that hardly a soul left the hall until the four lectures had finally reached their appointed endings and Mr. Cage had arisen to turn off the recorders. The audience clapped, a bit weakly, then moved out into the sunshine of the McGill campus looking slightly dazed. Hardly a word was said. What could you say?

But I was impressed. A wonderfully keen sense of timing, of duration, of the lift and fall of ideas in the form of words, phrases, and especially, pauses. Time, silence, is of the essence to Mr. Cage, and how right he is.

(Why else, for instance, do I find it essential to turn off my phonograph for ten minutes or so every hour? My ears need healing, my mind needs time to pause, to think back, to ruminate.)

The Cage lectures are on four tape tracks and he can read any one of them "live," or play all four. The timing, too, is optional, so that a different combination of speech and of silences is produced at each presentation. These are vital ideas in the Cage lexicon of controlled randomness, the basis of much of his thinking.

Inscrutable East

And so, finally, to the big Cage pieces themselves and to the other works, a few of them, that fall into the same school. Mr. Cage and the others have mostly done away with standard musical notation, in favor of highly illustrative and ornamental scores," covered elaborately precise graphs, calligraphy, color charts. More important, they have dispensed with literal musical tones in favor of options, or more often, areas of tone. Tones covering variable territory, like tone-clusters, or white noise, or gray noise. Tones to choice, anywhere or anyhow within certain specific limits. Sounds produced meticulously via unorthodox techniques, like hitting the side of the piano with a specially calculated felt hammer at exactly the right instant, or the careful, extremely faint tapping of a bit of metal on the outer rim of a wind instrument.

Still more important, these composers have also dispensed with exact time-locations for their notes, substituting time-areas within which certain things must occur. Note sequences are similarly freed, the sequence often optional, frontwards, backwards, all at once. (Serial or twelve-tone composition shares this kind of thinking, though not *ad lib.*)

And above all, this new music is philosophically orientated towards Zen. I'm not

Zen student, but in practice this is clearly interpreted to mean a kind of extreme deliberateness, a total lack of mechanically regular rhythm, a waiting for the moment, a sort of pause-before-each-note, as though every move were a move in a chess game. The feeling, come to think of it, is strangely chess-like, as one listens and watches. The slow, graceful, careful movements, the long periods of apparent meditation on the part of the performers, the complete absence of rush or fuss or hurry, the meticulous care in detail and the utter seriousness of view, at all times, the predominating, exasperating, relentless slowness—these are chess-like.

But even more, they are oriental—for this entire school of musical thinking is strongly oriental in its approach, an importation from East to West, the reverse of the more familiar kind.

No wonder the audience coughed and harked and giggled and twisted, no wonder people burst into guffaws, or walked out angrily! This stuff was fundamental, a world against a world; it was the very sense of the East, invading the West's hurry and bustle.

I remember a friend's prescription for squelching the man who tries to hurry you at the green light. You turn off your ignition, slowly open the car door, get out with deliberation, walk back very quietly, and ask the driver behind you, with the sweetest of smiles, "Is there anything I can do for you?" The resulting sputter of sheer fury is the kind of feeling roused up by this orientally-slanted music! Infuriating, but also insidiously fascinating. There's slow dynamite in it.

Those three piano pieces. Each one lasted a good fifteen or twenty minutes. For each one, the pianist, Toshi Ishiyonagi, an utterly inscrutable small young man, came out with a whole armful of gadgetry and went about *preparing* the piano, with the utmost leisure. To bursts of hysterical giggles, which he ignored completely, he laid out his tools, red hammers, white hammers, pieces of cloth, nuts, bolts, and set up the score, which for one of the works was an enormous cardboard affair about six feet long in four colors that he set up diagonally across the piano face—the angle somehow stimulated renewed hysterics all over the hall, which shows how far gone we were. His every move was an *adagio*. Each piece of bolt swam slowly through the air in his hand and was inserted in its place, as though moving through smooth oil.

After minutes of this preparation the audience was already reduced to a nervous frenzy. The pianist then sat down, ever so slowly, stared a long time, adjusted his bench, picked up a felt hammer, reached slowly out towards the piano case and WHACK!!—the sound was like thunder, the audience practically wept with nervousness. Long pause. Then, snake-like, another hand moved out, into the piano innards and, like a mouse, *pink!* Long silence. Again that slow-motion, and a sudden cat-like fury of crashing notes, all over the keyboard, gone before you could see the hands. Long pause. . . .

Thus, one move at a time, one sound at a time, the music went on for an eternity. It was exhausting, unnerving. That was when the McGill students cracked up, and I began hysterically shushing them, to my own amazement. The first piece, or pieces, ("Last Pieces," by Morton Feldman), was succeeded by, as much more, just as slowly, as silently, the "Ricercar for Piano" (Behrman); then came the "Music for Piano No. 8" (Toshi's own). On and on. It was absolutely hellish. I have never gone

through such an agonizing hour. But I stuck with it, withstood the audience hysterics that kept spreading out in waves, then half-subsiding, and at the end of all this, I stuck it out for still another piece, exactly the same technique but for two players, in and out and around the one piano.

Thank the Lord, David Tudor's entirely scrutable American face broke the tension a bit. He's serious, too, but somehow he exudes the West in spite of himself. Probably all wrong for the music, yet it was a salving balm for our Western nerves, I can tell you. I could take Toshi Ishiyonagi and David Tudor, together.

Aeon

After that, piling on top, came "Aeon," the most extreme of the two Cage works. It lasted well over an hour and not a soul had the faintest idea what it was all about. Not a soul near me, anyhow. (Natch, the program didn't tell us anything). The music was Cage at his finest and longest. The great piano-thunder of distortion let loose regularly every minute or so, until I thought I'd go nuts. Assorted squawks and squeaks went on here and there, the feedback howled eerily, the violinist occasionally rose out of a sort of stupor and played one note on his fiddle, without vibrato, and Mr. Cage went through his dramatic stopwatch act, the human stopwatch, arms like a second hand.

After more than an hour of continuous ballet and Cage-music, large portions of the audience, now cowed far beyond any sort of giggles, too bewildered to pay further attention to the really magnificently incomprehensible complexities of the stage ballet before us, just quietly got up and hurried out in droves, looking beat and apologetic. It was more than an unprepared human being could take, and, remember, nobody deigned to give us so much as a hint as to what was going on. Rightly, of course. All art should be understood in its own terms, not through external accounts of it in words. But . . . well, people are human. So was I.

Immediately at the end, I left the theatre and the next morning took off for Vermont, Massachusetts, and Connecticut. I missed the rest of the festival. I didn't have what it took.

Atlas Eclipticalis

But I can't end without a brief account of the particular ethos of the two big Cage works, this ballet, "Aeon," and the earlier one, which caught me at the beginning when I was still full of listening energy—I like it a lot, even including the thunder. This is just so you'll get a bit of the diabolical logic behind the Cage operation.

This first piece was called "Atlas Eclipticalis with Winter Music (Electronic Version)" and was played by 17 instruments, with contact mikes (including the piano's, though I understand that the work which never sounds twice the same, may be performed by as many as eighty instruments, each with his own separate part to play. On this occasion, it was accompanied by light-sculptures by Mousseau and hung paintings by Jean McEwen, both of Canada.

The title is explanatory, if you know what it means. The music is a *tour de force* of patterned randomness, of intricately controlled chance. Mr. Cage, it seems, took a pictorial atlas of the constellations and placed translucent music paper over them. The paper had a special kind of staff, a very reasonable kind, in

(Continued on page 91)

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The PIONEER comprehensive stereo amplifiers are recommended with pride for their distortion-free reproduction, wide frequency characteristics, wide applications, high performance, high stability and beautiful design.

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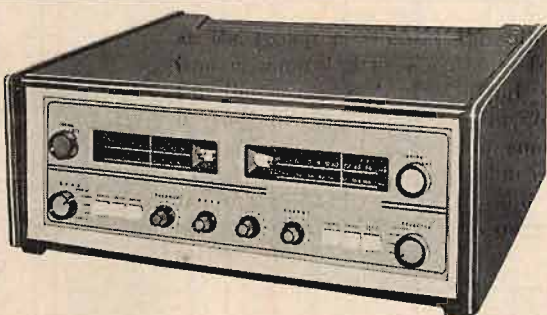
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Standard type specially emphasizing stability
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SM-B201

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- * Loudness control which allows constant tone quality regardless of the volume is provided.



The causes for distortion have been removed
22-WATT FM/AM/AM STEREO TUNER
AMPLIFIER

(Output Transformerless)

SM-W203

- * While conventional amplifier with an output transformer is attended with various restrictions in the manufacture regarding its frequency characteristics, SM-W203, which is output transformerless, can be provided with excellent low-pass and high-pass frequency characteristics, making it capable of distortion-free reproduction over a wide range of frequencies. The highest tone quality is guaranteed with SM-W203.
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- * Available also at the PIONEER are high-impedance speaker systems that completely match SM-W203.



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24-WATT FM/AM/AM STEREO TUNER
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SM-B200A

- * Built-in scratch filter and rumble filter have made it possible to enjoy beautiful noise-free music reproductions.
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- * No danger of hum since the preamplifier has been transistorized.
- * This amplifier is provided with performances that are equal to three to four amplifiers of conventional type.



5 Otowacho 6-chome, Bunkyo, Tokyo, Japan

PIONEER ELECTRONIC CORPORATION

Buyer's Guide and Condensed Applications Chart—Norelco® 'CONTINENTAL' Tape Recorders

This condensed guide is published by the High Fidelity Products Division of North American Philips Company, Inc. It offers the consumer the factual data he needs to select the tape recorder best suited to his specific requirements.



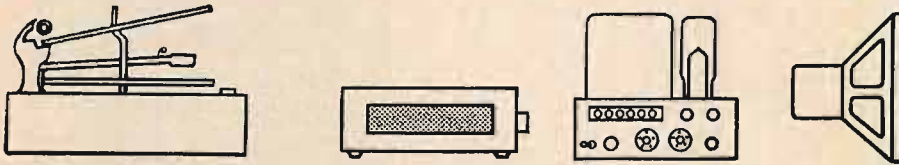
	Continental '100' Model EL 3585	Continental '200' Model EL 3541	Continental '300' Model EL 3542	Continental '400' Model EL 3536
PRIMARY USERS	The entire family—at work, at play, at home or away.	Serious music lovers with limited budgets.	Schools, churches, teachers of voice and music. Psychiatrists, speech therapists and recreation directors—and collectors of pre-recorded stereo tapes.	Professional musicians, studio recordists, serious music lovers, high fidelity enthusiasts. Commercial sound installations.
ESPECIALLY SUITABLE FOR	On-the-go, on-the-shoulder recording and playback — anything, anytime, everywhere.	Portable, high-fidelity tape-deck applications. Portable public address.	Audio visual and all specialized teaching applications; music program source for factory, office and home; portable P.A.	Professional-quality stereo recording, live or broadcast; space-saving hi-fi system control center and portable P.A.
SPECIAL FEATURES	Battery-operated, 100% transistorized, feather-light. Records from any source. Tapes interchangeable with all 2-track 1 7/8 ips recorders.	Stereo head output direct to external stereo preamp. Records sound-on-sound. Mixing facilities. Compact, lightweight, inexpensive.	3 speeds. Stereo head output for playback through external stereo preamp. Records sound-on-sound. Mixing facilities. Headphone monitoring.	Completely self-contained for stereo recording and playback at all speeds. Price includes dynamic stereo microphone. Transport mechanism meets all professional standards.
RECORDING CAPABILITIES	Monophonic 2-Track Monophonic 2-Track	Monophonic 4-Track Monophonic 4-Track	Monophonic 4-Track Monophonic 4-Track	Stereo and Mono 4-Track Stereo and Mono 4-Track
PLAYBACK CAPABILITIES	Monophonic 2-Track	Monophonic and Stereo* 4-Track	Stereo* and Mono 4-Track	Stereo and Mono 4-Track
SPEEDS	1 7/8 ips	7 1/2 ips	7 1/2, 3 3/4, 1 7/8 ips	7 1/2, 3 3/4, 1 7/8 ips
PLAYING TIME PER REEL	Up to 2 hrs. on a 4" reel	Up to 4 hrs. on a 7" reel	Up to 16 hrs. on a 7" reel	Up to 16 hrs. on a 7" reel.
WEIGHT	7 lbs.	18 lbs.	30 lbs.	43 lbs.
SUGGESTED LIST PRICE	\$129.50	\$179.50	\$269.50	\$399.95

For complete technical data and detailed descriptions of Norelco 'Continental' Tape Recorders, write:

NORTH AMERICAN PHILIPS COMPANY, INC., High Fidelity Products Division, 230 Duffy Avenue, Hicksville, L. I., N. Y.

*Tape head output.

EQUIPMENT



PROFILE

LAFAYETTE FM TUNER KIT, MODEL KT-650

Not too long ago Lafayette issued a line of quality high-fidelity component kits which it labeled the Criterion series. Included in this series are the KT-550 100-watt basic stereo amplifier, the KT-600A stereo control center, and the KT-650 FM tuner. In other words, the KT-650 is intended to be Lafayette's best FM tuner kit. Not having tested the entire Lafayette line, we can't report as to its relative virtues. However, we can say that the KT-650 is a good FM tuner at an exceptionally low price. If there were such a rating as cost per microvolt of sensitivity, this unit would certainly be one of the best buys available. Even more important, the audio quality is very good (distortion less than 1 per cent).

One of the strong points of the KT-650 is its ease of assembly as a kit. Here, as in its other kits, Lafayette has made good use of printed circuit boards and pre-aligned i.f.'s to make construction a simple job even for the novice. Construction time was a scant 12 hours and, after alignment by the concise method provided in the instruction manual, we were able to pull in all the stations in our locality.

Circuit Description

The signal from the 300-ohm antenna input is fed through an unbalanced line to the cathode of the grounded-grid r.f. amplifier (first section of a 6AQ8/ECC85). The output of the r.f. amplifier is tuned (in the plate circuit) by one section of the main tuning capacitor and is coupled to the grid circuit of the mixer (second section of the 6AQ8/ECC85) by means of a capacitor. The grid circuit of the mixer is tuned by the second section of the main tuning capacitor. The local oscillator is one section of a 6BK7B and applies its signal to the grid of the mixer stage. It is tuned by the third section of the main tuning capacitor. The difference frequency (10.7 Mc) from the mixer tube goes through the first i.f. transformer (in the plate circuit) through two stages of r.f. amplification (6BA6's) and the second and third i.f. transformers. Then the signal goes through two limiting stages (7543's) coupled by a limited transformer, and from there to a Foster-Seeley type of discriminator circuit. The audio output of the discriminator goes through a de-emphasis network and through the level control to the grid of the output tube (6AV6). The output tube is connected in an anode follower configuration. The heavy feedback used in this type of circuit keeps distortion to a minimum. Also, the relatively low output

impedance (about 1500 ohms) permits the use of cables up to 20 feet long without significant loss of high-frequency response. An audio output is also taken from the output of the discriminator and fed without de-emphasis to the multiplex output jack. A.f.c. is provided by applying the d.c. component at the output of the discriminator to the grid of the a.f.c. tube (first section of the 6BK7B). A tuning indicator (EM84/6FG6 "eye" tube) indicates maximum voltage in the grid circuit of the second limiter tube by maximum closure of the tuning eye. A half-wave selenium rectifier supplies B+ for the tubes. Although this circuit provides no surprises, it is straightforward and representative of good practice.

Construction

Years ago when kits first became popular they were primarily intended for constructors with some experience. This was evidenced by the use of the specialized electronic "lingo" in the manual and by the fact that parts were supplied in random order which, of course, meant that the kit builder of necessity would have to have some familiarity with electronic components. This is no longer true. For example, in the introduction to the assembly manual it is stated "the assembly instructions have been written primarily for the kit builder who is inexperienced in electronics." The truth of this statement is evidenced by the excellent instruction manual. Not only is each operation clearly spelled out, but also there are a large number of pictorials which clearly show

how each part is placed. In addition to this, there are several photographs which show what the unit should look like after it is completed.

Although aimed primarily at the novice builder, instructions are provided for several levels of competence in aligning the front end of the tuner. The simplest method described, obviously for the novice, requires only the alignment tool provided with the kit and a thin bladed screw driver. This method is surprisingly precise and we were able to achieve the published sensitivity with it. The second method requires experience plus an FM signal generator, a VTVM, and an a.c. voltmeter. Using this method, we were able to achieve better than the published sensitivity. With both methods variations are provided to accommodate those people who have extra equipment. For example, in the simpler method a variation is given for those who have a VTVM. In the more complex method, a variation is provided for those who own a distortion analyzer.

A very fine feature of the manual, in our opinion, is the unusually detailed technical description coupled with the very clear explanation of FM characteristics and terminology. This manual is actually very informative.

Performance

We are very pleased to report that the technical specifications or claims printed on the inside of the cover of the manual are conservative. That is, in every case we were able to at least achieve the specification and in most cases, the kit we built performed somewhat better. For example, in the case of usable sensitivity, the listed value is 6 μ v (IHF standards)—which we achieved using the simplest method provided and no instruments. With instruments we were able to achieve 5.2 μ v. Although this does not again make the KT-650 a very sensitive tuner, it is adequate for all but the lowest signal areas. Harmonic distortion is listed as 0.15 per cent total at 1000 cps. and 100 per cent modulation. This is precisely what we found. We also found the intermodulation distortion to be just under 1 per cent. Frequency response is within 0.5 db from 20 cps to 20,000 cps (range of our test). The audio output level is listed as 1.75 volts; we found the output to be almost 2 volts.

In total perspective the Lafayette KT-650 is a good tuner which provides an audio signal consistent with high-fidelity component equipment. Its extremely modest price makes it a very good choice for those with a limited budget. K-23



Fig. 1. Lafayette FM-tuner kit, Model KT-650.

BOGEN-PRESTO AM/FM-STEREO RECEIVER, MODEL RP-40A

In the unlikely event you haven't noticed it, FM-stereo is here. We mention this because this unit is actually the first FM-stereo receiver with which we have had occasion to become involved. In addition, at the time we were testing this unit, there was only one stereo station on the air (WQXR) in our locality—and the stereo programs being broadcast at this particular time were between 1 and 2 a.m. on week days. Experience indicates that the Bogen-Presto RP-40A is capable of receiving good stereo providing the antenna is appropriate for the location. To demonstrate what this latter point means we should point out that we do our testing some 25 miles from the heart of New York City. When we first set up this unit we used the built-in FM line antenna. The background noise with this arrangement was intolerable on stereo. Then we installed a simple folded-dipole antenna. This produced better results but still not very good. Finally, we connected the unit up to our large high-gain antenna and this eliminated the background noise.

Now back to the receiver. The Bogen Model RP-40A is a complete stereophonic AM/FM-stereo tuner, control center, and 44-watt (22 watts per channel IHFM) audio amplifier. It is an up-to-the-minute unit with complete control over all inputs and outputs independently. This includes separate program selectors which permit directing either mono or stereo programs to either or both audio channels. Thus, the modes and function selection is incorporated in these two controls. Separate slide switch selectors are provided for two remote and two local speaker systems. These permit channeling of mono or stereo programs to local or remote speaker systems from the same or different program sources. Another interesting feature is the use of clear plastic tabs to indicate the location of much-used stations. These tabs are slid along until they are underneath the location of the particular station to be marked. When the sliding indicator is over the station, the clear plastic tab lights up thus providing visual point of reference.

The appearance of the RP-40A is clearly intended to be opulent. The front panel and most of the knobs are finished in gold and some of the trim is jet black. This combination is very rich-looking and this combination is very rich-looking and undoubtedly would blend well with the decor of most homes.

Circuit Description

The FM signal goes from the 300-ohm antenna terminals through an unbalanced line to the tuned grounded-grid r.f. amplifier (6AB4), then to a twin triode (12AT7) oscillator-mixer, through three i.f. amplifier stages (6BA6 and two 6AU6's) with dual limiting action, and then feeds the semiconductor crystal ratio detector. The output of the ratio detector is fed to an EM84 eye tube which is used as a tuning indicator; the output is also fed to the built-in stereo adapter as well as the reactance tube which controls the oscillator. A switch is provided to cut this a.f.c. in and out, as necessary. An a.g.c. circuit maintains audio-level output within 0.5 db with a range of signal variation which is quite considerable. The stereo adapter utilizes the GE-type approach wherein a matrix is used to derive the left and right audio signals. The 19,000-cps pilot is used to lock in a 19,000-cps oscillator which is then doubled to attain the 38,000-cps carrier which is reinserted. A separation control is provided on the back of the chassis which normally is needed only when tubes are changed, or the broadcast signal is below standard for one reason or another.

The AM circuit features a t.r.f. amplifier stage, (6BA6), followed by a converter and one i.f. stage to feed a diode detector. It has its own separate electronic indicator (EM84 "eye tube").

The audio section utilizes four twin triodes (eight tube sections) and two pentodes in each channel. The power output tubes are 7355 pentodes. Three of the four triode sections (two 12AX7 and one 12AU7) are used for preamplification and/or tone compensation. The third twin triode (the 12AX7) is used to drive the output tubes. D.c. is used on the heaters of all the preamp tubes.

Performance

Considered as an integrated audio amplifier, the Bogen RP-40A performs very well. Frequency response is within 1 db from 20 cps to 20,000 cps. Distortion at full output is less than 0.8 per cent. Sensitivity at the magnetic cartridge input is 2.5 mv. FM sensitivity is 2.9 μ v (IHFM) which, of course, is adequate for almost all applications. The AM sensitivity is 3 μ v for 20 db signal-to-noise ratio.

As a control center the RP-40A is very versatile, indicating advanced thinking. As we noted before, the FM-stereo potential of the RP-40A is quite good provided all other conditions are equally good. It is other conditions are equally good. It is striking in appearance and a good performer. K-24

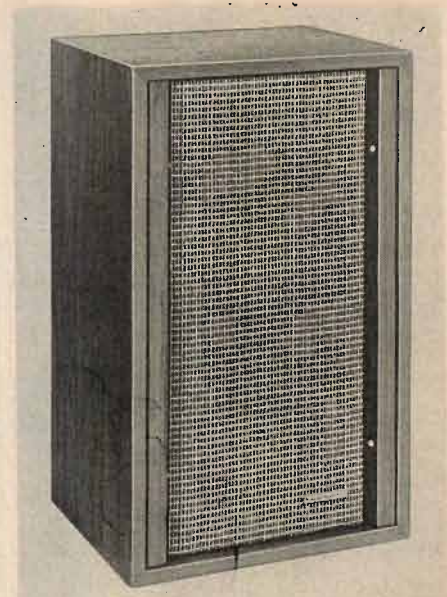


Fig. 3. H. H. Scott speaker system, Model S-2.

H. H. SCOTT SPEAKER SYSTEM, MODEL S-2

A loudspeaker is truly a remarkable device. With nary a string or other similar mechanical contrivance, it can imitate the sounds of a full orchestra of musical instruments. Violins, oboes, trumpets, harps—all of these can be, and are, reproduced with a startling degree of realism.

Consider, for example, the H.H. Scott Model S-2 speaker system. Enclosed in a handsome walnut box (we understand it is available in a variety of finishes) are four separate speakers; one for the low frequencies, two for the mid-range, and a spherical dome unit for the high frequencies. With no more than these four units, and the acoustically matched enclosure, the S-2 can achieve the special sound which characterizes each of the musical instruments named, or any combination of them.

Naturally there are limitations. It is close to impossible to eliminate completely the inherent characteristics of the speakers in their enclosure. But these limitations are audible only to those with unusually critical hearing.

For instance, the inherent characteristic of the S-2 system, in our estimation, lies in that portion of the sound spectrum occupied by instruments such as the trombone, french horn, bassoon, and so forth. But this built-in sound "color," when mixed with the natural tone of the musical instruments, is almost undetectable in listening tests. At least we found it so.

On the other hand, the S-2 can reproduce the rest of the sound spectrum with excellent realism.

Let us hasten to add that the H.H. Scott S-2 speaker system provides a well balanced tonal picture; the transition between frequency ranges is quite smooth. Part of the reason for the smoothness of the frequency response is the careful design of the crossover networks.

Although previously mentioned briefly, we would like to call attention to the handsome appearance of the system. Figure 3 gives some indication of this, but we must admit that the oiled walnut unit we tested is handsomer "in the flesh."

Repeating our opening statement, a loudspeaker is a remarkable device—and the H.H. Scott S-2 is a good loudspeaker system. K-25



Fig. 2. Bogen AM-FM-stereo receiver, Model RP-40A.

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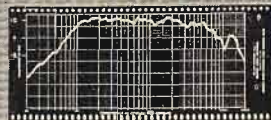
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DESCRIPTION:

The Gigolo is constructed with a resonant resistant all wood product of at least 3/4" thickness throughout. Its outside dimensions are 24" long, 12" high, 9 1/2" deep. The heavy construction and the fine workmanship suggest a value far exceeding its low price. All units sold on 100% low price. All units sold on 100% MONEY BACK GUARANTEE. Price \$15.00. Unfinished only.

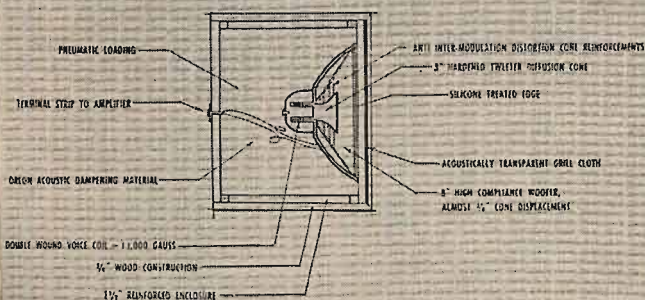
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SPECIFICATIONS:



Frequency response	500	Tone bursts	3500
Maximum frequency response	19-21000 cps		
Maximum frequency response	19-21000 cps		
Frequency response ± 8 db	45-18000 cps		
Harmonic distortion	less than 3% 70-21 kc		
Impedance curve	within $-0 \pm 200\%$ of 8 ohms		
	20-20000 cps		
Flux density	11000+ gauss		
Frequency response curve run at continuous 10 watts.			

Power handling capacity, the Gigolo may be used with small economy amplifiers of very low wattage, as well as with the highest power component amplifier with satisfactory results.



A.E.S., Inc.
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Address _____

City and State _____

Enclosed find check _____ money order _____

SONOTONE STEREO CERAMIC CARTRIDGE, MODEL 9T

Sonotone has been manufacturing ceramic cartridges for many years. Indeed they are one of the pioneers in this area. Previously, however, they concentrated on making cartridges for a segment of the record playing public other than the audiofan. This does not reflect upon the quality of the cartridges they made (and still do in huge quantities) for the "mass" market—they were just not aimed at the audiofan.

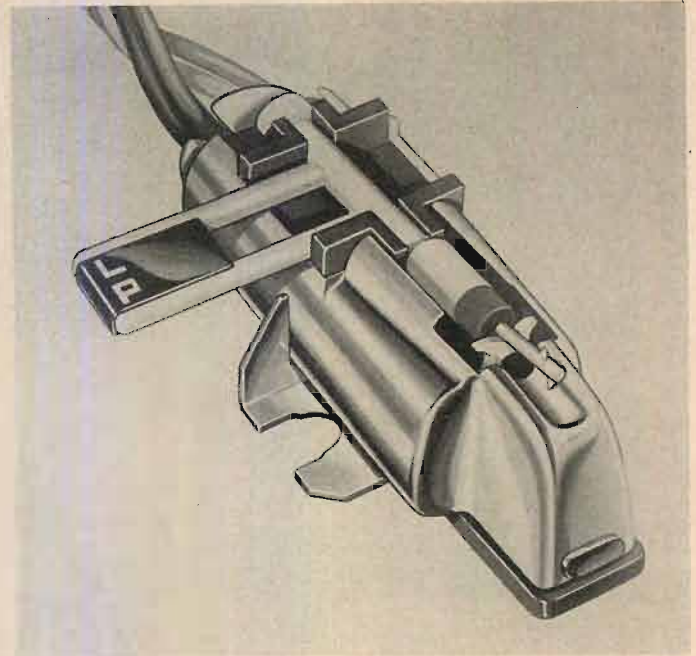
Now they are aiming at the high-fidelity market.

The assembly we received for testing is entitled "Velocitone" and consists of the 9T cartridge plus a pair of equalization networks which permit the cartridge to be plugged into the magnetic inputs of the amplifier. The 9T is a turnover cartridge with interchangeable styli. With the networks, the 9T may be compared to and interchanged with any of the popular magnetic cartridges. Unfortunately, the use of equalizers eliminates one of the good advantages of the ceramic cartridge—its relatively high output. High output is an advantage because it makes it unnecessary to have low-level amplifier stages and, all things being equal, improves the signal-to-noise ratio. On the other hand, there are many amplifiers today which do not make provisions for the ceramic cartridge.

Previously we noted that the 9T is aimed at the high-fidelity market. Now let us see how accurate Sonotone's aim is. Their aim is good; right on target in fact.

Before detailing the test results, we will describe our reactions to the listening tests. Using the equalization network, we

Fig. 4. Sonotone stereo ceramic cartridge, Model 9T.



found the 9T to be quite smooth throughout its range. Both lows and highs were handled well.

We were able to track well with a stylus force of 2 grams although 4 grams gave us somewhat better results. Frequency response was within 1 db from 20 cps to 10,000 cps. From 10,000 cps to 15,000 cps it dropped off 2 db. Channel separation was 12 db at 30 cps, 27 db at 1000 cps, and 3 db at 13,000 cps. Separation at the high frequencies was definitely limited—

only 6 db at 10,000 cps and continuing to decrease to the 3 db mentioned at 13,000 cps. The output voltage, with the equalizers, was 10 mv; without equalizers the output was 0.4 volt. The compliance was given as 3.5×10^{-8} cm/dyne.

The Sonotone Model 9T cartridge, with equalizers, is certainly in the domain of the audiofan. Its performance and "sound" certainly are quite good although stereo separation could be improved.

Also, it is quite modest in price. K-26

GRAY PROFESSIONAL STEREO TONE ARM, MODEL 208-S/16

The Gray 208-S/16 is a viscous damped tone arm designed for professional and broadcast use. Gray has been making professional arms for nearly as long as we can remember—at least as long as we can remember being interested in such things.

A broadcast or professional tone arm is different from the home arm in several important areas. First of all it must be rugged. The amount of use (and possibly abuse) that a professional tone arm receives in everyday use rules out delicate,

easily damaged units. In addition the professional tone arm must be able to change cartridges quickly, and without the need for readjustment every time.

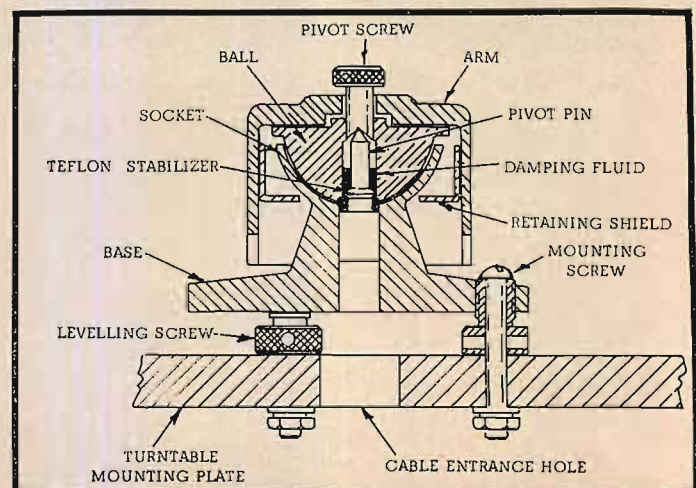
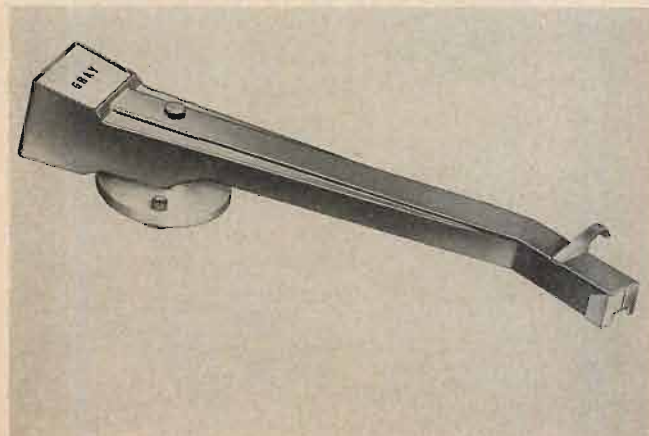
As far as the ruggedness requirement is concerned, one need merely examine the arm to be convinced that it is really built to last. The interchangeability requirement is met by a plug-in cartridge slide assembly. The cartridge is mounted on a slide which is balanced as an assembly. Thus, by having several pre-balanced slide-cartridge assemblies, the broadcaster will always be able to change cartridges within a matter of seconds. He can also change from mono to stereo operation with the same rapidity.

Gray is well known as the pioneer of the

viscous damping principle in tone arm construction. This involves inserting a damping fluid between the mating sections of a ball socket as shown in Fig. 6. The silicone damping fluid tends to resist motion when the arm is moved rapidly but offers almost no resistance when the arm is moved slowly. This is intended to keep the arm relatively motionless so that only the stylus vibrates.

The low resonance (6 cps), great ruggedness, and quick interchangeability of cartridges make the Gray 208-S/16 a truly professional arm. We operated it with several high quality cartridges, with stylus forces as low as one gram and it performed exceedingly well. It did not project its forces as low as one gram and it performed exceedingly well. It did not project its "personality" at all. K-27

Fig. 5 (below). Gray professional stereo tone arm, Model 208-S/16. Fig. 6 (right). Cross-section of pivot and ball socket of Gray arm.

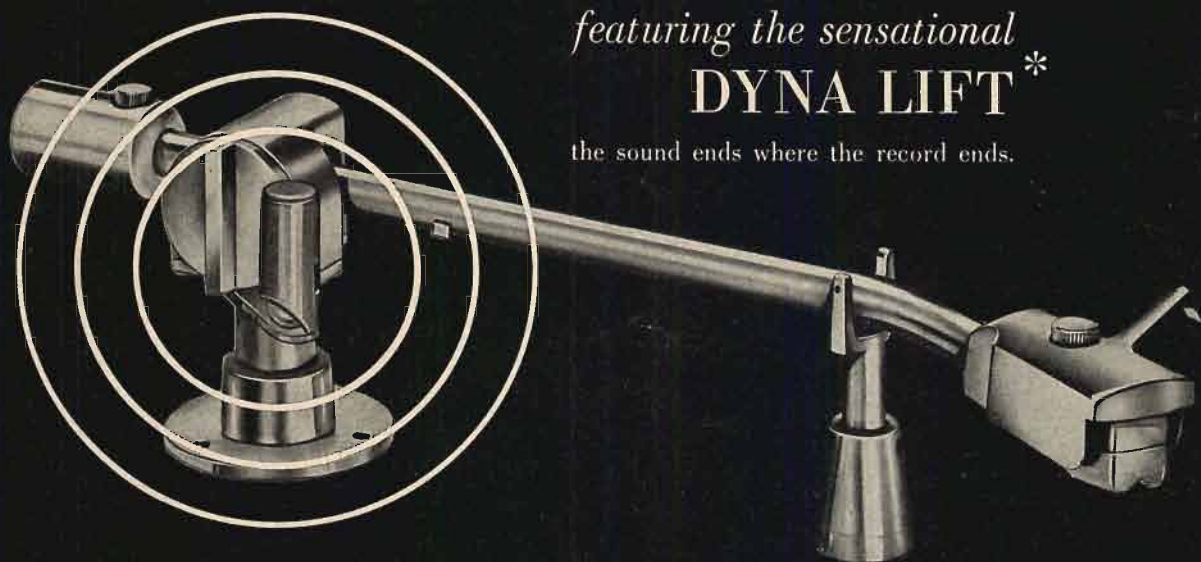


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1. Dyna Lift* Self lifting device eliminates stylus abuse and undesirable run out groove sound at the end of the record. Dyna lift's magnetic system lifts arm perfectly from record more delicately than possible with the human hand. As proven by actual tests conducted. • **2. Perfect Dynamic Balance** Achieved by locating pivot points at exact center of arm mass. • **3. Precise stylus force adjustment** Calibrated knob dials any stylus force from 0-8 grams. Accuracy $\pm 0.1g$ • **4. Maximum compliance** Precision vertical and lateral ball bearing suspensions. • **5. Lowest fundamental resonance** 8 cycles per second. • **6. Stylus overhang adjustment** Unique cartridge bracket-mount permits adjustment of cartridge position in shell for lowest tracking error. (0.65°) • **7. Lowest inertia** Achieved by critically calculated distribution of arm mass. • **8. 5 wire circuit** eliminates ground loops separate 5th wire provides common ground for arm and turntable. Complete shielding. • **9. Plug-in installation** Arm provided with plug terminal and supplied with 4 foot shielded plug in cable assembly. • **10. Self latching arm rest.** • **11. Vertical Height Adjustment** for both arm and arm rest— $1\frac{5}{8}$ inches. •

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DUAL TURNTABLE-CHANGER, MODEL 1006 CUSTOM

It is over two years since we reported on the antecedent of this rather remarkable record-handling unit. At that time, we were quite impressed with some of the features and the performance of the Dual 1006—and we still are. Of course, there is a very good reason for this—the Dual 1006 Custom is very similar to the earlier Model we reported upon but with some significant improvements. One thing that has not been “improved” upon is the appearance and for that we are quite thankful. The types of changes that have been made are all apparently related to improving reliability and eliminating service problems. For example, the cam wheel assembly has been completely redesigned. A glance at Fig. 7 shows the rather large cam which controls the various cycles of operation. The major improvement in this cam wheel seems to be in the unusually tough material from which it is fabricated.

Before going any further into a discussion of the mechanism, we would like to dwell for a brief time upon the rather unusual method whereby the lead-in groove of the record is located on this unit. Actually when we say unusual we mean that it is unusual in appearance. Perhaps it would be best to start by describing what occurs. When the START button is pressed, the arm raises and moves towards the center of the record, drops down on the record and then apparently scoots right across the record until it arrives at the edge of the record. The arm then raises again, moves over a little bit and sets down right in the lead-in groove. Of course, the unusual appearing action is when the arm goes rapidly across the record. On the surface this would seem to be damaging to the record—but closer examination reveals that when the arm raises initially, two little rubber rollers extend out and beyond the stylus so that these rubber rollers are really touching the surface of the record as the arm moves out towards the edge. In reality, the record is not at all damaged but instead it permits the lead-in grooves of odd-sized records to be located. This may seem to be a rather doubtful virtue in view of the fact that most records available today are in one of three standard sizes. However, we found that there are a goodly number of children's records, for example, which are not the standard size. After the edge of the record is found and the arm raises, the wheels retract so that the stylus can engage the groove. Of course another very significant value of this system is that records of any diameter may be stacked in any order.

Before we forget, it should be noted that the Dual 1006 Custom is a 4-speed unit with some other unusual features. For example, alongside the arm rest is a built-in stylus gauge which is a simple dial indicator actuated by a “weighing platform” into which the edge of the arm is hooked. This is a useful feature for those who are likely to use different cartridges because it provides an immediate check. It should be noted that this gauge did not agree with an independent gauge we used to check it. We would recommend that the built-in gauge be calibrated at the outset. Once checked, however, the built-in gauge could be relied upon to provide a good guide.

Operation

Figure 7 shows the Dual 1006. At the front are three pushbuttons—STOP, START, and REPEAT—which provide a variety of

Fig. 7. Dual turntable-changer, Model 1006 Custom.



operations. After putting on one record, or a stack, one simply pushes the START button and the unit starts, plays the record(s), stops and shuts itself off, retracting the idler so there is no pressure on the motor shaft which can cause “flats.” If one wishes to stop in the middle of a record intending to start again with that same record one pushes the REPEAT and STOP buttons, the arm goes to the rest and the unit stops. To start again, one pushes the START and REPEAT buttons together and the same record is played again from the beginning. To repeat the record after it finishes, press the REPEAT button; to repeat immediately, press the REPEAT and START buttons simultaneously. To use manually, put in the short spindle, push the MANUAL button (just back of the other three) and place the arm on the records manually. Except during the change cycle, the arm is freed completely by an ingenious clutch arrangement.

The Mechanism

The 3 lbs. 9 oz. turntable is driven by a sturdy four-pole induction motor which is coupled to the main frame through special vibration mounts. The drive is through an idler wheel to the rim of the turntable. There is a separate drive wheel for each of the four speeds. To prevent flat spots on the rubber wheels, all drive elements are disengaged when the record is shut off.

The record changing mechanism is located in the special sturdy spindle on which the records are placed. When the first record has been completed the shaft that runs through the spindle is pushed upwards which causes the fingers on which that runs through the spindle is pushed upwards which causes the fingers on which the next record is resting to be retracted

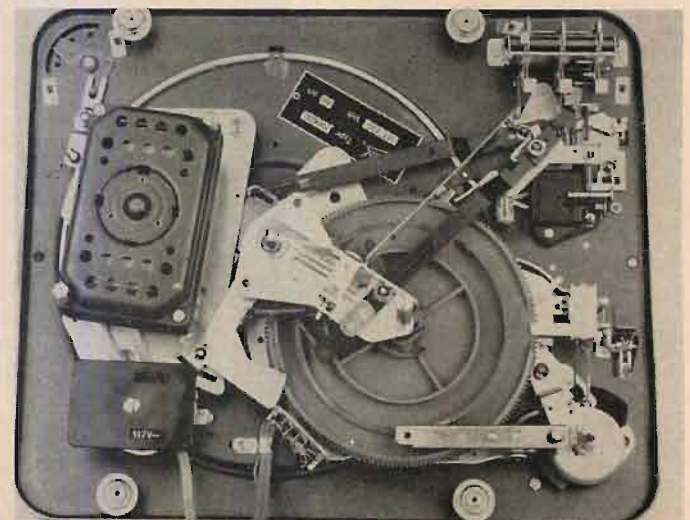
at the same time other fingers lift the remaining records up and away from the record which is about to be dropped. Naturally, this procedure requires that the spindle be locked in position. For this reason when one installs the spindle it is carefully inserted and rotated slightly so the little projections lock in position. The change cycle is controlled by the cam wheel which in turn is set in motion when the turntable starts to rotate. By means of a vertical cam surface it raises or lowers the arm or drops the next record. Actually, there are raised cam surfaces on both faces of the gear-toothed cam assembly. Operation of the mechanism is unusually smooth and relatively quiet. We have operated it through hundreds of cycles and have not as yet observed even the slightest sign of difficulty.

Performance

When we tested the antecedent of the Dual 1006 Custom, we noted that the rumble level that we measured then exceeded the MARTB standards. This standard specifies that rumble shall be rated in db below 1.4 cm/sec stylus velocity at 100 cps which corresponds to 7 cm/sec at 1000 cps with standard equalization. The minimum rumble for a turntable by these standards is -35 db. We measured -36 db. Flutter and wow measured at 0.25 per cent which again is essentially inaudible. We were able to operate the unit very well at a stylus force of 2 grams.

Although we may be repeating ourselves, we would like to note again the Dual 1006 Custom is attractive both in appearance and in performance. It is also modest in price. It is well worth considering by any audiophile who is in the market modest in price. It is well worth considering by any audiophile who is in the market for a record playing mechanism. K-28

Fig. 8. Bottom view of Dual turntable-changer.





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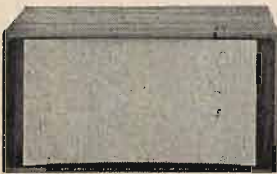
Sensational sight, sensational sound, remarkable bass, undetectable crossover, incredible transient response, transparent highs, smoothest wide-angle projection... Every superlative ever used to describe a precision transduction system has been applied to the new JBL Olympus. The system includes a new 15" Linear-Efficiency low frequency unit, the LE15; new high frequency driver, the LE85; new slant plate acoustical lens, exponentially-tapered horn, and new dividing network. All unite to reproduce sound so clean, so smooth, so intact that the Olympus is destined to establish a new standard for this type of system. The free-standing, trim, beautifully-proportioned enclosure is available in all JBL wood finishes and with choice of carved wood or fabric grille.

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THE MADISON



THE DALE

THE JBL MADISON

An exquisitely-styled minimum volume enclosure, the Madison reflects the Danish design influence and is especially popular in oiled teak or walnut finish. Finished four sides and front for vertical or horizontal placement. Takes the LE8 speaker or S5 system.

THE JBL DALE

A timeless, elegant, modern design with removable legs and hangers on back (also on Madison) for wall mounting. Finished four sides and front. All finishes and grille cloths available.

HIGH QUALITY, LOW COST COMPACT LINEAR-EFFICIENCY SYSTEMS



THE LANCER 33

It is possible to offer typical JBL precision response, fine cabinet craftsmanship, and lasting-listening satisfaction at a lower price than ever before by making a simplified enclosure, longer production runs, limiting choice of finishes, using one grille, and providing somewhat less flexibility. The Lancer 33 is a ducted acoustical enclosure with an LE8 eight-inch, full range speaker. Lancer finishes are those most frequently asked for—tawny walnut, oiled walnut, dark mahogany, ebony, and pumice. Grille cloth is beige linen-weave.

THE LANCER 66

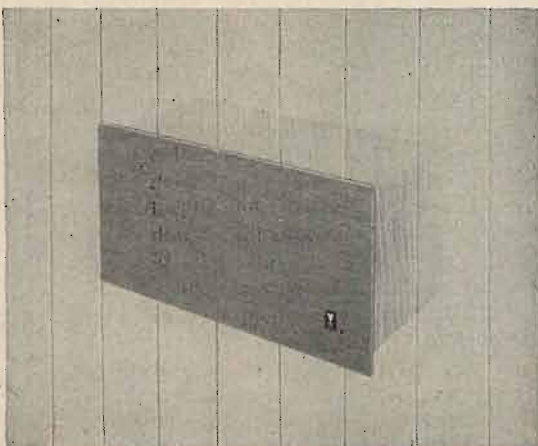
Similar in appearance to the 33, the Lancer 66 is a "buttoned-up" enclosure with a two-way, dividing network system with an LE 10 and new high frequency unit. Performance is remarkably smooth and transparent. Lancer speakers are factory installed.

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NEW AMPLIFIERS

H. H. Scott proudly introduces two new models of the famous 222 and 299 amplifier series. These new amplifiers have more features . . . more power . . . even better performance than before. The superb new 299C is rated at 72 watts (IHFM). Professional features include: front panel stereo output jack for stereo headset; pickup selector switch; derived center channel level control and complete tape recorder monitoring facilities. The powerful 44 watt 222C is built in the Scott tradition of fine quality and advanced engineering. At its price of under \$155 it represents outstanding amplifier performance and value.

NEW SPEAKERS

Imagine . . . from Scott . . . a new speaker system selling for less than \$100! The new S-4 incorporates the same type exclusive multiple crossover circuitry first used in the higher priced S-2 and S-3 speakers. The S-4 will deliver truly superior sound and at a modest price. When choosing your system be sure to hear all three Scott speaker systems. We believe you will agree with leading musicians of Boston's famous Symphony Orchestra who commented, "I have never heard any reproduction of organ which

sounded so faithful to the original. I felt I was sitting in the center of Symphony Hall." (Berj Zamkochian, organist.)

"I was in the control room when this recording was made. Played through these new speakers, the reproduction was closer to the original performance than I have ever heard before." (James Stagliano, First Horn, recording artist Boston and Kapp records.)

NEW KITS

Now there are six kits produced by H. H. Scott. Newest of all are a fabulous FM Multiplex Tuner Kit and an exceptional 48-watt complete Amplifier Kit. The LT-110 FM Multiplex Tuner Kit, priced at \$159.95, gives you Wide-Band multiplex circuitry, plus the pre-assembled Scott



silver-plated front end, in a fun-to-build professional kit. The new LK-48 dual 24 watt integrated stereo amplifier makes available to the kit builder H. H. Scott quality, performance and engineering, at an astonishingly modest cost — \$119.95. As with all H. H. Scott kits these two new models feature H. H. Scott's full-color instruction books, exclusive Part-Charts, Kit-Pak, and styling and performance so professional you'll be proud to demonstrate them to envious friends.

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Newest of all . . . and one of the most exciting single Hi-Fi developments of recent years is the new H. H. Scott 350 FM Multiplex Stereo Tuner. This is the world's first true Wide-Band Multiplex Tuner. It has an amazing IHFM usable sensitivity of 2.5 microvolts . . . stereo separation that fully meets stringent FCC transmission specifications. Special circuitry is provided to assure perfect tape recordings. We are proud of this new tuner, and we think you too will take pride in it.

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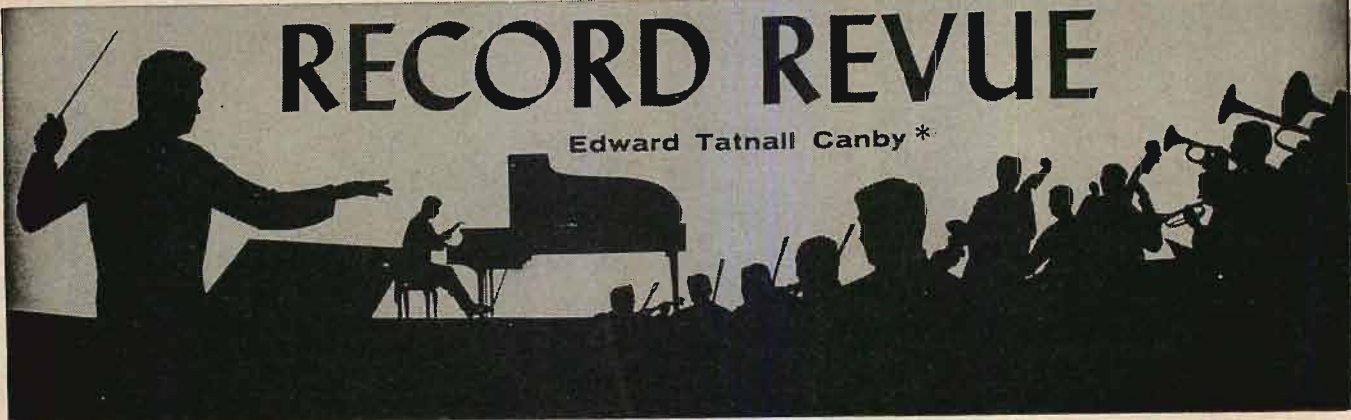
H. H. Scott, Inc., 111 Powdermill Road, Maynard, Mass.

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Outstanding new Scott components include (left to right) LT-110 FM Multiplex Tuner Kit, 299-C 72 Watt Complete Stereo Amplifier, S-4 Speaker System and 350 Wide-Band FM Multiplex Tuner. Slightly higher west of Rockies.

RECORD REVUE

Edward Tatnall Canby *



Don't Miss it

Spain. (Lutys de Luz, Flamenco Songs and Dances).

Monitor MF 357

Just four people and a tape recorder, in a bare, empty room, or so it sounds. One guitar. One singer. Castanets. Loud heel and toe tappings on the floor, reverberating thinly. But somehow a great deal of the curious art of flamenco, combining dance and music, words, sounds and visions, manages to get across in this recording, even though the most important aspect, the visual, is wholly missing.

The handsome Lutys (see cover) is a Spanish dancer and general theatrical creator, but she hasn't let any organizational talents go to her head here. All is simple, the singing voice, well off-mike, is just the rightly harsh, emotional, ornamental male sound that brings out the Moorish in the Spanish idiom, gives the impression of total improvisation while keeping exactly in step with guitar and dancer (who know the rhythms and words too); the guitar explodes, strums, stops altogether, ruminates darkly, just as does the voice; sometimes there is only the foot-tapping, for minutes at a time.

I might be wrong but I suspect this is pretty fine flamenco.

BRAVO!

Kodaly: Hary János Suite.

Liszt: Two Hungarian Rhapsodies. Vienna Symphony, Tibor Paul.

Epic BC 1114 stereo

Epic BC 1114 stereo

(mono: LC 3752)

Whenever the name "Tibor" appears on a disc my eyes and ears perk up, as I've said before, and notably when the music is Hungarian.

This is a sparkingly taut and well turned out "Hary János," as could be expected from the Hungarian Mr. Paul (now resident in New South Wales) and the knowing Viennese orchestra. The Liszt has similar qualities, and you probably will go right along with the Epic (Philips) stereo, too.

Madrigals & Motets. The Budapest Madrigal Ensemble, Ferenc Szekeres.

Monitor MC 2054

... And then there are the Ferencs. That's another good Hungarian name, though not quite as sure-fire as Tibor. This is an odd record and my curiosity as a madrigal conductor (Western-style) was aroused. The singers, I found, are of a real old-fashioned sort, a big group that sings Sixteenth Century music in a lush and Wagnerian manner, though pleasantly, even so. Their second side is more to the point, being music of modern

* 12 Forest Ave., Hastings-on-Hudson, N. Y.

Hungary including Bartok and Kodaly (also a certain Ferenc Farkas, confirming the Ferenc-ish quality of this disc).

There's a stereo version of this one, but I didn't get it from Monitor.

Mozart: Piano Concerto in C, K. 415; Sonata in F, K. 280; Vars. "Ah vous dirai-je, Maman," K. 265. Clara Haskil; Festival Strings Lucerne, Baumgartner.

**Deutsche Grammophon
138670 stereo**

Grasp her quick while you can still get her; the greatest little wisp of a Mozart-Beethoven player in recent times, who died suddenly in December of 1960. For my ear there was no finer Mozart player on earth and there were few who could do such lovely things with Beethoven, though she was not the powerhouse kind of Beethoven pianist. Here she does a great concerto, a superbly easy and fluent piano sonata (how many big pianists stumble dismally over these tantalizingly delicate little works?) and the slight variations on *Twinkle Twinkle Little Star* (as we know the tune), played for the first time I've ever heard them as though they really were intended as music. They are music, with her incredibly beautiful phrasing and balance.

See the Epic label, back awhile, for many a fine Haskil disc.

Stravinsky: Serenade in A; Piano Sonata. Schoenberg: Suite, Op. 25; Two Piano Pieces, Op. 33a, 33b. Charles Rosen.

Epic BC 1140 stereo

(mono: LC 3792)

No question, here is a very fine pianist for this music. It sounds like music, under his touch. It sounds that way to me and it will to you.

He has the requisite abilities. A highly proficient finger technique, a good ear for the stuff and a professorial, musicological background that, clearly, gives him the big, broad viewpoint which can put the music into its proper place. All this comes through not as scholarship but intuitively in the music itself, as we listen. We can read about it, too, in Mr. Rosen's own words on the album jacket.

The two middle-early Stravinsky works will be easiest for most listeners. More than easy—just plain attractive, as piano music. Rosen calls the Serenade "lovable," which perhaps indicates how well he understands its sense. That's just what I would have said, listening to him play. The Piano Sonata is somewhat more formal but made of the same cloth, more or less—it has for us today a marvelous pianistic simplicity and a unique piano sound, with its easy and steady rhythms, its decorative runs and roulades. I found it top listening.

As for Schoenberg, nobody ever said he was easy to listen to, aside from his early popular Romantic works ("Verklaerte Nacht"). These are the landmarks of his early twelve-tone, or serial music, still with that slightly Viennese off-beat decayed-waltz sound to them. Under the Rosen hands, even Schoenberg sounds pianistically musical and quite reasonable for listening. If you ever had a mind to try him, this is the moment. . . .

Vivaldi: Concertos for Flute, Oboe, Bassoon; Double Concertos for 2 Flutes, 2 Oboes, 2 Violins, 2 Mandolins. Soloists and "I Musici."

Epic BSC 111 (2) stereo

(mono: SC 6040)

Read the above titles and you'll see what today's Vivaldi recording means. Concerto after concerto, new ones all the time, endlessly. Concertos for Everything. Before the last War there were something like 80 violin concertos by Vivaldi in one library, as a mild starter. Whether they survived I don't know, but if not, the supply is inexhaustible from elsewhere.

Now just keep one thing in mind: Vivaldi did not write any of these works to be played in a long sequence, one right after the other, like this. Not even the big Collected Concertos, "L'Estro Harmonico" and the like, which were simply groups of six or twelve assembled conveniently for publication and titled for quick sale. (Only the familiar "Four Seasons" is really a connected group—and it is only part of a larger published collection.)

So—try these one or two at a time. The amazing thing is that old Vivaldi never lets you down, never wavers far from his own strong, rock-solid style, serious, good humored, often exotically colored but seldom all-out in emotion like so much of Bach and the other Germans of the North.

As I customarily point out while this series continues, "I Musici" underwent somewhat of a musicological revolution when Epic (Philips) took over this group of 11 players and put them to work under a Dutch-Italian arrangement supervised by the man with the perfect name, Vittorio Negri-Bryks. Now, things are done authentically, with the right sort of instrumental complement and balance, with a proper *tutti* and *solo* relationship in the concerto form, retaining the wonderfully light Italian sheen and accuracy of the string playing that formerly had made the group famous.

On these discs, I found the two-way concertos the most pleasant listening off the bat, notably the one for a pair of mandolins. But the single-solo works are there in reserve, on the other two faces, when you've had enough duet music.

Gregorian Chants. (1) Feasts of the Blessed Virgin; Immaculate Conception. (2) All Saints; Christ the King. (3) Sunday Vespers; Compline. Choir of Monks, Abbey of Saint-Pierre de Solesmes.

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Adam: Giselle (complete). London Symphony, Fistoulari.

Mercury SR2-9011 (2) stereo

An awful lot of Giselle here, two whole-discs, but if you enjoy this pleasantly lyrical and old-fashioned music, belonging to the oldest ballet now in regular repertory, you'll find this a really first-rate playing, sensitive and very musical. No—I didn't even play all of it; but a very few minutes were plenty to advertise the music's happy effect in this version. With Mercury recording to give it sharpness and presence, it is highly worth recommending. A companion two-record recording, same performers and conductor, is the "Sylvia" ballet by Delibes. The other Mercury complete ballet recordings are done with Antal Dorati, some nine or ten of them.

Tchaikowsky: Swan Lake Highlights. Concertgebouw Orchestra of Amsterdam, Fistoulari.

London CS 6218 stereo

... Let's note, too, that London offers its own set of ballet recordings and provides us with the selfsame Maestro Fistoulari. Indeed, on the low-price Richmond label you can have the selfsame orchestra too, the London Symphony, playing the complete "Swan Lake." (CM 9218) These highlights, with Fistoulari, are a version in stereo but these, too, were issued under a limited-time low-price offer of \$2.98, stereo. Might still hold good.

Beethoven: Pastoral Symphony (No. 6). Concertgebouw Orch., Sewallisch.

Epic BC 1134 stereo
(mono: LC 3785)

Judging the "Sixth," on one record after another, is perhaps the most subjective task that any record reviewer must face. The symphony, as Beethoven said, is more feeling than tonal painting, in spite of the verbal descriptions of the movements in terms of nature and the country. Feeling in the playing, feeling above all in the listening.

No sooner had I finished writing about the Lorin Maazel "Sixth," with much approval, than I came upon this one—very different, but I find myself again approving. Odd, because for a number of years I simply could not find a "Sixth" that I liked, though there were many that came in on the musical tide. (No; I will not go back to see how they stand up now. Comparative criticism between performances is self-limiting, like those patent sub-atomic forces in nature that are unmeasurable because they are altered by the measuring process. Can a listening ear judge the tenth playing of a "Sixth" with the same feelings as the first? Not mine.)

What matters, is that this in its own way is a very good "Sixth." There is a curious contradiction in it that may be the result of a happy combination of performers, a dynamically rising young Bavarian conductor and a solidly, luminously conservative Dutch orchestra.

The music plods, almost stolidly, and yet it is light. The "beat" is lumpish and almost march-like, and yet the rhythmic span is easy, poetic, unaffected, not a bit rigid, never hard. I found it quite absorbing, this curiously straight-ahead music-making, and I particularly enjoyed the relaxed, un-tense quality of it, stolid, yet never stodgy.

Epic has hit on a particularly nice recorded sound here, quite vivid and real, with an interesting play of inner melodies brought to the fore. The conductor probably had something to do with that, but even so the recording is outstandingly good for Beethoven.

Here's Milt Kamen!

Capitol SW 1565 stereo

The guy's funny! I wouldn't have believed it for myself—Capitol has so many comics now that there's a special department, "Capitol Comedy Selections," to keep up with them

all, and I've tried this one and that one, until now, without much enthusiasm. The format is always the same. Big screaming studio audience, laughs every time he opens his mouth no matter what and even before he says it, a series of half-anecdotes mostly topical and each leading outward via the "speaking of so-and-so" technique until nobody in his right mind could remember where the froth started. . . . Well, Mark Twain started the system, anyhow, as you can tell if you've heard Columbia's "Mark Twain Tonight," but as I was saying. . . .

Mil Kamen is sort of the essence of good old New York, rolled into one round package. If you've been around dat boig and hoid its lingo, in da Bronx, Brookalyn, even in Minhattin, in the trains (subways to you and me), on the avenoo, in da pok, well this guy has it. Even Groucho Marx has to admit he's good.

Thing is, I don't really think he *knows* he has it—that is, Newyorkese. Like all people from thereabouts he takes it for granted that all the world talks and thinks the same way.

Now don't go and tell me he comes from L.A. He shoulda hoid 'va boig witda name of L.A. I got nooz fa yoo.

Well, it's not that nutty, but it is quite wonderful. Try the Milt Kamen version of "Hamlet." It's on Side Two.

(P.S. For the info of our friends in L.A. In N.Y. "I got nooz fa yoo" means anything from "I have some news for you" to "Fat chance" or just plain "No!". In N. Y. the mothers don't shout to their small kids "Come here *this minute!*" They yell "Gitovah-heeya! And the kids get over, too.)

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Andrea Gabrieli: Mass: Pater Peccavi; Two Motets. Coro della capella di Treviso, D'Alessi.

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backwoods, when these recordings were first made. This is a fine Sixteenth century Mass by the elder of the two Venetian Gabriellis, sung spaghettil à la Caruso, with lots of enthusiasm and the most extraordinary lack of historical perspective. Not *all* Italian music is by Verdi! Those who know a bit about older choral works of this sort are in for a shock when they try this one.

Big Carusos, little ones—(Carusini, perhaps), those choirboys of Italy whose style has been inelegantly described as “squalling”—a richly wobbly over-all ensemble that sounds like the chorus of a provincial “Trovatore” and is just as full of sincerity. The Italians *like* their old music this way and, I suppose, it's up to us to take it or leave it in its own terms. The spirit is wonderful, but every note begins with a scoop, a slide upwards; the pace is sturdy and elephantine, like slogging through swamplands, a sort of slow march-time all the way, never flagging.

All very fine, but the unforgivable sin, as I hear it is the sadly indeterminate pitch.

Everything is vaguely out of tune. The pitch seems to sag lower with every chord, though oddly enough this is an illusion of sorts, for most of the time the chorus actually remains more or less at the level from which it starts out. But the inner pitch relationships, between notes of the scale, are insecure and unlovely. Old Caruso would never have sung it this way.

Monteverdi: Il Ballo delle Ingrate (arr. Lupi). Emma Tegani, Claudia Carbi, Luigi Sgarro; Orch. da Camera di Milano and Cho., Gerelli.

Vox DL 650

Here's another of Vox's astonishing Italian efforts, old music again in a slightly outlandish “arrangement” for modern orchestra, with piano, harp and what-not; but here there are three noble performing elements to bring through the lovely music of Monteverdi (1608), three excellent voices, soprano, mezzo and basso. In spite of the “arrangement,”

they make the recording desirable. Rich, poignant but beautifully controlled and stylized, all three of these voices are aesthetically good for the Monteverdi expression. No Caruso-izing here!

The work was a sort of semi-operatic “spectacular,” relying on lavish scenery and arresting new-style music for its impact. We lack the scenery and the music doesn't sound “new,” but the sense of it still carries authority, given some familiarity with this interesting transitional period in our music. Vox tosses this performance at us with no more than an outline of the “story-line” to help—no texts, no translations. (Unless maybe a folder fell out of my album.) The recorded quality is adequate in mono, though not a sibilant in a carload can be heard. (Last time I ran into this record was as Vox PL 8090 back in the early '50s, and it could be older.)

Giovanni Gabrieli: Sacrae Symphoniae, Canzoni. Choir, Brass, the Gabrieli Festival, Gillesberger.

Vanguard BGS 5037 stereo

Oddly enough, it seems to take the transalpine Viennese to put on a reasonably “authentic” performance of older Italian music, like this from Venice; the Italians still cling to their slightly outdated unauthenticism, their fancy “arrangements” for Wagnerian orchestras and Verdieque choruses. This Viennese-type performance of the brilliant double-choir music of Saint Mark's in Venice is highly authentic, according to the original manuscripts, freely doubled or alternated with voices and brass as was the custom in Gabrieli's time (around 1600), with *Intonazioni*, free improvisations on the organ, to set the key for each work. But nevertheless the spirit of the performance and the sound is pleasantly Viennese, the outlines soft and mellow, the voices wobbly but sincere and musical. My only reservation in a really lovely double-choir portrayal is the rather march-like rhythm in some sections, the word-phrases lacking adequate shaping. Gorgeous music, any way you hear it. The Canzoni are short works for brass, one of which is the famous *Sonata pian e forte*, contrasting soft and loud timbres, piano and forte.

Early Baroque Music of Germany—Heinrich Schütz and Melchior Franck. New York Pro Musica, Greenberg.

Decca DL 79412 stereo

The Pro Musica people work industriously through a perfect mountain of old music each year—give them another decade and the supply will begin to run out. Their organization is highly efficient, complete with musicologist and a slew of newly revived and reconstructed old instruments to go along with the solo voices, as per the latest in musicological research. They are as enthusiastic as they are industrious; never a dull moment.

But not too many profound moments, either. It is rarely possible to achieve a really moving insight into such music in the time available in this fashion, and with so much to cover. Nor has it occurred to the Pro Musica (as it surely did long ago to the Belgian Pro Musica Antiqua performers under Safford Cape) that a standard, well trained, modern concert voice is not the best thing in the world for older music. These voices are good ones—by modern standards. They make very little concession, though, to a possible “authentic” vocal production in harmony with the demands of a music very different from that of more recent times.

Having said all that—I'll note that in this record the group is at its best, singing works mainly intended for solo voices and from a relatively recent time, the Seventeenth century, when the modern concept of the brilliant solo voice was already well launched. Most of the works here are solos and duets; only a few are more suited to choral singing, in five or six parts. The doubling of some voices with instruments is newly authentic, probably the way things were done in those days, and helps the musical sense for today's ears, given these big, brilliant vibrato vocal sounds.

To be sure, Schütz is a gentle composer, and

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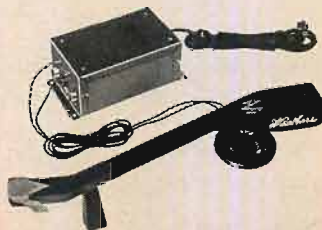
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Melchior Franck (not related to the later César) is the same; yet these are big, loud performances. I enjoyed them, nevertheless, and the instrumental element is well done throughout.

Musique de Joye (Country Wedding Festival, 17th Century France). Telemann Society Orch., Schulze.

Vox DL 570

Telemann: Three Concerti. Telemann Society, Schulze.

Vox DL 590

There are two Schulzes, Richard and Theodora; he conducts and researches, she plays recorder, oboe; the Telemann Society would seem to be their joint baby. I'm not at all clear as to just where in space the Society makes these recordings, since the Vox operation involves both French and American segments—jackets printed in France in French and (sometimes) English, records pressed in the U.S.A., from varied masters.

The "Musique de Joye" is an elaborate suite of old "pops" music, its many separate sections originally intended for informal playing at a country wedding, many of the tunes being well known airs and dances. The original was "arranged" (as we would say it) by one Jean Hotteterre, of Paris. The Schulzes have fixed this up for an appropriate small orchestra and a group of recorders, the whole accompanied (on paper) by a running account of the wedding activities. See the jacket. The music is simple and charming, but Richard Schulze has injected some irritating mannerisms into the playing, notably a dogmatic, plodding sort of staccato in the recorders and a slightly exasperating hiccup effect at each of the cadenzas (endings). Theodora Schulze shows herself here and in the Telemann record as an excellent performing musician, fluent on the recorder in these works.

The Telemann pieces are actually two concerti, one for oboe and the other a brilliant work for three trumpets and two oboes, plus the well known "flute" suite in A minor, often heard in souped-up symphonic versions as played by major symphony outfits with a flute solo. These are more authentic playings, and the "flute" here is the proper recorder as originally intended, very nicely played by Theodora S. She also plays the oboe solo—she must play *two* oboes—you'll note there's no second oboist mentioned. (The three trumpeters are given credits.)

The Schulze authenticity includes a valiant try at the difficult double-dotted rhythm so seldom achieved in these works by modern orchestras—not bad, here. Generally the music flows nicely, but there is again a certain dogmatic heaviness, evidently the director's, which takes the bloom off what otherwise would be a fine peach in the Baroque style.

The Royal Brass Music of King James I. Trumpet, trombone, ensemble dir. Thurston Dart.

L'Oiseau-Lyre SOL 60019 stereo

It was a good idea to gather together this "house music," composed for King James' brass band by a whole list of not too well known Britishers who came just after the great times of Queen Elizabeth I. Giles Farnaby is the only one familiar to modern Elizabethans; the more curious among us have probably already run into the redoubtable Giovanni Coperario, whose real name was plain John Cooper—he wanted to sound fashionable in the Italian manner. Also Jérôme Bassano and Alfonso Ferraboseo II, all of these if I am right born properly British. (Well, if movie people can do it, and songbirds for disc jockeys, then why not Englishmen?)

Mr. Dart went to Paris to borrow a group of brilliant French brass players here. The sound is plenty brassy but after a dozen or so little pieces it gets a bit monotonous; and I'm afraid these Frenchmen knew less about old English music than Mr. Dart himself, who knows plenty. They sound like solid brass men to me, the kind who play at the Opéra and the Conservatoire.

Handel: Great Tenor Arias. Kenneth McKellar; Royal Opera House Orch., Boulton. London OS 25234 stereo

This is British Handel de luxe—take warning thereby. The works. Big, Romantic orchestra, a large, liquid, slightly sentimental tenor with a golden voice, lots of bounce in the fast parts and a plethora of ritards, those real drippy slowings-down-at-the-endings, which move many Britishers and plenty of Americans to tears of gratitude.

Warning, merely because some people bridle at the mere thought of all this. If you don't, then you'll find Mr. McKellar right in the old-fashioned Handelian groove, positively weeping in the "Messiah" (of course—*Comfort Ye* and *Every Valley*), but surprisingly agile and accurate in some of the lesser known and more lively excerpts. He's tops in his field, if you go for the field.

MacDowell: Suite No. 1. Gillis: The Alamo. Downs: Elegiac Prelude. National High School Symphony Orch., Maddy, Gillis.

Nat. Music Camp (1) stereo

The great Interlochen complex of teaching and publishing facilities here projects its first stereo LP in a series. The student performances will be of interest to Interlochen graduates and students and to parents and educators—but for the rest of us, the interest is so-so, as is the music itself.

First, though the skill with which these kids play is remarkable considering their age, there is inevitably that child-like quality of unquestioning imitativeness—"aping their elders"—which is bound to take the place of inner conviction in this kind of student performance. It's the same in a student "Hamlet"—or a "South Pacific"—for kids learn by doing. And the inevitable rough edges appear, too, in spite of a relatively high polish. Good for learning but not for listening.

More important is the lamentably unchallenging music here featured, as uninspired in content as it is complex and elaborate in orchestration. The MacDowell Suite, a first recording, is a highly dated example of the impressionist vein of sentiment popular hereabouts near the turn of the century, thoroughly alien to the lives of present-day teenagers, yet not vital enough to rate as classic music of the past. For my ear, the Gillis "Alamo" piece is an overblown mass of patriotic conventionality, expertly orchestrated and empty of real content. The Downs work is more serious and as seriously devoid of anything new in the way of musical thought, though it is again expertly orchestrated.

Is our musical training always to be carried on in this manner, producing highly proficient instrumentalists who can "play anything" but who haven't learned to know what music really can say? It seems to me that a properly trained high school music student should play this sort of stuff with a large grain of salt, understanding its pretentious superficiality in toto, understanding its pretentious superficiality in toto, understanding its pretentious superficiality in toto, understanding its purely technical brilliance. Maybe some of these students do, but I wonder . . .

Ravel: Piano Concerto in D for the Left Hand.

Prokofiev: Piano Concerto No. 3 in C. John Browning; Philharmonia Orch., Leinsdorf.

Capitol SP8545 stereo

An interesting record here—one side is excellent, the other not so good, though the performers are the same.

John Browning, one of the new younger pianists, has more than enough left-hand technique to play the enormously demanding concerto Ravel wrote for Paul Wittgenstein, the one-armed pianist. But in this performance, the desperate, harsh emotionalism of the Ravel dissonance seems to miss him. It just isn't there. Perhaps dissonance has gone so far now that the once-violent Ravel harmonies no longer say what they were meant to, at least to younger performing ears of this sort.

The Prokofiev Concerto, a work of the early Twenties, on the other hand seems perfectly

(Continued on page 90)

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STEREO

The Birdland Story

Roulette Stereo SRB2

As keeping pace with modern jazz built Birdland's reputation, the management apparently believes the twelfth year of successful operation is no time to rest on its laurels. Only a quarter of this two-record album is devoted to mono mementos left behind by some of the historic figures who helped establish the club. The story is brought up to the present, with the added benefits of stereo, by three groups drafted from among the younger men who are frequently active on the stand today. They also point to the future and are likely candidates to take care of subsequent chapters. With such players of great resources as Al Grey, Thad Jones, Lee Morgan, Bobby Timmons and John Coltrane to call on in the years ahead, the club can look forward to another prosperous decade.

Manager Oscar Goodstein is already welcoming a new generation of paying customers, some of whom may think there has always been a Birdland at the corner of Broadway and 52nd Street. A souvenir booklet, handsomely illustrated and enclosed in the boxed set, reveals the delays and difficulties encountered before the doors opened on December 15, 1949. The founders still seem to retain the optimism of those embryonic days, or they would hardly expect Leonard Feather to compress the entire Birdland story into twenty pages. Most noteworthy happenings are covered, however, including the rise and fall of rival clubs, the Charlie Parker saga, and the promotional windfall brought about by George Shearing's *Lullaby Of Birdland*. A steady stream of anecdotes moves the story briskly along, and the memories of many readers will be jogged into recalling other choice items that were barred due to lack of space. Incidents sensational enough to have attracted wide newspaper coverage are also avoided, but the author never hides the fact that running a jazz club on Broadway is still a tough and tricky business.

The survey of performances from the past ignores the familiar Shearing theme, surprisingly enough, favoring instead a sample of Harry Belafonte's brief career as a pop singer. Belafonte, who was one of the attractions on the opening bill, is heard with Machito's Afro-Cuban outfit on *Lean On Me*. Bud Powell appears at his pianistic peak on *Somebody Loves Me*. The era of cool sounds is revisited as Stan Getz plays *Hershey Bar*, and then joins guitarist Johnny Smith on *Moonlight In Vermont*. Parker's partners are Miles Davis on *Embraceable You*, and Dizzy Gillespie on *Confirmation*.

While enough remembrances of this caliber could be found to fill an entire four sides, with a terminal salute from the bands of Count Basie and Maynard Ferguson, an important part of the Birdland story would be left untold. The lifeblood of jazz must be constantly renewed, and Birdland does its bit by startling young players off at the

famous Monday night sessions and helping to launch new groups. The sessions forming the bulk of this set are prime illustrations of how new stars are made, as three of the musicians involved have since become leaders. Billy Mitchell and Al Grey of the Basie band are now heading a unit jointly, and trumpeter Lee Morgan has left Art Blakey to set out on his own. And John Coltrane, who leads the latest edition of a quartet that was formed less than two years ago, contributes three originals to strengthen his position as a reigning force on tenor sax.

Each group enjoys a side to itself, with Morgan in command of Art Blakey's quintet and drummer Art Taylor substituting for the regular leader. Among their originals is another new Bobby Timmons work, *Minor Strain*, which again proves the pianist to be closely attuned to the current jazz pulse. The Basie contingent is in charge of Thad Jones, who provides three original lines and enlists brother Hank to fill in on piano. The trumpeter delivers a fine muted solo on *Tip Toe*, and Frank Wess joins Mitchell and Grey as an added starter.

All three groups perform as they might on any good night at Birdland. The solos are first class, and the qualities needed to assume the burdens of leadership go on display in more than one instance. The only question left unsettled is whether the name of one of the Janes brothers, Frank Wess or Bobby Timmons will go up on the club marquee next.

Blue Mitchell: Brasses And Strings

Fortissimo Stereo XK8006

After getting the new Fortissimo subsidiary off to a resounding start with jet planes, racing cars, pipe organs and other decibel producers, Riverside finally applies the same careful processing methods to an outstanding jazz release. The results are truly fabulous, and it will be a great day when recordings of such quality become an industry standard rather than a curiosity for the audio enthusiast. One way to hasten the day is through consumer pressure, and the pleased reaction to this album should make itself felt in short order over a wide area.

Because of the broad appeal of solo trumpet in conjunction with supporting brass and strings, many listeners will investigate the Fortissimo XK series for the first time. The descriptive notes avoid tags that might warn off purchasers addicted to either straight jazz or mood music, and with good reason, for the album belongs exclusively to neither category. Tadd Dameron and Benny Golson supply arrangements far superior to the anonymous scoring that usually makes every mood album sound the same as another. They add a swinging touch of distinction to the strings without departing too far from the norm. Concertmaster Harry Lookofsky keeps the section on the alert, and it is fully capable of matching wits with the accomplished jazzmen who make up the large brass choir. Golson is on the podium to prevent the debate from getting out of hand.

Blue Mitchell enjoys a dual recording career, working at Riverside as a contract

artist and appearing on Blue Note in his featured role with the Horace Silver quintet. All his efforts until now were directed at listeners to small-group jazz, but the switch to a larger framework and tender toying with ballads comes off without a hitch. The album's theme might well be taken from a new Dameron opus titled *Smooth As The Wind*, so relaxed and graceful are readings of *But Beautiful*, *Nearness Of You*, and *For All We Know*. Mitchell's solos are structured according to plan, yet his long, lithe lines are freely improvised and hold much jazz interest. Particularly impressive are two pieces of Silver's, who can bask in the reflected glory of his employee's playing on *Strollin'* and *Peace*.

As this album proves the case for quality control and polymax pressings without resorting to sensational sounds or stereo gimmicks, it provides an ideal introduction to the Fortissimo XK series. Recordings of jets and racing cars are excellent tests of equipment, but brasses and strings give a better indication of how closely a finished record conforms to the original tape. All thirty-eight minutes of playing time are distinguished by extreme clarity and lack of distortion. More often than not a featured trumpet is recorded at a greater volume level than the rest of the brass and allowed to blot out supporting strings. This can be a blessing with certain string sections, but here the balance is about as natural as anyone could want.

Now that Riverside has set new standards for the industry, it might confer a further boon on the purchaser by pressing all its stereo releases on polymax material. Much of the resistance to the premium price asked for stereo discs would disappear if they all met such high standards. If any economies must be made, the first thing to go should be double-fold covers which devote a full page to telling what instrument is to be heard where.

Les McCann: Pretty Lady

Pacific Jazz Stereo 25

A little commercial success was all Les McCann needed before certain portions of the jazz press began to accuse him of borrowing from other pianists, outright plagiarism, contrivance, and other crimes too grievous to mention. The truth of the matter is that McCann's own originals have always been the most interesting and memorable parts of any of his albums. As though to prove the point, he includes two new compositions in his current excursion into the world of balladry, and they are as fresh and exciting as anything he has done. One is the gracious title tune, and the other a tender entreaty called *Doreen Don't Cry, I*. Influences can be detected as McCann goes to work in the romantic department, but the sum total is always greater than any of the parts on *Django*, *Little Girl Blue*, and *I'll Take Romance*.

In the latest edition of the trio, Herbie Lewis has ably replaced the agile Leroy Vinyegar, while the reliable Ron Jefferson continues on drums. McCann's playing is always enjoyable, but the Bosendorfer piano used on this occasion makes it even more so, and the superb tone stretches luxuriously in stereo.

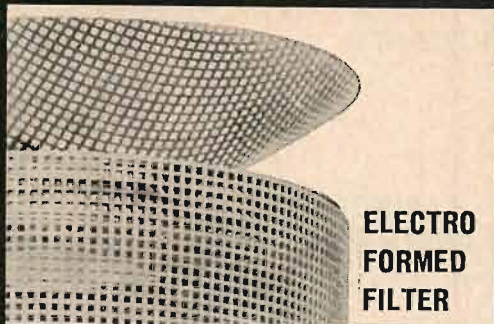
Ida Cox: Blues For Rampart Street

Riverside Stereo RLP9374

The annals of jazz are full of unique recording, even though the religious tracing of influences by jazz historians sometimes makes them all seem alike, but there will never be a match for Ida Cox's "final statement." How she was located at her home in Knoxville, Tennessee, also is an unusual story, and historians are polishing it down to the last detail. The question of Miss Cox's age is still not settled, however, but she began singing in Southern minstrel shows at fourteen. Regardless of whether she has passed her seventieth birthday or not, her voice has acquired all qualities usually associated with a benevolent grandmother. In any event, she has no compunctions about referring to Coleman Hawkins and Roy Eldridge as "boys."

For purposes of comparison, several of the original recordings of numbers scored here have been reissued on Riverside RLP

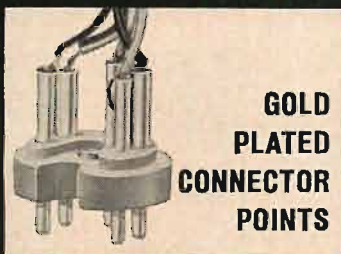
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147. One in-person specialty never available before is a determined *Mama Goes Where Papa Goes*. The boys respond with youthful vigor, and Eldridge's trumpet obligatos are just what Miss Cox needs to get back into the swing of things. One of her reservations about journeying to New York was that she would rather sing with her church choir than return to the blues. If the boys at Riverside are looking for another statement, they might try recording Miss Cox and the choir. Pianist Sam Price, Milt Hinton, bass, and drummer Jo Jones complete the accompanying quintet.

Abbey Lincoln: Straight Ahead
Candid Stereo 9015

For some time now Abbey Lincoln has mounted a one-woman attack on the conventions of jazz singing, and in this encounter the bastions are breached with a revolutionary effect that will be felt eventually in all areas of jazz. Failure to become acquainted now with what she is trying to accomplish will only mean coming back to this album later, as it is bound to become a jazz landmark. She stands far ahead of anyone else on the path the next great female singer must travel, and her progress to date can hardly be assimilated in one sitting. Not that Miss Lincoln succeeds in everything she attempts, but all her efforts are venturesome and full of meaning. And her very best invites comparison with the Billie Holiday of *Strange Fruit*.

The composers, lyricists and musicians assisting Miss Lincoln are all distinguished, and it is impossible to say which of the three groups is the most impressive. Oscar Brown provides a setting for Paul Laurence Dunbar's *When Malindy Sings*; Randy Weston and Max Roach collaborate on *African Lady*, a new poem by Langston Hughes; Mal Waldron contributes the title tune, and the singer herself penned the words to Thelonious Monk's *Blue Monk*. Coleman Hawkins is a tower of strength in a supporting cast which includes Max Roach, Eric Dolphy, Booker Little and Waldron. Stunning stereo, as engineered by Bob d'Orleans, benefits the entire company.

Judy Garland: Judy At Carnegie Hall
Capitol Stereo SWBO1569

If anyone harbors doubts about all the rave reviews of Judy Garland's Carnegie Hall concert last April, this two decker recording of the event should go a long way toward dispelling them. Critics are known to be sentimental about show business comebacks, but the plaudits are thoroughly deserved in this case. Not that Miss Garland is infallible, for she falters more than once during the last part of the program. Somehow it only makes her seem more human than the well rehearsed little girl who first sang *Over The Rainbow*. There is nothing mechanical in the way a missed note is covered up, and she sails into the next chorus more vigorously than ever. She passes all the tests of a real trouper, and twenty-six numbers are more than enough to

twenty-six numbers are more than enough to expect of a singer in one evening. Mort Lindsey conducts the lively orchestra, and the show is still going strong on tour. Miss Garland may not return as often as Harry Lauder, but this recording will endure for as many years as some of his. Should the applause be too thunderous in stereo, then be satisfied with the monophonic version, but by all means get one or the other.

Harry Belafonte: Jump Up Calypso
RCA Victor Stereo LSP2388

Back in 1955 the astonishing success of Belafonte's first calypso album caused the recording industry to break out in a rash of congas and bongos. For a while each departing banana boat carried one or more talent scouts on the passenger list. The excitement subsided when they found native singers knew all about collecting royalties, and besides the best drummers were already on the way to New York. The LP liberated Belafonte from commercial pressures of any sort, and he was able to move on to spirituals and chain gang songs before the calypso bubble burst. Only a second Belafonte album could inflate it again, and after a six year wait the public should be just about ready for the start of a new Caribbean cycle.

This time stereo is on tap in the studio to help recreate a carefree Trinidad street scene during the annual Jump Up Carnival. Collectors lucky enough to possess recordings made at the festivities several years ago by Emory Cook will have a good idea of what the real thing is like. Belafonte worked with Irving Burgie on arrangements which make it easy for a broad audience to readily grasp the meaning and humor in the songs, and his performances are honed to a razorsharp edge. The unusual supporting cast of orchestra, chorus and Trinidad Steel band is directed by Ralph Hunter, who collaborated with engineer Bob Simpson in creating lifelike stereo effects. The steel drummers are well deployed to add soft accents on the romantic *Land Of The Sea And Sun*, or unite in full force on the lively *Angelina*. Ideal demonstration material are the whopping bass notes from the big marching drums on the ecstatic *Go! Down Jordan*.

**Mavis Rivers: Mavis
Reprise RSL1702 (4-track stereo tape)**

While Frank Sinatra failed to take a swinging album title away from Capitol, he did succeed in getting Mavis Rivers to come along and help start his Reprise label. The Samoan lass is one of the brightest new vocal talents to appear in several years, and she improves with every studio visit. Where her previous supporting groups only hinted at a jazz backing, Marty Paich's arrangements allow the singer considerable latitude, in addition to encouraging solos from the likes of Jack Sheldon, Stu Williamson, Bud Shank and Bill Perkins. Everyone enters into the joyous spirit of *It Don't Mean A Thing*, and *Saturday Night*. A bit of seductive South Sea Island magic transforms *Candy*, *There's No You*, and other ballads. And Miss Rivers can claim credit for the sultriest version ever of Harold Arlen's *A Sleepin' Bee*.

However, the best excuse for investing in the stereo tape is the priceless tuba playing of an unheralded member of the dectet. Besides adding a full-bodied sound to the ensembles, Red Callender is quite capable of swining any group he joins. Tape plainly reveals details of his craft that are often hidden, and a tuba has seldom appeared so winsome and winning before.

**Terry Snyder: Footlight Percussion
United Artists UATC2228
(4-track stereo tape)**

Many engineers still insist their work lies closer to the arts than to science, but the rise of stereo spectaculars and sounds in motion is rapidly making jobs for computer technicians. Not only is memory storing valuable for channel switching and other aspects of the re-mastering process, but the need for an IBM machine to plan a session will soon become an actuality. Before long every popular song and show tune will be catalogued become an actuality. Before long every popular song and show tune will be catalogued and information listed as to past performance. A few seconds with the machine will tell whether a title has received the bongo or chimes treatment, and which way the instruments went.

Until then, record companies must trust the brains of such mortals as Terry Snyder, whose top-flight drumming got him in on the act at the beginning. Presently engaged in an "ultra-audio" series, he gives the mental once-over to a dozen Broadway hits. Chimes and bells are assigned to *If I Were A Bell*, and *'Til There Was You*. Vibes win out on *Bali Hai*, a Chinese gong song on *Anything Goes*, and bongos are featured throughout. Tape ensures all the ultras which the promotional literature promises in the way of wide-range, channel-separation, and instruments floating from speaker to speaker.

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between have done nothing to separate his playing from a deep blues heritage. European recognition resulted in a Presige LP on his return, and now another album unfolds still more of his undiluted lyrics and solo piano. His discography dates back to 1929 and the old Paramount label, according to the list supplied by Rudi Blesh, whose notes also evaluate a career that began in Kentwood, Louisiana, near the Mississippi line, and became an important part of the epic folk blues just being rediscovered by a new generation of collectors. Besides reviving such time-tested solo numbers as *Vicksburg 44*, and *Crescent City*, the pianist recalls a concert of last year on *London Blues*, and extemporizes *West 46th Street Boogie*, where Folkways was located until a month or so ago.

While Little Brother's vocal powers are no better than average, his singing is completely natural and free of any influences foreign to the blues. His accompaniments are unexcelled anywhere, and no one held a stop watch to rule out extra choruses of solo piano on *Early One Morning*, *Now About That Prisoner*, and *I Ain't No Bulldog*. Plainly audible in the recording are the drumlike foot taps which set basic tempos. If Little Brother's right hand seems not to know what the left is doing, both hands are fully aware of his rhythmic foot.

**Charles Perry: The Sound Of Brushes
Music Minus One MMO175**

As a sequel to an earlier album titled "Fun With Drumsticks," Music Minus One performs a similar service for aspiring drummers who want to develop good brushwork. The boxed set contains a pair of wire brushes, instruction folder and practice record. Also affixed to the back of the box is a practice pad of hard cardboard. As brushes are less noisy than sticks and require more patience to master even on an amateur level, much of the fun of starting out with sticks is missing. Many beginners who take instinctively to sticks are baffled by brush strokes, and some practice pads will go sailing out the window. In that event, the frustrated student can always try his luck later on a suitcase, an object which one theory cites as playing an implements used, but wire brushes are better. Whisk brooms are thought to be the first implement used, but wire brushes are better balanced for the pace of modern drumming.

Charles Perry outlines various strokes in the folder and demonstrates them on the record. After that, the fledgling can test his wings with such accompanists as Mal Waldron, Addison Farmer and Wendell Marshall, or try matching wits with Wilbur Ware's bass solo on *Beware*. At least, Dave Hancock's engineering makes the brushes sound alive on the LP.

**K. C. Douglas: K.C.'s Blues
Prestige/Bluesville 1023
Prestige/Bluesville 1023**

Not all migrating Mississippi blues singers head for Chicago, although that city claims most of the supply at one time or another. K. C. Douglas went to California, where he supplements his earnings as a field hand by singing and playing guitar for numerous migrant workers who arrive from southern states during the summer months. His first LP was recorded in 1936, during one of Sam Eskin's field trips, and Emory Cook released it as part of a series devoted to the glories of the open road. It is now a rarity, as only a few copies were in circulation before a fire in the company's Stamford laboratories destroyed the remaining stock. Douglas was rediscovered recently by Chris Strachwitz, a California blues enthusiast who began making tapes of the singer's extensive repertoire, and this is the first of two LP's promised for release on Prestige.

During early years of wandering, Douglas encountered many veteran blues practitioners and became well versed in various older styles. Knowing how to reach an audience is part of his stock in trade, and he gives entertaining accounts of *Rootin' Ground Hog*, *Born In The Country*, and *K. C.'s Doctor Blues*. Strachwitz, in addition to encouraging his protege to develop original material, lends an attentive ear and turns out a good recording.

**Robert Pete Williams: Free Again
Prestige/Bluesville 1026**

While on the hunt for worksongs at Angola prison farm in 1958, Harry Oster recorded a blues singer sentenced to life and included examples of his work on three LP's of material gathered from inmates. They were issued on Oster's Folk-Lyric label and played a vital part in winning a parole for Robert Pete Williams, the lifer who is now working on a farm. The producers of both Newport Festivals also invited the singer to appear on their stage, but Williams must remain within the boundaries of Louisiana for seven years. This LP will shorten the wait for blues collectors, who again owe thanks to Oster for recording his discovery on portable equipment and sending the tapes to Ken Goldstein at Prestige. So far, Williams has never left his native state, and he expresses the absence of extraneous influences with the remark, "All the music I play, I jest hear in the air. You can hear the sound of it, comin' forth, soundin' good . . . blues come to me, and I jest get it all in my head."

Folklorists will consider Williams a great find because of his purity of style and the raw imagery of his blues dialogues. Collectors of country blues will be more impressed by a

heartfelt intensity that often matches the searing cry of the late Robert Johnson. Williams also is nearly equally as good a guitarist, and an opportunity to practice along with a good studio recording might give him the edge.

**Django Reinhardt: Djangology
RCA Victor LPM2319**

This LP consists of material privately recorded in Rome during late 1949 and early 1950, and it reunites Django Reinhardt with Stephane Grappelly, the other principal partner in the Quintet of the Hot Club of France. An Italian rhythm section hardly justifies billing the original group on the liner, and only a thorough reading of the fine print discloses the information that the sessions were never available in this country before. However, one mistake offsets the other, and the competence of the rhythm team disposes of any excuse for not sitting back and enjoying the great gypsy guitarist at his romantic best on *Beyond The Sea*, *Lover Man*, and *Menilmontant*. Recordings of Reinhardt during this period are rare, and the added presence of Grappelly's swinging violin makes this collection especially valuable. The sound shows signs of age, but Reinhardt's guitar is

unamplified, and the famed pair reworks such original hits as *Minor Swing*, *Djangology*, and *Swing 42*.

**Coleman Hawkins: Stasch
Prestige Swingville 2013**

Most present-day studio musicians can run through arrangements and come up with polished and technically exact copies of famous swing-era bands, but seldom do they get inside the music. The Prestige Blues-Swingers were casually assembled for this date and they are equally casual about Jerry Valentine's arrangements, but they do swing and feel the spirit. A prime factor is the presence of Coleman Hawkins as nominal leader, and the great tenor saxist thoroughly enjoys the chance to play for dancers again. When Hawkins records these days, much of the weight of carrying a small-group session usually falls on his shoulders, along with the strain of maintaining his reputation. Valentine assumes most of the burdens on this set, and his recreations of the freewheeling style of the Earl Hines and Billy Eckstine bands are just what the featured soloist needs to go about his

(Continued on page 92)

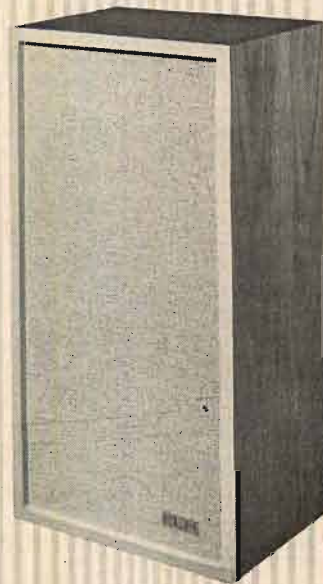
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HAROLD LAWRENCE*

Music In Utopia

THE VISION of the perfect society has been a favorite subject for writers and philosophers throughout the centuries. It has assumed various shapes, including an aristocracy of intellectuals; an all-powerful, benevolent state; a world without governments where responsible, mature people manage their own affairs; and other schemes ranging from pure humanism to the most mechanistic design for living. All these visions, however, from Plato to H. G. Wells, are colored by the social and political atmospheres in which they were conceived. Thus, Utopian blueprints usually tell us more about the evils of existing systems than about those of the golden future.

Plato, appalled by the waste, corruption, decadence, and hypocrisy of democratic Athens, outlined a Utopia ruled by an intellectual elite. In his *Republic*, children are separated from their parents at birth, "possessed" by the state so as to protect them from family influences. Birth control and eugenics are strictly enforced: men may reproduce only between the ages of 25 and 45; any child born from a male not within the specified age is to be destroyed. As for breeding, "the best of either sex should be united with the best as often, and the inferior with the inferior as seldom, as possible. . . . The offspring of the inferior . . . will be put away in some mysterious, unknown place, as they should be." Plato was practical enough to realize that such a practice might provoke outright rebellion among ordinary citizens and therefore advised that it remain a secret known only to the rulers.

To mid-twentieth century man, Plato's elaborate plan for the ideal society seems elaborate plan for the ideal society seems by turn naive, presumptuous, arrogant, and even chilling. It would probably shock this disciple of Socrates to find distorted echoes of his principles in some of the more brutal aspects of modern life, such as the extermination camp, the Chinese commune, and the Soviet *internat* (a sort of boarding school in which children are to be "entered as early as three months of age, with parents visiting only on week-ends"¹), although he might regard the latter as a step in the right direction.

Nothing is left to chance in Platonic society. Men and women marry, procreate, think, play, work, and perform certain civic duties according to a so-called divine order. Plato freely admits that the idea of a divine order is strictly a gimmick invented to forestall grumbling on the part of the unfranchised masses.

What role does music play in the *Republic*? As with almost everything else, Plato has some definite ideas on the subject. First, music cannot be separated from gymnastics, since the two arts are closely intertwined. Exclusive devotion to the latter can lead to "a temper of hardness and ferocity," while an overdose of the former will result in "softness and effeminacy." A full-time musician in Plato's Utopia runs the risk of total degeneration: ". . . when a man allows music to play upon him and to pour into his soul through the funnel of his ears those sweet and soft and melancholy airs . . . and his whole life is passed in warbling and the delights of song . . . he begins to melt and waste, until he has wasted away his spirit and cut out the sinews of his soul."

No Sad Songs Allowed

Having dealt with music in general, Plato now turns his attention to specific details: "We have no need of lamentations or strains of sorrow. . . . These . . . must be banished." Also outlawed are the flute, "bad rhythm," and "lyres with three corners and complex scales, (or) any other many-stringed curiously-harmonized instruments." The Dorian and Phrygian modes, however, are acceptable, as are "good rhythm," the lyre and harp in the city, and the shepherd's pipe in the country. Among the civic duties of musicians is that of composing songs for wedding festivals, staged by the rulers for the purpose of replenishing the human herd. Pre-selected brides and bridegrooms are married en masse to the accompaniment presumably of lyre and harp played in the state-approved Dorian and Phrygian modes.

The static concept of Plato's *Republic* is nowhere better illustrated than in his warning that unless music and gymnastics are "preserved in their original form, and *no innovation made*," [the italics are mine] the security of the State itself would be in jeopardy.

Boston, 2000

The word, "Utopia," was compounded by Sir Thomas More from the Greek, "no place" or "imaginary land." It was the name given to an island occupied by the citizens of an ideal commonwealth described in *Utopia* (1516). A large body of literary works stem from *The Republic* and *Utopia*. One of the most influential of these, Edward Bellamy's *Looking Backward* (1887), is a vision of Boston in the year 2000. Within the framework of our contemporary life, and with Orwell's and Huxley's disturbing pictures of the Utopia of the future clearly in our minds, it is

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¹ *The New York Times*, August 27, 1961

easy to regard Bellamy's novel as quaint and curiously old-fashioned, although his description "in retrospect" of Boston in 1887 is a powerful indictment of a callous social system.

Unlike Plato, Bellamy has little to say about the philosophical and psychological aspects of music in Utopian Boston. He is primarily concerned with techniques to bring music to the broadest possible audience. In this respect, Bellamy's novel falls into the category of the scientific Utopia, and, like many works of this genre, its projection into the future is at times remarkably accurate.

"She made me sit down comfortably," says the hero, Julian West, who has been invited into the music room by Edith Leete, daughter of his 21st-century host "and, crossing the room, so far as I could see, merely touched one or two screws, and at once the room was filled with the music of a grand organ anthem; filled, not flooded, for by some means, the volume of melody had been perfectly graduated to the size of the apartment."

At least four different programs are available to the listener at any hour of the day or night. The performances are 'live' and emanate from various music rooms in the city, "perfectly adapted acoustically to the different sorts of music. These halls are connected by telephone with all the houses of the city whose people care to pay the small fee."

Music To Rise By

Later in the novel, West dreams that he is in the banquet hall of the Alhambra, watching a "band of nautch girls, round-limbed and luscious-lipped, (dancing to the) music of brazeu and stringed instruments." He awakens to "find it broad daylight and the room tingling with the electric music of the *Turkish Reveille*." He learns at breakfast that his "telephone" had been timed to rouse him with music, and that the pieces played "during the waking hours of the morning were always of an inspiring type." The "musical telephone" is also used to lull Bostonians to sleep with appropriately "soothing tunes."

At a public restaurant, "windows opened on a courtyard where a fountain played on a courtyard where a fountain played to a great height and music made the air electric."

Bellamy's description of music in 2000 is, amazingly prophetic. As may be seen in the above extracts, he anticipated radio broadcasting, high fidelity sound reproduction, subscription radio, clock radios and Muzak.

Easy-Chair Listening

In Utopian Boston, churches and concert halls have been replaced for the most part by acoustically treated chambers, which bring music and sermons to "audiences often reaching 150,000." Amateur music-making is discouraged: "All the really fine singers and players are in the musical service, and the rest of us hold our peace. . . ."

In Plato's Utopia, music is sister to gymnastics, should be practiced in moderation, and must never depart from cer-

(Continued on page 88)

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NEW PRODUCTS

● **New Speaker System.** The new Isotone "Cellini" is a modestly sized speaker system with a volume of 2½-cubic feet and incorporating 6 feet of continuously folded channeling. The tremendous air resistance inherent in this makes for improved



damping and linearity of response from 30 to 18,000 cps. Heretofore obtainable only in custom-built models, the Isotone principle is available in a series of models starting at \$65.00 (1½-cubic foot model). Isotone Associates, 3402 Third Avenue, New York 56, New York. **K-1**

● **Tape-to-Slide Synchronizer.** Utilizing a pencil mark for cueing, the Mark-Q-Matic Model MQM-1 is a new type of tape-to-slide synchronizer which is completely self-contained and does not have to be installed onto or into the tape recorder or projector. To add sound to slides the MQM is simply placed next to the tape recorder, and the tape is looped through a sensing slot. The tape is then recorded and cued to



the slide with a pencil mark. There is no need to laminate, splice or slit the tape, or to record a beep signal. The MQM uses no vacuum tubes. A feature of this patented cueing method is that the cue is visible to the eye and the cue mark can be erased without effecting the tape. The Mark-Q-Matic MQM with full instructions and connector kit is priced at \$49.95. General Techniques, Inc., 1270 Broadway, New York 1, New York. **K-2**

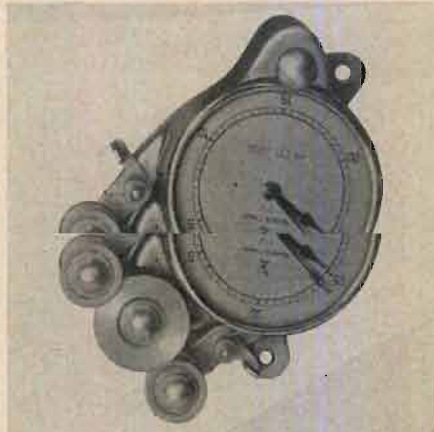
● **Moderate Cost Dynamic Microphones.** With the new Models 70 and 71 dynamic microphones, University brings high quality and performance to the moderate cost microphone field. The Models 70 and 71 feature low-frequency response down to 50 cps with a smooth rolloff below this frequency. Output in the treble and high-frequency range shows negligible loss to 14,000 cps and reaches an upper usable limit in the 18,000-cps region. The pickup pattern on both models is omnidirectional.

Impedances of 30, 50, and 20,000 ohms are available via the color-coded leads at the end of the integral cable at the level into high impedance input is 28 mv/10 dynes/cm². The finish is acrylic silver-grey and non-reflecting black. Both models have integral 1½-ft. microphone



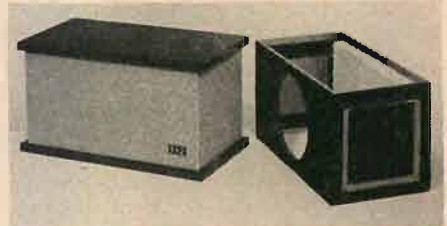
cables. Model 71 is slightly greater in over-all length and incorporates an on-off switch. Price for Model 70 is \$29.95 and for Model 71, \$34.95. University Loudspeakers, Inc., 80 So. Kensico Avenue, White Plains, N. Y. **K-3**

● **Professional Tape Timer-counter.** Manufactured with stop-watch precision, the Super-scope Model TC-30 professional tape timer-counter mounts instantly to the side of any



recorder. It is precision made to indicate tape travel accurately in seconds and minutes. The perfect accessory for any recording enthusiast or professional studio. Super-scope Inc., Sun Valley, Calif. User net price \$19.95. **K-4**

● **Bookshelf Speaker System.** Employing a new principle of low-frequency loading, the Rus-Lang Model "1+2" speaker system utilizes flexible cabinet end panels constructed of stiff laminated materials and mounted on sponge rubber surrounds. This system achieves an 8-db gain over conventional enclosures of the same size by utilizing the back-wave energy of the speaker. The "1+2" speaker system consists of an extended range 8-in. speaker in a sealed enclosure. The molded curvilinear cone with cloth surround provides greater compliance, lower harmonic generation,



and eliminates edge reflections. Speaker impedance is 8 ohms and power handling capability is 20 watts continuous program material. The enclosure is constructed of genuine oiled walnut 9¾-in. high, 18-in. wide, 9½-in. deep. The grill cloth is white and gold. This system retails at \$34.95. Rus-Lang Corporation, 138 Hurd Avenue, Bridgeport, Conn. **K-5**

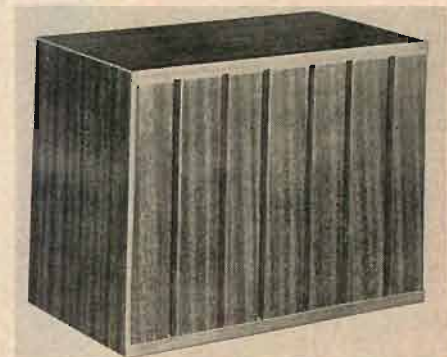
● **Sine-Square Wave Audio Generator.** Suitable for use in the laboratory as well as the service shop, the Lafayette TE-23 Sine-Square Wave Generator is a high-quality factory wired reliable instrument. Features include a front panel meter to monitor rms output; separate step and variable attenuators for both wave forms;



dual cathode-follower output; and a frequency response of from 20 cps to 1 Mc plus or minus 1.5 db except on the 0.01 range. Frequency accuracy is within plus or minus 5 per cent on all bands. Rise time of the square wave is less than 0.15 us. The steel case is grey in color with a leather handle and the front panel is two-tone silver and charcoal. List price of the TE-23 is \$69.95 (available Dec. 30, 1961). Lafayette Radio Electronics Corporation, 165 - 08 Liberty Avenue, Jamaica 33, New York. **K-6**

● **Speaker Without Grill.** The Utah Model

SH-3 features a random-width wood paneling design to eliminate the need for a grill cloth. The almost invisible slats help load the 6-in. x 9-in. speaker. Measuring only 8-in. x 10¼-in. x 6¾-in., the SH-3



is available in blond mahogany or walnut finishes. Screw terminals on the back cover facilitate easy connection to existing music systems. Utah Radio and Electronics Corp. Huntington, Indiana. **K-7**

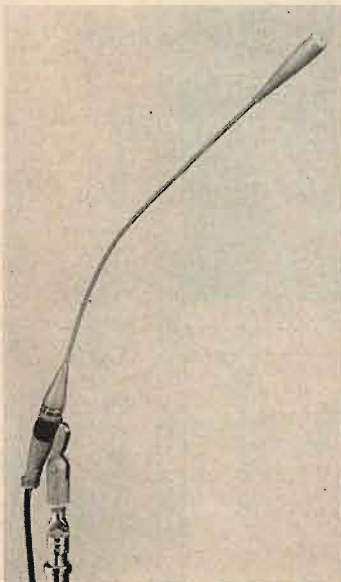
● **Power-Line Monitor.** The latest addition to RCA's test equipment line Model WV-120A Power-Line Monitor responds continuously to fluctuations and changes in power-line voltage. The RCA Power-Line Monitor alerts the technician or experimenter to voltage problems before they cause trouble. It provides him with an accurate reading at a glance without the need of handling probes, setting switches or interrupting his

work. Features of the Monitor include an expanded scale from 100 to 140 volts for easy reading and a moving-vane type meter that indicates true rms values even when line voltage is not pure sine wave. Accuracy is plus or minus 3 per cent at 100 and 140 volts and plus or minus 2 per cent at 120 volts. Frequency range is from 25 cps to 400 cps. Meter action is fast enough to reveal fluctuations and "bounces" in line voltage.



Large scale pointer and voltage designation permit a clear reading from a distance of 10 feet or more. User price of the WV-120A is \$14.59. Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y. **K-8**

● **"The Thin Man" Microphone.** The Electro-Voice Model 652 microphone (dubbed "The Thin Man") is a dynamic, non-directional, voice-range microphone which received its name because of the 24-in. length of its semi-rigid "neck." The semi-rigid 1/8-in. tubing permits the microphone to be moved up, down, to the right or to the left. It permits placing the microphone conveniently close to the sound source for full range pop-free response without distracting or obstructing the view of either the performer or the audience. Two transparent baffles (supplied with the microphone) allow accentuation of the presence range—the smaller baffle for a 3-db boost and the larger for a 6-db boost at 5000 cps. Used without a baffle, Model 652 provides smooth response from 80 cps to 8000 cps. The "Thin Man" mike is also available with a 15-in. long tubing (Model 652A). Both Models are sold complete with Model 300 stand adapter and 20 feet of three-conductor, rubber-jacketed, brown, broadcast-type cable. Electro-Voice Inc., Buchanan, Michigan. **K-9**



Both Models are sold complete with Model 300 stand adapter and 20 feet of three-conductor, rubber-jacketed, brown, broadcast-type cable. Electro-Voice Inc., Buchanan, Michigan. **K-9**

● **New Headphone Series.** Employing the identical plastic cones utilized in the well-known Permo-flux headphones, the new "Feather-Lite" series features high performance in a lightweight headphone. Especially valuable for use in language teaching systems; 2-way communications, monitoring in the studio or laboratory, the featherlite headphones are economically priced. Monophonic types are available with impedances of 8 or 100 ohms and stereophonic types are available with impedances of 16/16



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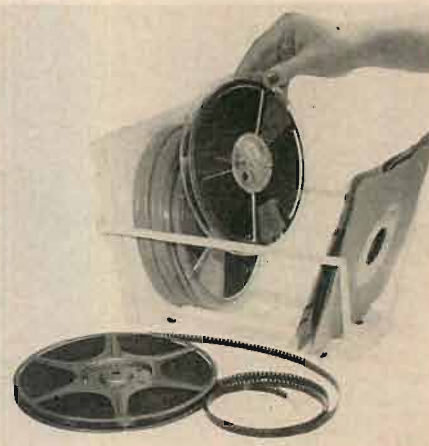
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ohms. Also available in this series is a new headphone with boom-mounted microphone. Permoflux Corporation, 4101 San Fernando Road, Glendale 4, California. **K-10**

• **Tape Rack.** The new Robbins Model TR-12 stores up to 1 dozen 7-in. reels of recording tape or 100 7-in. records. This attractive tape or record storage rack



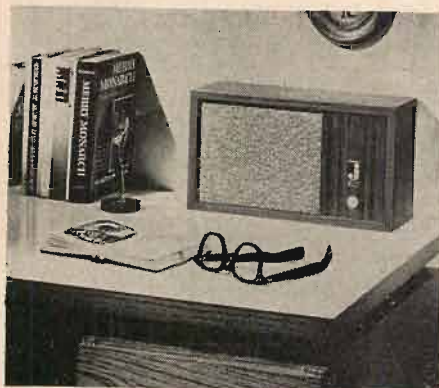
made of high-impact polystyrene measures only 5-in. x 8-in. x 9/16-in. List price is \$1.25. Robbins Industries Corp., Flushing, N. Y. **K-11**

• **Coaxial Stereophonic Earphones.** The new Superex earphones, Model STM, are claimed to be the first high fidelity stereo earphone unit to employ separate woofer and tweeter reproducers in each phone and an adjustable crossover network. The frequency range of the earphones is stated to be 20 cps to 20,000 cps. Although designed primarily for stereo listening in the home the Superex phones are ideal for use in tape monitoring, silent-instrument practice, audio analgesia for dental surgery, and studio monitoring. The crossover network is enclosed in a separate attractively cased unit attached to the phone. Separate controls allow individual



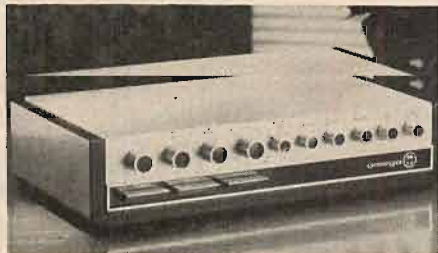
adjustment of the sound in each phone. Other features of the new earphone unit include an adapter for use in monophonic systems, soft, durable plastic foam cushions which are treated to resist contamination and which eliminate distracting external sounds, and a completely adjustable and spring-supported band. The connecting cables are strain-relieved to prevent damage if the cord is accidentally overextended. Impedance is 8-16 ohms. Net price of the Superex Model STM is \$29.95. Superex Electronics Corp., 4-6 Radford Place, Yonkers, New York. **K-12**

• **Ultra Compact 2-Way Loudspeaker System.** The new Jensen Model X-10 is 1/6th the bulk of a regular shelf loudspeaker system. The Model X-10 utilizes a special miniature, long-travel woofer which is mass loaded and precisely matched to its small enclosure for improved bass response. A 3-in. direct radiator tweeter carries response out to 14,000 cps. For convenience in extension speaker



applications, volume is adjustable by means of a small knob on the front panel. It may be used with any amplifier having 4, 8, or 16-ohm outputs. Power rating is 6 watts and it can be used with higher-rated amplifiers at "reasonable" listening levels. Model X-10 in an oiled walnut cabinet is priced at \$29.75. Dimensions are 7¼-in. high x 13-in. wide x 4¾-in. deep. Jensen Manufacturing Co., 6601 So. Laramie, Chicago 38, Illinois. **K-13**

• **All-Transistor 60-Watt Stereo Amplifier.** A new 60-watt stereo amplifier, utilizing all-transistor circuitry and featuring several other innovations in high-fidelity sound control, has been announced by The Omega Electronics Corporation. The unit has a rated power output of 30 watts per channel for stereo and 60 watts for mono. Distortion is less than 1 per cent at full output. The new amplifier has frequency response within 3 db from 13 cps to 20,000 cps at rated output. Direct coupling and degenerative damping provide an ideal output signal to drive any speaker. The transistorized circuitry of the Omega is designed for continuous operation with a minimum of service and maintenance. Microphonic noise, tube heater hum, and excess heat are non-existent in transistors. Master bass and treble controls allow simultaneous balanced adjustment for both



channels. Independent balance controls for both bass and treble are also provided. These, plus mode, volume balance, blend, and loudness controls provide complete flexibility and allow "ultra-fine" adjustments for the most sensitive listener. Additional controls include: scratch filter; rumble filter; phase switch; and a tape monitor. A five-position input selector enables the unit to be used with phonograph, FM-AM tuner, tape-head, TV, or an auxiliary source. Another advanced feature of the Omega amplifier is an exclusive cartridge output compensator. This enables the amplifier to be adjusted to the specific output voltage of the ceramic or magnetic pick-up cartridge. Thus all front panel controls operate over their optimum range regardless of the cartridge output level. The unit is priced at \$229. Omega Electronics Corporation, 10017 North 19th Avenue, Phoenix 21, Arizona. **K-14**

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NEW LITERATURE

• **Frequency and Time Standard Systems Manual.** A comprehensive manual of frequency and time standard systems is now available as Application Note No. 52 from Hewlett-Packard Company. This 56-page manual is divided into four sections. The first section contains a general discussion of such problems as frequency and time control, radio propagation, time scales, and so on. The second, third, and fourth contain detailed consideration of system operation, frequency determination, and time determination respectively. Several sample problems and solutions are included, and the text is supplemented with sixteen illustrations and six tables. Hewlett-Packard instruments used as system components in the described applications include the Model 103AR, and 104AR quartz oscillators, 113AR/BR frequency divider and clock, 114AR/BR time comparator, 120AR oscilloscope, 724AR/BR and 725AR standby power supplies. Data sheets for these instruments are included as an appendix to the manual. Application Note No. 52 may be obtained without cost by writing Harry J. Lewenstein, Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, California. **K-16**

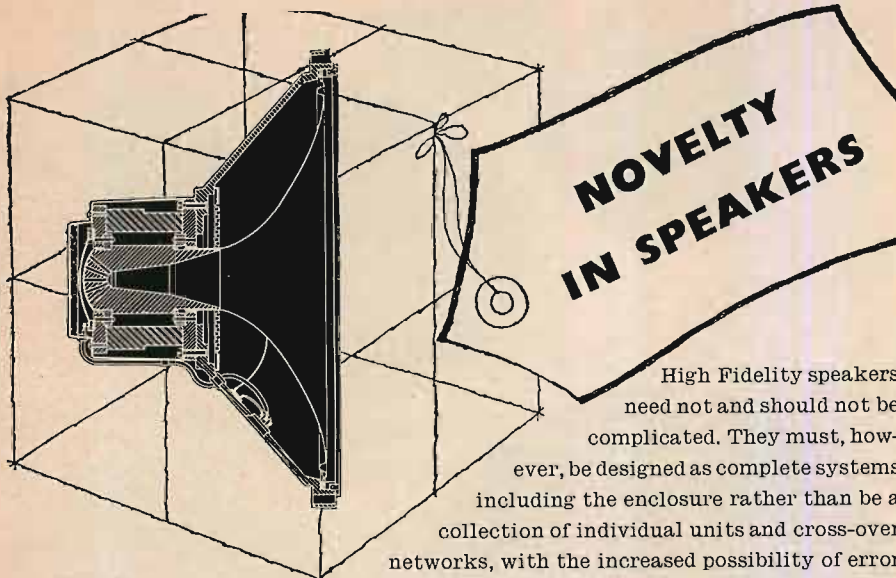
• **Tips for the Serviceman.** Chicago Standard Transformer Corporation announces the publication of the fifth issue of Stan Cor's Corner which incorporates descriptions and illustrations of almost thirty service shop gadgets, ideas, and shortcuts designed to save time for the serviceman. These range from various ways to handle and salvage transistors to a technique for accurate cutting of dual-concentric control shafts. Also included is a page showing EIA color codes for power, audio, and i.f. transformers. Stan Cor's Corner No. 5 is available without charge from any Stancor distributor or from the company. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill. **K-17**

• **Condensed Tube Catalog.** Amperex Electronic Corporation announces a new, 25-page condensed tube catalog. The catalog contains descriptions and basic specifications on the full line of Amperex tubes consisting of: cold cathode trigger tubes, entertainment and audio tubes, ignitrons, indicator tubes, photomultiplier tubes, "Premium Quality" tubes, radiation counter tubes, rectifier diodes, subminiature tubes, thyratrons, traveling wave tubes, UHF special purpose tubes, and voltage reference and regulator tubes. Write on company stationery to Amperex Electronic Corp., Advertising Dept., 230 Duffy Ave., Hicksville, L. I., N. Y. **K-18**

Hicksville, L. I., N. Y. **K-18**

• **Speaker Catalogue.** Acoustic Research has published its first comprehensive speaker catalogue. This catalogue includes general information, technical specifications, and surveys of press comment on the various models of AR loudspeakers. It is available free for the asking. Requests should be addressed to Acoustic Research, Inc., 24 Thorndike Street, Cambridge 47, Massachusetts. **K-19**

• **FM-Stereo Explained.** H. H. Scott, Inc. announces a new 16-page booklet explaining FM-stereo. This easy-to-understand booklet tells all about this new method of broadcasting, recently approved by the Federal Communications Commission. There are sections explaining how it is possible to receive stereo by tuning to a single FM station; how to adapt existing consoles and FM tuners for stereo; how to set up a new FM-stereo component system. There is a special appendix explaining the difference between FM and AM radio transmission, and the technique used by radio stations in broadcasting FM-stereo. Free copies are available by writing to H. H. Scott, Inc., Multiplex Division, 111 Powdermill Road, Maynard, Mass. **K-20**



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During the past thirty years, the authors have developed the techniques of sound control in opera, open-air amphitheatres, theatres on Broadway, theatres on-the-road and off-Broadway, in concert halls and night clubs, in Hollywood and in the laboratory. Some of their techniques are used in broadcast and recording as well as in performances where an audience is present. From their laboratory have come notably successful applications of sound control to psychological warfare and psychological screening.

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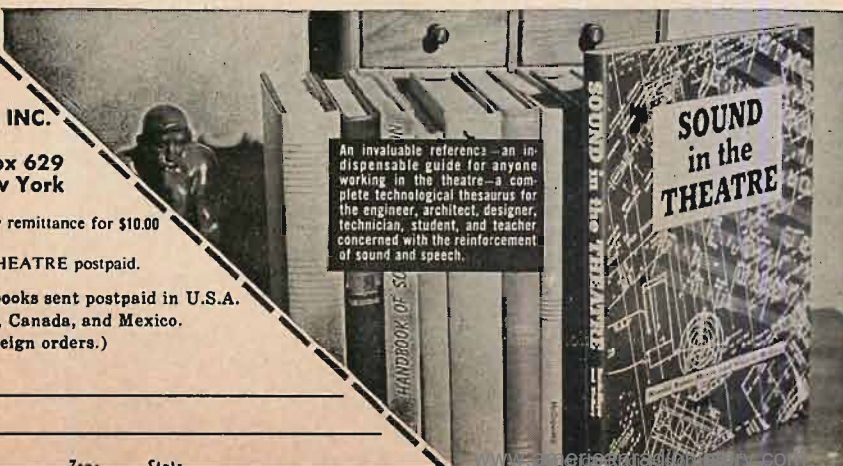
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THIS MONTH'S COVER

This home built cabinet, of which the owner is particularly—and justifiably—proud was built from his own plans in a friend's cellar workshop over a period of about a month, with the only power tool available being a 10-in. circular saw. The installation is in the home of its builder, Peter Corey, in Jamaica Plain, Massachusetts, and was photographed by his brother-in-law.

The equipment consists of a Fisher FM90X tuner and a Dynaco PAS-2 stereo preamp in the upper left compartment, and underneath is a Heathkit TR1-D tape recorder. The upper right section contains a Rek-O-Kut N33-H turntable with an ESL arm and a Shure M-3D cartridge. All compartments are mounted on ball bearing slides, which operate with fingertip effort.

The cabinet was constructed at a cost of just under \$90, which includes about \$10 worth of small tools.

LIGHT LISTENING

(from page 10)

Yoruba Tribe. His ensemble of African drums is one of the more dynamic attractions of the night life of New York City. It reflects the tricky cross-rhythms of Nigeria, whose capital was the scene of Olatunji's birth some 33 years ago. Add to the vivacious Yoruba beat a few touches of South American color and you have a combination calculated to quicken the pulse of any recording director looking for new stereo material. Much of the time, the spotlight is on the chanting chorus which shares honors with the six-man percussion team. Almost as an afterthought, a delegation from our domestic jazz scene was called in to reinforce the session. Several winds, three trumpets, traps, two basses and a guitar find themselves overshadowed once the roof raising gets under way. No shortage of unusual demo possibilities in this one.

Pachanga with Barretto and his Charanga Orchestra

Riverside 97506

Having expanded its recording activities to include music for dancers, Riverside is working its way into the Latin field by way of the Pachanga. This new dance, also called the Charanga, has been gaining increasing attention from record firms but it is still a bit early to determine its potential as a full substitute for the long-established merengue or cha-cha. Since most of the promotion of the Pachanga has been within our own shores, it is not surprising to find New York-born Ray Barretto at the head of the orchestra in this album. This position of eminence is a follow-up to the rank he occupied in the Latin orchestras of Tito Puente, Jose Curbelo, and Tito Rodriguez. Barretto's jazz work includes a special assignment in a recent Riverside album by Eddie "Lockjaw" Davis for which Ray supplied a Latin percussion section. The instrumentation in these Hector Rivera originals follows the usual pattern of the charanga orchestra—a flute soloist, a vocal group and a small batch of violins used in place of the saxophones, trumpets and trombones of a regular dance band. Studio acoustics in this recording are on the dry side, adding an extra edge to the tartness of the violins.

Vardi and Medallion Strings: Maggie's Theme

Medallion MS 7527

Bob Fine, who heads one of the more active recording outfits in New York, recently acquired the modern studio facilities in Bay-side originally installed by Everest Records.

This recording represents the first session I've heard on the Medallion label in which a Fine crew handles the former Everest equipment. The fact that this ultra high-standard studio facility was placed on the market in recent months would seem to indicate that the mass audience is not too interested in the audio quality of the pop records it buys. This is hardly earth-shaking news to readers of this magazine. It should be pointed out, however, that other factors were involved in Everest's decision.

The new crew demonstrates in the sound of the Emanuel Vardi orchestra that it has already mastered the custom-built six-channel eighteen-position console out at Bayside. Brass, woodwinds and chorus supplement the strings in a project which owes its inception to the success of "Maggie's Theme." The Vardi arrangement of this tune from Walt Disney's comedy "The Parent Trap" earned a high place on the popularity charts as a single record. Other films represented are

"La Dolce Vita," "Goodbye Again," "Exodus" and "Pepe." Even in this high-powered company, one of the bright spots in the album is the unpretentious *Bilbao Song* (could that be the reason?) from Kurt Weill's "Three-penny Opera."

Song Without End (Original Sound Track) Colpix CXC 602

This particular sound track offers better listening for piano fans on tape than it does on disc. While no playback medium can disguise the corny nature of some of the choral excerpts from Hollywood's lavish appraisal of the life and music of Franz Liszt, the sound is definitely more acceptable in the tape medium. In one respect tape has almost an unfair advantage. The man who selected the recording characteristic for the Colpix disc certainly placed no faith in the generally accepted virtues of the RIAA curve. The formula, whatever its nature,

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defied my efforts to find a listenable playback setting. As processed by UST, the sound of the piano heard throughout the picture in the off-screen performances of Jorge Bolet has a chance to establish its normal character. Liszt's pyrotechnics, which embrace both ends of the keyboard fare better in this reel than they would on the average stereo record. The chorus heard in Handel's *Largo*, Wagner's *Pilgrim's Chorus* from *Tannhauser* and Liszt's *Un Sospiro* still has some of the boxed-in effect that was noticeable in the disc version. The Los Angeles Philharmonic Orchestra makes only fleeting appearances in the recording. Perhaps it's just as well because it sounds only slightly better on the tape than it did on the disc. I suppose Hollywood has its own problems in determining the length of its so-called concert sequences in films dealing with music. Far too much of this recording is given over to snippets of selections. Make no mistake Bolet is good and his piano has received realistic recording. The difficulty lies in the fact that he is heard in this reel for a total of only twenty-four minutes. **AE**

ABOUT MUSIC

(from page 81)

tain inflexible rules. Plato would surely have considered Bellamy "soft" and "effeminate," because of the latter's insatiable love of music. "It appears to me," says Julian West, "that if we could have devised an arrangement for providing everybody with music in their homes, perfect in quality, unlimited in quantity, suited to every mood, and beginning and ceasing at will, we should have considered the limit of human felicity already attained, and ceased to strive for further improvements." According to this, music lovers may not have to wait for the year 2000 for their Utopia. **AE**

SPEAKER POWER

(from page 54)

and the ability of the speaker to produce sound pressures proportional to applied instantaneous power.

Much effort has been expended to reduce weight of moving parts such as the diaphragm, and so forth—even to the extent of using aluminum ribbon voice coils instead of copper. There is seen to be a premium placed on high efficiency. This significantly applies not only to speakers but to amplifiers.

High efficiency results in reduced distortion in the speaker and less demand on the amplifier. Generation of heat in the speaker is one by-product of inefficiency. One unsympathetic high-fidelity dealer drove a low-efficiency speaker to a cooking temperature and then applied a surge that tore the voice coil loose, all at moderate listening levels. By contrast a horn of medium efficiency was driven to an output of about 20 acoustic watts without damage except to the listeners' ears at the 130 dbi level.

The principles of physics still apply. **AE**

ALIGNMENT

(from page 44)

pip that can be readily observed. *Figure 4* shows the panel of the unit. The large dial that operates the tuning capacitor reads over 360 deg. but actually turns through its full tuning range in 180 deg. and is calibrated only over the 0 to 50 range of its markings. Both frequency ranges were calibrated by checking against FM broadcasts, as described in the article "Junk-box FM Alignment Unit," and a calibration curve was drawn for each range, rather than marking the frequency values on the dial. The paper vernier pasted on the panel implies the necessity for reading frequency to a degree of precision that is actually not necessary; the FM tuner is aligned to produce a symmetrical curve of maxi-

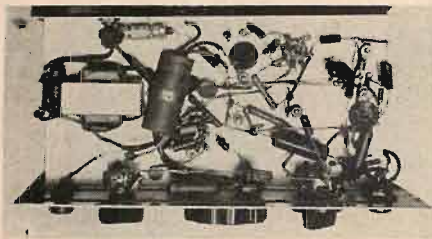
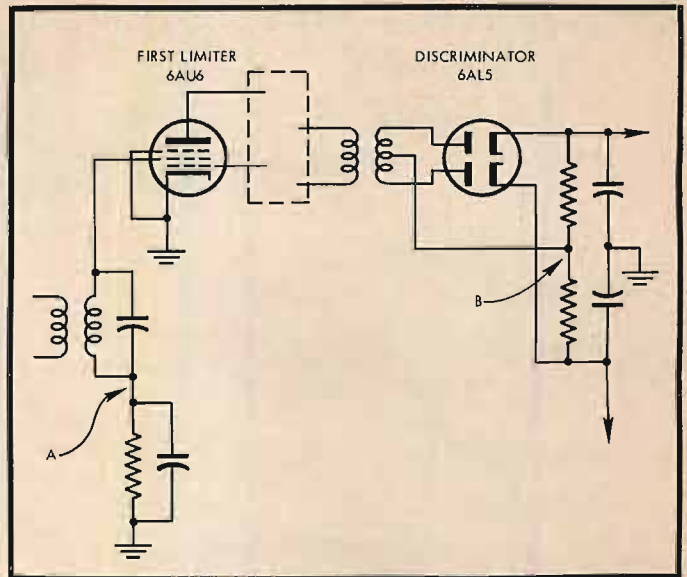


Fig. 6. Under-chassis view.

Fig. 7. Locations for aligning i.f. and discriminator.



mum height and width, with as little as possible depression in the center.

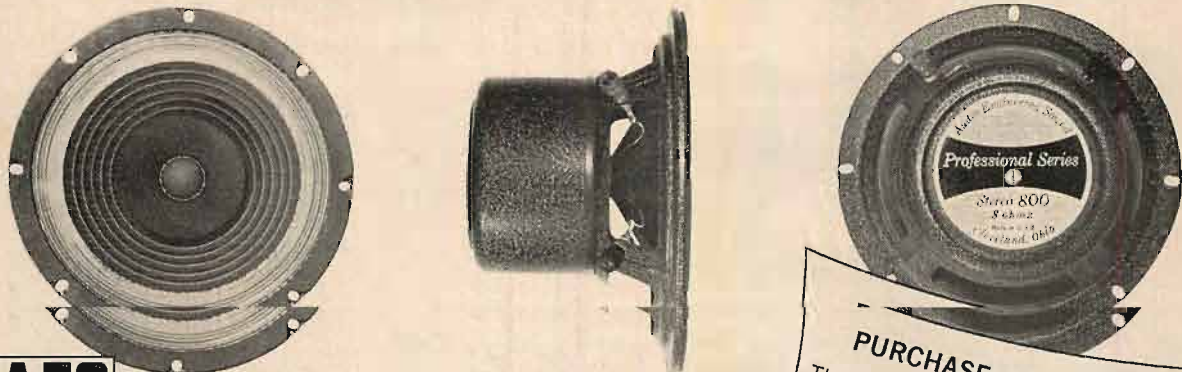
When the unit and the oscilloscope are connected to the a.c. line, it may be found that the variable marker is at the left end of the response curve when the dial indicates 11.2 mc; all that is necessary is to reverse the a.c. plug of either the alignment unit or the oscilloscope (but not both) to make the curve read from left to right. A panel

output for the marker generator is provided (lower right on *Fig. 4*) in case it may be desired to use it alone as a CW generator.

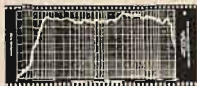
Figure 5 is a rear view of the unit, and *Fig. 6* shows the under-chassis wiring. It was considered advisable to shield two of the oscillating tubes, but no other precaution was taken to prevent unwanted interaction of circuits, and no difficulty was encountered. The

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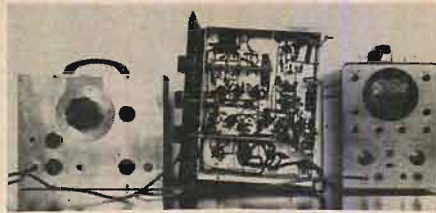


Fig. 8. Aligning an FM tuner.

12AV7 tube is the one without a shield. The unit must be secured firmly in a metal enclosure to prevent r.f. leakage.

In aligning an FM tuner, it is always advisable to follow the specific directions provided by the manufacturer of the tuner. In general, the grounded side of the sweep generator line is connected to the grounded side of the tuner; the "hot" side of the sweep generator line is connected, through a capacitor of about 100 pf, to the grid of the mixer tube of the tuner. In aligning the writer's tuner, the grounded terminal of the oscilloscope is connected to the grounded side of the tuner, and the "hot" lead from the vertical amplifier is connected, through a resistor of 100,000 to 250,000 ohms to point A on Fig. 7 to align the i.f. transformers; then to point B to align the discriminator. The i.f. transformers are aligned, secondary first, starting with the transformer

nearest the first limiter, and working back toward the tuner input. Figure 8 shows the sweep generator connected to point A. Æ

PARTS LIST (Fig. 1)

R_1	51 ohms (optional)
R_2, R_3, R_4	10,000 ohms
R_5	1500 ohms
R_6	1800-ohm pot.
R_7	4300 ohms
R_8	72,000 ohms
R_9	300 ohms
R_{10}	8200 ohms
R_{11}	900-ohm pot.
R_{12}	1800 ohms
C_1, C_6, C_7, C_8	0.005 uf
C_2	10 pf
C_3	5 pf
C_4	30 pf
C_5	30 pf
C_9, C_{10}	20 uf
C_r	10.7 Mc crystal
Var	Varicap, Type V-20 Pacific Semiconductors, Inc.
$Rect.$	Rectifier, silicon or selenium

PARTS LIST (Fig. 3)

R_1	8200 ohms
R_2	2000 ohms
R_3	82 ohms
R_4	200-ohm pot.
R_5	22,000 ohms
C_1	23-35 pf max. (variable)
C_2	46 pf
C_3	5 pf
C_4	1000 pf
C_5	15 pf
C_6	2000 pf

RECORD REVUE

(from page 73)

suiting to Browning's understanding—indeed, I haven't heard it so intelligently and simply portrayed. The music tends towards the nervous, the piano part cluttered and complicated—when played with less than Browning's understanding.

The Philharmonia behaves well under Leinsdorf, but again better in the Prokofiev than in the Ravel work.

Bach: Oeuvres pour Orgue (Organ Works). Walter Kraft, Silbermann organ at Ebersmunster.

Vox ST PL 511.440 stereo

This is an amusing disc, I must say—not the music but the "Oeuvres"—which are all Bach all right, but a completely different program as between the record itself and the cardboard jacket. Nope—it's the right record; both the label and the jacket call it number 511.440.

Moreover, I was amused by the usual French effort to promote the Gallic virtues by laying claim (like the Russians) to all the nearby areas. Here's a composer named Bach, an organ built in 1730 by one Andreas Silbermann, in a town called Ebersmunster, played by a man named Kraft—and for all one can tell, reading the French album notes (no English), the whole thing redounds to the glory of La France!

Well, no offense intended, for it does, at that. The organ is in Alsace, accounting for the Ger . . . name. Silbermann was a student of a genuine French organ builder, François Thierry, even if he did build a few German-type organs back in the Eighteenth century. And Walter Kraft . . . well, I dunno about him. Anyhow, it's a really glorious Baroque

organ and Kraft's playing of the Bach program—the one on the disc label—is business-like and expressive too, with nicely varied registrations. The program includes the big favorites—*Tocatta in D Minor, Fantasy in G minor*.

Manuel Gayol—Guitar Recital.

Kapp 9052-S stereo

The "guitar masterpieces" uncovered by

The "guitar masterpieces" uncovered by Manuel Gayol and played here are not exactly great music from the non-guitarist viewpoint, but they do rank as pleasant period works, comfortably expressive on the instrument and redolent of the better-grade salon music of their times, ranging from the late Seventeenth century through the Nineteenth. Senor Gayol is from Puerto Rico, lives in New York, plays musically and with sensitivity if not, at least on this record, any great *bravo*.

Piano Portraits. Leonard Pennario.

Capitol SP 8541 stereo

Pennario can turn out some very good piano, as has been observed here before, when he rolls up his musical shirtsleeves and gets down to real sweat. Too often, though, he seems to prefer the smoothly Hollywoodish approach, as here.

Somehow, Debussy (*Arabesques, Goldfish*), Mendelssohn (*Scherzo*), Scarlatti, Liszt, all get the slightly velvet treatment, though every one of them is basically well played. Perhaps it is the piano itself, which is *very* suave one in its tone. And/or it might be Capitol's best mood-music mike styling. A perfectly swell background disc, anyhow, of music that was mostly intended for strictly foreground listening. Æ

SAVE TAPE, TIME AND MONEY



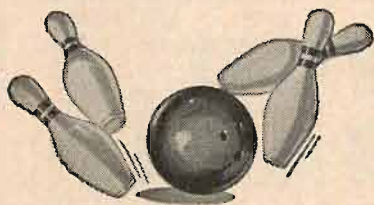
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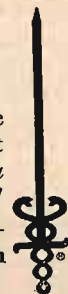
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AUDIO ETC

(from page 56)

which the lines are unequally spaced, according to the actual pitch distance between the notes, so that they make a literal pitch-graph, accurate in terms of pitch-squared versus vertical rise. Thus the space from the E line to the G line, one and a half steps, is smaller than that between the G line and the B line, which is two whole-steps.

Simple and ingenious, especially when you realize that on *this* music paper, you can indicate all the out-of-tune pitches in between by placing your marks a bit high or low on the spaces or lines.

That's precisely what the constellations did for themselves. They made pitch patterns on the music paper.

Next (if I get it straight), Mr. Cage somehow derived from each constellation a sort of circle or loop of star tones. I don't know just how this transformation was done, but I am certain that it was *very* logical. I saw the actual scores for the music.

The entire piece is divided into time-segments, each precisely two minutes long, by stopwatch. Each two-minute segment of music is represented by a looped line on the music paper, about an inch or so in diameter; on the loop are the notes, maybe ten or twelve, each representing a pitch, but not a time, nor any length.

Now I may be mixed up, but I think it works this way. Mr. Cage stands before his orchestra—big or small as the case may be—and raises his left hand, looks at his stopwatch, punches it, snaps his upraised left fingers. The time-sequence is under way. His arm moves slowly downwards, like a sagging statue of liberty; at the 30-second point, horizontal, he snaps his fingers again; at one minute the hand reaches his side and the right arm begins to climb upwards on the other side. At 1:30 he snaps again, horizontal, and at two minutes the left arm starts all over again.

It made *my* arms ache to watch him, but his dignity was unchallengeable, complete with conductor's formal tails and white tie.

During the two-minute span, each player must produce all of the tones on his loop. When he does so is entirely up to him. He plays when the spirit moves him, at the inscrutably right instant, when he *feels* it. The numbers, above the loop, such as 8-2, indicate that he must play, say, eight short notes and one long one; but again he may take his choice. He may play the loop either way around, as he is moved to do.

Fantastic! Our 17 instruments were ranged outwards across the stage and onto cat-walks (this had been a burley-que house 'way back) reaching out to the sides. I don't remember the instrumental roster exactly (it can be different every time), but there were strings of all sorts, trombones, trumpet, harp, double bass, flute—a bit of everything. And piano, of course. Each player sat solemnly in extreme contemplation, staring at the score before him, glancing at the human Cage stopwatch; then deliberately, as though prompted by inner nature, rising up to play his single note. A long one. Or a short one. Never more than one. Never a tune. Never a theme. Never an idea. Just individual, deliberate notes-in-time, each a pearl of a different color, each produced on a sort of psychic impulse, unpredictably

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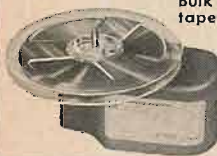
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but rigidly shaped in the all-over. Quite a show! It went on for twenty minutes and this was only one page of the master score, which had four pages.

This time, at least, Cage was kind to us. Imagine an hour and twenty minutes. . . .

Æ

JAZZ

(from page 79)

business in an easy and relaxed mood on *Trust In Me*, and *My Babe*.

The title tune is named after a cryptic term used by musicians before continental styling replaced zoot suits, and it might be roughly translated as currently meaning "boss" in teenage slang. The nine men are recorded to sound better than larger groups did in a studio back then, and band enthusiasts should not overlook this release. Ray Bryant takes care of piano honors on Pete Johnson's *Roll 'Em*, and Jerome Richardson's alto sax enlivens *Since I Fell For You*.

Arthur Lyman: Percussion Spectacular Hifirecord L1004

This Hawaiian group was dealing in sound spectacles before stereo and all that percussion came into the picture. The members of the quartet are all past masters at the game, having learned to fill out the stereo spectrum the hard way, before channel-switching and other devices made it easy to double on a variety of instruments. Each was forced to help out by dipping into the vast pool of percussive effects himself, and they see no justice now in turning the sport over to an engineer at the control panel. They still insist on recording naturally, just as they perform at the Hawaiian Village Hotel in Honolulu, and the only extra aids are the encouraging cries of native birds. Aside from handling percussion assignments, Arthur Lyman plays vibes and marimba, John Kramer plays flute and clarinet, Harold Chang plays xylophone, and pianist Alan Soares doubles on celeste. The many purchasers of Lyman's previous efforts will immediately recognize the fine acoustics of Henry J. Keiser's Aluminum Dome.

As part of the label's new "Life" series, the recording is given the full treatment this time and is packed in a double-fold album. Audiophiles will find two center pages devoted to a description of the equipment used, with photographs of a Neumann cutting lathe, Teldec amplifier rack, AKG microphone, Ampex mixing panel, and other expensive equipment. It would seem that no expense is being spared to ensure top stereo reproduction, but Lyman, who sticks to the same home remedy tested so successfully before, turns in the best performance yet issued in the series. The prescription contains a mixture of exotic sounds, with a modern jazz touch and proves highly effective on *Autumn Leaves*, *September Song*, and *Granada*. In addition to several South Pacific themes, Lyman ventures forth on *Navah Nagiluh*, and *John Henry*. Æ

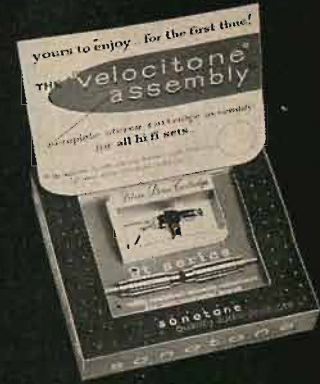
PATENT LOSS

(from page 50)

this offer to the Chicago Stock Yards Company had brought this inventor within the prohibition of this feature of the patent law irrespective of whether his act was a sale or an offer to sell.

"Under this language," said the court in that decision, "a completed sale, either with or without delivery, is not demanded. An offer to sell, made to a prospective purchaser after the experimental stage has been passed, the invention reduced to practice and the apparatus

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manufactured in its perfected form, is a placing on sale within the statute."⁶

Emphasis placed by the courts on a denial of a patent subsequent to the use of an invention for what is termed by the statute a "public use" for more than a year has been derived in part at least, from an early Supreme Court decision where the infringement of a patent of a wooden pavement was defended on the ground that this pavement had been in public use beyond the permitted statutory period.

That it had been in use for more than the time allowed under the statute was conceded but by the inventor it was insisted that such use was entirely an experimental one. In sustaining the inventor in his contention the Supreme Court of the United States said of this definition,

"When the subject of invention is a machine, it may be tested and tried in a building, either with or without closed doors. In either case such use is not a public use within the meaning of the statute so long as the inventor is engaged in good faith in testing its operation.

"He may see cause to alter it and improve it, or not. His experiments will reveal the fact whether any and what alterations may be necessary. If durability is one of the qualities to be attained a long period, perhaps years, may be necessary to enable the inventor to discover whether his purpose is accomplished.

"And though during all that period he may not find that any changes are necessary, yet he may be justly said to be using his machine only by way of experiment, and no one would say that such a use pursued with a bona fide intent of testing the qualities of the machine, would be a public use within the meaning of the statute.

"So long as he does not voluntarily allow others to make it and use it and allow others to make it and use it and so long as it is not for sale for general use, he keeps the invention under his own control and does not lose his title to the patent."

This statement of the law amplified with the further comment that, "It would not be necessary in such a case that the machine should be put up and used only in the inventor's own shop or premises. He may have it put up and used in the premises of another and the use may inure to the benefit of the owner of the establishment.

"Still if used under the surveillance of the inventor and for the purpose of enabling him to test the machine and ascertain whether it will answer the purpose intended and make such alterations and improvements as experience demon-

strates to be necessary, it will still be an experimental use and not a public use within the meaning of the statute.

"Whilst the supposed machine is in such experimental use the public may be incidentally deriving a benefit from it. If it be a grist mill or a carding machine, customers from the surrounding country may enjoy the use of it by having their grain made into flour or wool into rolls and still it will not be in public use within the meaning of the law.

"But if the inventor allows his machine to be used by other persons generally, either with or without compensation, or if it is with his consent put on sale for such use, then it will be in public use and on public sale within the meaning of the law."

Only a year before another decision of that same court involving this provision of the patent law was handed down that has since been often used as a yardstick in distinguishing those inventions that have and those that have not been within this condemned field of public use.

A fruit jar manufacturer had been assigned a patent issued May 10, 1870 to John L. Mason for an "improvement in fruit jars." Later when the assignee of this patent sued for infringement the defense was set up, "that there had been 'purchase, sale and prior use' of the invention more than two years prior to the application for a patent.

When the court sustained this defense both on the ground that the invention had been in public use within the prescribed two, now one, years and also that it had been abandoned to the public the Supreme Court said, "Inventors are a meritorious class. They are public benefactors. They add to the wealth and comfort of the community and promote the progress of civilization. A patent for an invention is as much property as a patent for land. The right rests on the same foundation and is surrounded and protected by the same sanctions. There is a like larger domain held in ownership by the public.

"Neither an individual nor the public can trench upon or appropriate what belongs to the other. The inventor must comply with the conditions prescribed by law. If he fails to do this he acquires no title and his invention or discovery, no matter what it may be, is lost to him and is henceforward no more his than if he had never been in anywise connected with it. It is made, thereupon, as it were by accretion, irrevocably, a part of the domain which belong to the public at large. The invention here in question is within that category."⁸ Æ

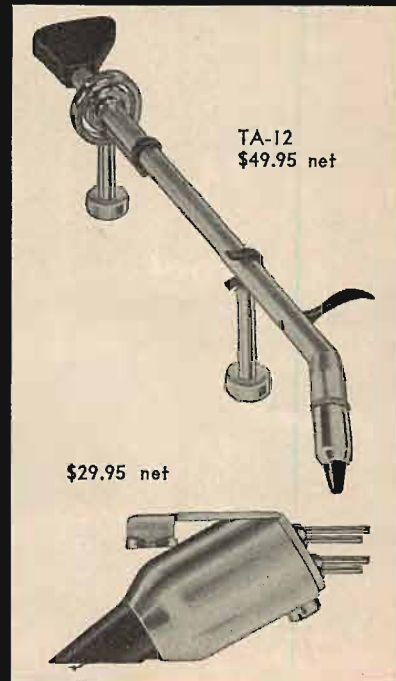
⁷ Elizabeth v. Pavement Co., 96 U.S. 126, October, 1877.

⁸ Consolidated Fruit Jar Co. v. Wright, 94 U.S. 592, October, 1876.

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⁶ Wende v. Horine, 225 Fed. 501, January 5.



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TRANSISTORS

(from page 40)

into the transistor. If we call it R_{out} , the current divider equation becomes

$$\frac{i_{load}}{\beta i_b} = \frac{1}{1 + \frac{R_L}{R_o}}$$

where R_o is usually very nearly equal to R_2 .

Moving back to the input circuit, another current divider is seen. If a signal current, i_{in} , is applied to the circuit, the useful proportion that actually gets to the transistor is

$$\frac{i_b}{i_{in}} = \frac{1}{1 + \frac{r_{in}}{R_1}}$$

where r_{in} is the transistor (not stage) input impedance and in this instance is equal to $r_b + \gamma r_e$. If the last two equations are combined, the ratio of useful output current to input current becomes

$$\frac{i_{load}}{i_{in}} = \beta \left(\frac{1}{1 + \frac{r_{in}}{R_1}} \right) \left(\frac{1}{1 + \frac{R_L}{R_o}} \right)$$

The maximum gain is β . It cannot be achieved because biasing resistors must be used. The only way to minimize the loss is to make the biasing resistors as large as possible. Since there is one basic universal law which says "you can't get something for nothing," the maximum sizes of the bias resistors turn out to be discouragingly low. We'll return to this after a brief pause for impedance matching.

The maximum power transfer theorem states that, if the maximum power is to be transferred from a generator to a load, the resistance of the load must equal that of the generator. This theorem is, like all mathematical theorems, quite true. Unfortunately, it is also irrelevant. One seldom matches the input impedance of a vacuum tube. One never matches the output impedance of an amplifier to a loudspeaker. A 60-cps power generator is never matched to its load. Thus there is no good precedent or reason for impedance matching in transistors. The transistor is a current-operated device. You put a current in and you get a current out. Thus, the thing usually desired is not maximum power transfer but maximum current transfer. This point cannot be stressed too strongly. Do not match impedances. There is no mystic benefit to be gained from so doing, and in most cases gain will actually be reduced. In the circuit of Fig. 7, people have been known to add a resistor in series with C_1 to match to the output impedance of the preceding stage. On other occasions, R_2 has

been lowered to match the input impedance of the following stage. *Don't do it!*¹

Leakage Currents

Transistors will be destroyed if excessive voltages are applied to them. In most cases, a collector supply of 30 volts or less is required. To get enough bias current, this alone implies relatively small bias resistors.

The input impedance of a grounded-emitter transistor is almost equal to the current gain times the emitter resistance and since the internal emitter resistance is roughly equal to $26/I_e$, a high bias current reduces the input impedance considerably. But this again implies small bias resistors.

Most important, however, is the leakage current, I_{co} . This current flows at all times when the transistor is operating, but is defined as the current which flows in the collector-base circuit when the proper operating bias is applied but the emitter lead is open. I_{co} is relatively independent of the voltage across the collector-base terminals, but it increases with time, temperature, hard usage, and various other factors. And, if the resistance in the base circuit of (A) in Fig. 2 is high, I_{co} causes an additional component of collector current to flow. This component is equal to βI_{co} and, if I_{co} increases very much, can produce a voltage drop in R_2 large enough to saturate the transistor. I_{co} will often start out at 5 microamperes or more. In a high β transistor, this can be fatal.

Even in a circuit like (C) of Fig. 2, troubles can develop. The equivalent base resistance is R_1 in parallel with R_3 , as far as I_{co} is concerned. I_{co} through this resistance produces a voltage. This voltage is applied across R_1 , and an additional voltage is applied across R_3 , and an additional component of emitter current flows. If R_1 in parallel with R_3 is say, 10,000 ohms, and I_{co} goes from 5 to 50 microamperes, the base is raised by nearly half a volt. If R_4 is 225 ohms, I_e increases by 2 ma. This can shift the collector voltage by a considerable amount. It is apparent, therefore, that although the circuit of (C) in Fig. 2 greatly reduces the effects of β variations, it does not necessarily solve all biasing problems. To reduce I_{co} troubles, the current

¹Note that impedance matching is of considerable importance in certain applications such as terminating transmission lines. In addition, if transformer coupling is available between a source and load and neither the load nor the source has zero or infinite impedance, it can be shown that the optimum turns ratio for maximum power transfer also gives maximum voltage and current transfer.

The Pro's Nest

Saul J. White
Chief Engineer, Audax, Inc.



No. 6: IN MEMORIAM

When Skipper was a pup I used to test my tweeters on him. His beautiful upright ears would become alert and his head would cock to one side or another, attempting to relate the sounds to some primeval experience in his German-shepherd ancestry. The twisting of his head was probably his method of utilizing the maximum binaural position to locate the source and separate it from reflections off the walls.

Through the years we had much sport together with a Galton whistle, bird-call squeezer, and an ultrasonic generator preserved since World War II. Even the upper registers of my accordion would titillate him.

Skipper could distinguish the idling or starting of my car from others. Though he might be asleep in the rear of the house, the sound of a car stopping at our curb would rouse him, barking furiously if it was other than mine, but silent and awaiting at the door if it was mine. His sharp and analytical hearing permitted him to differentiate the sound pattern of different motors. When I purchased a new car there was confusion for several days, and I was at first greeted like a burglar until the new adjustments took hold.

He could distinguish between the front and rear door bells, sending him dashing to the appropriate end of the house. But he never took to the ringing of the phone. Some instinct informed him that this constituted no threat to the household. However, I did contemplate training him to answer the phone and take messages in my absence.

Jazz and symphony left him cold. I found no method of arousing his emotions with music or rhythm of any kind. His tolerance for loudness was the same as for us humans. Should I operate my audio system with great volume, he would slowly rise from the living room floor and quietly slink away as if not to hurt my feelings. His hearing was his paramount sense, even though it lacked appreciation of aesthetic virtues.

He knew the members of my family by name. He understood not only my commands, my blandishments, and baby-talk, he could also respond to inflections of my voice. We tried verbal experimentation that took on the flavor of poetry. We developed a private language between us more articulate than the communications of Gertrude Stein to Alice B. Toklas.

As Skipper grew older he lost this sharpness for sounds. He no longer was at the door to greet me. In fact it was now I who awoke him to receive his greetings. His growing deafness led to deception. He would suddenly rush to a door or window barking furiously as if a murderer was forcing his way in. Then he would subside with embarrassment at his error. He stayed close to my side when we walked or visited in the country.

I attached a hearing aid to Skipper but without benefit. He was furious at this, scratching and pawing at the ear to which it was strapped. He snapped, shook, and rolled on his back in a wild effort to rid himself of the insulting contrivance. He showed violent anger at this substitute for what was formerly his proud dominant sense.

For a time I maintained the hearing aid on him by force of straps and bandage, hoping that he would eventually become accustomed to it, but for this short time, it did not register and his responses were as poor as before. This, I felt was because the animal cannot recognize any validity in monaural sound. He would not accept its synthetic quality and felt it an injury to his dignity.

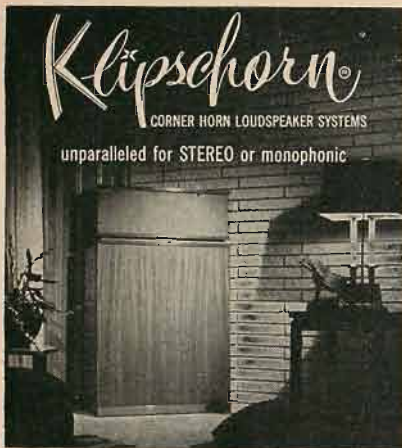
So I removed it at my wife's urgings. "After all" she wisely observed, "Skipper doesn't know he is deaf." After some reflection I considered this to hold some logic.

Ours is a family where affection and loyalty are freely demonstrated and exchanged, and for fourteen years Skipper was part of that rapport. My two daughters grew up sharing their play and their love with him. But as he grew older he feared separation more and more. My daughters went off to distant colleges and Skipper in his deafness became inseparable from my wife and self.

We recently boarded him out to a veterinary's kennel while we made a trip to the West. On our return he was dead. He had not touched food or water for nearly two weeks. Ours is the loss of a close friend, a four-legged relative united with us by affection, loyalty and understanding. Skipper has given our family enrichment. We deeply miss him.



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CIRCLE 96B

in R_1 and R_2 must be considerably larger than the largest anticipated I_{co} . For most purposes, 50 microamperes is a good estimate for I_{co} maximum in germanium transistors. Thus the R_1R_2 current should be at least 0.5 ma. It is a good rule of thumb to make the R_1R_2 current at least this large and preferably as large as the current in R_3 if that current is greater.

It should be noted that silicon transistors have much lower I_{co} 's and bias resistors can be ten times larger than those for germanium without causing trouble.

Conclusions

If Ohm's Law is applied with confidence, transistor circuits are no harder to understand than circuits containing vacuum tubes. This does not mean that complete understanding can come from arguments such as those used in this paper. High-frequency effects, direct-coupled circuits, feedback, transient response and many other items of great practical importance have been deliberately omitted in the interest of establishing a feeling for transistor operation based on a minimum of physical and mathematical reasoning. A little experience will show both the value and the limitations of this approach. **AE**

AUDIOCLINIC

(Continued from page 6)

phonic tapes or stereo tapes of this track width, the tape will probably be left in the "heads up" position, but, of course, the wind will still be smooth.)

One record company goes to considerable trouble in storing its master tapes. A layer of paper is wound between each layer of tape to prevent contact between adjacent tape layers. The object of this stringent precaution is to eliminate or at least minimize print-through.

A tape owner of my acquaintance has constructed a mumetal safe to store his tapes in. It is characteristic of mumetal that magnetic fields cannot easily penetrate the metal. Hence, a box constructed of this material will minimize the effects on the stored tapes of stray magnetic fields, which, if strong enough, would increase print-through and tend to erase signal. **AE**

AUDIO TECHNIQUES

(from page 52)

Furthermore, they are interesting as to source. The bulk of the material was housewife—two groups not heard from supplied by a high school student and a often enough by this department and by AUDIOCLINIC. Now that summer is over, I hope you had a fine time before assuming the routine procedures of the fall and winter seasons. Let's hope, too that you have uncovered more interesting material to share with other readers via this column.

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AMPEX, 400A professional tape recorder.

AMPEX 400A professional tape recorder, \$385.00. V. R. Hein, 418 Gregory, Rockford, Illinois.

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ELECTRICAL ENGINEER having particular interest in electro-acoustic relays and several decades of experience seeks position in N. Y. Metropolitan area. For resume, etc., write CK-1, Audio, P. O. Box 629, Mineola, N. Y.

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Industry Notes...

• **Harman-Kardon Names General Manager.** Donald Spanier has been appointed General Manager of Harman-Kardon, Inc., Sidney Harman, President of Jerrold Electronics Corporation, announced today. Harman-Kardon is one of the constituent companies within the Jerrold complex. As General Manager, Mr. Spanier will be the company's chief administrative officer, overseeing all activities. Prior to joining Harman-Kardon, Mr. Spanier was General Manager of Polaroid of Japan, Inc., where he introduced the Japanese and other Southeast Asians to locally made "Picture-In-a-Minute" products. Mr. Spanier also served as management consultant to the Commonwealth of Puerto Rico in connection with its industrialization program, and founded and served as President of the Puerto Rico branch of the Society for the Advancement of Management.

• **Jensen Promotes Four In Management.** Four promotions have been announced by Jensen Manufacturing Company, Division of the Muter Company, Chicago loud-speaker manufacturer, according to Ralph P. Glover, vice president. Karl Kramer has been made Manager, Commercial Sound Products. Eugene G. Van Dever becomes Manager, Export Division. Frank D. Lintern has been advanced to Sales Manager, and Theodore A. Piranek to Assistant Sales Manager, both in the Distributor Division.

• **Sony Expands.** In its continued expansion program, the Sony Corporation of America announced that it has opened a new central regional office in Chicago. The sales and merchandising subsidiary of the Sony Corporation, Tokyo, now has three offices in the United States: New York, Chicago, and Los Angeles. The Chicago office, 4950 West Belmont Avenue, has warehousing facilities which will help expedite deliveries in mid-west markets.

• **Amperex Announces 3 Executive Promotions.** The promotion of Mr. Charles Roddy from Product Manager, Transmitting and Power Tubes to the position of Technical Assistant to the President, has been announced by Mr. Frank Randall, president of Amperex. Mr. Randall also announced two other promotions: Mr. Ed King has been promoted from Sales Engineer to Assistant Product Manager, Professional Tubes and Semi-conductors; and Mr. Al Katz has been promoted from Section Head, Applications Engineering to Assistant Product Manager, Transmitting and Power Tubes.



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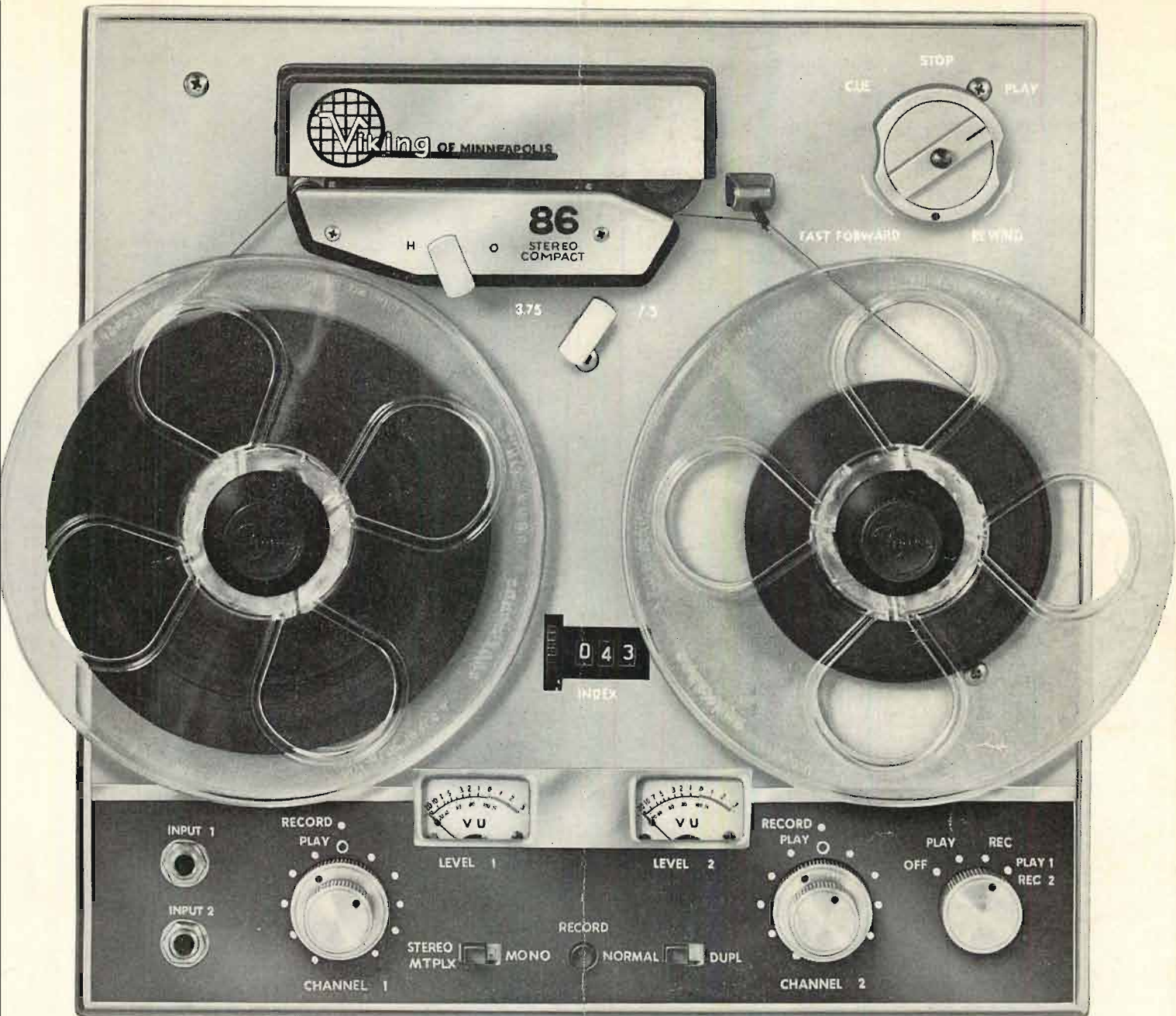
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