

Scott / The New Technology



At last! A powerful solid state receiver designed expressly for knowledgeable audiophiles

Scott's new 348 tuner/amplifier is *not* designed for the Mrs. . . . or for the kids. It's *not* a simplified combination unit. This compact receiver is designed expressly for the man who wants a top-end high fidelity tuner, a powerhouse amplifier, and a preamp with a really complete set of controls . . . yet still wants all this in one compact unit.

The 348 is a unique piece of high fidelity gear. Scott engineers have loaded it with every feature and control in the book . . . and in hi fi engineering, Scott wrote the book. It packs a powerful 100-watt punch . . . yet it fits in a *standard* 12" bookcase!

You won't find *any* output or driver transformers in the 348. Scott's advanced design has done away with these bulky distortion-inducing power-wasters.

New 348 has everything, even a sink!

The direct-coupled output circuitry of the 348 utilizes silicon transistors mounted on military-type heat sinks . . . more costly, but resulting in dramatically improved tran-

sient response, more instantaneous power for music peaks and cooler, trouble-free operation.

Every control feature you'll ever need is included in the 348: adjustable Dynaural interstation muting control; five-position input switch; seven-position stereo selector switch; dual bass control; dual treble control; balance control; loudness control; compensation switch; main/remote speaker selector; three-level phono sensitivity switch; flywheel tuning control; rumble filter; scratch filter; and tape monitor.

In addition, the 348 gives you a wider range of inputs and outputs than you'll find on most separate units: a switched front panel stereo headphone output; tape head, phono, and extra inputs for both left and right channels, two Tape In jacks; two Tape

Out jacks; and two AC outlets, one of which is switched.

The new Scott 348 is *not* inexpensive. Yet at \$479.95 it represents one of the best high fidelity bargains ever produced. It is superior in performance and features to the most expensive separate preamps, power amplifiers and FM stereo tuners on the market . . . and if you've added prices lately, you know you can't come anywhere near the performance of the 348 unless you spend more than \$800 on separate units.

SPECIFICATIONS: Usable sensitivity (IHF), 1.9 μ V; Harmonic distortion, 0.8%; Capture ratio, 2 db; Selectivity, 45 db; Cross modulation rejection, 80 db; Separation, 40 db; Music power per channel (at 4 ohms load), 50 watts; Steady state power per channel (at 4 ohms), 37.5 watts; Frequency response (1.0 db), 15-30,000; Hum and noise, -80 db.

Dimensions: In accessory case: front panel, 5½" x 17½"; from front foot to back of heat sink, 10½".



SCOTT®

H. H. SCOTT, INC., 111 POWDERMILL ROAD, MAYNARD, MASS.

Export: Scott International, Maynard, Mass. Cable HIFI. Prices slightly higher west of Rockies. Price and specifications subject to change without notice.

Circle 100 on Reader Service Card

AUDIO

December, 1965 Vol. 49, No. 12

Successor to **RADIO**, Est. 1917

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AUDIO Profiles

2300

Model 250

844A

AUDIO in General

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Number 28 in a series of discussions
by Electro-Voice engineers



TOO MUCH OF A GOOD THING

JOHN R. GILLIOM
Loudspeaker Project Engineer

Traditionally, high magnet weight has been used as one indication of speaker quality. Large magnets offer high sensitivity and high electrical damping, both important factors in conventional speaker system designs. There is one case however, where heavy magnets may not provide improved performance, and in some cases may contribute to poor sound quality.

The exception to the general rule is the compact speaker woofer. Excessive magnet size may offer excellent mid-range efficiency, but at the expense of bass rolloff above resonance due to overdamping. Since insufficient magnet allows underdamping with its typical "one note" bass, it follows that magnet size must be chosen with great care. There are three design controls that can be applied to compact woofer damping: acoustical, mechanical, and electrical. Included in the acoustical control is cabinet size and porting, interior padding or filling, and (usually undesirable) air pumping in and out of cavities in the air gap and magnet structure. Mechanical damping can be achieved by varying suspension resistance using different spider and surround materials, plus the use of damping compound. Electrical damping can be controlled by magnet size and structure efficiency as well as voice coil design.

In a series of exhaustive experiments involving tone burst tests, response measurements and listening panels, Electro-Voice determined that to optimize bass efficiency with linear response, acoustical and mechanical damping resistances must be reduced to a practical minimum. Magnet size can then be selected to achieve optimum balance between bass and treble response.

The actual magnet size will vary with a number of factors, including overall magnetic system efficiency and total moving mass. Except in cases of excessive cone mass, poor magnetic design, or low acoustical/mechanical damping, there is a limit to magnet size if ideal bass response is to be maintained. In fact, an unusually large woofer magnet may imply design weaknesses in other parts of the speaker.

For this reason it is felt wise to depend on other specifications than magnet size when judging the quality of any compact speaker system. In the final analysis, careful listening may prove most productive. In any event the development of the small sealed system has—in many ways—upset the traditional criteria for judgment of speaker system design.

For technical data on any E-V product, write:
ELECTRO-VOICE, INC., Dept. 1253A
602 Cecil St., Buchanan, Michigan 49107



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COMING

Articles

Putting Junk-Box Meters to Work—II

A follow up of the author's previous article in the August, 1965, issue. This one deals with methods of employing d.c. meters in circuits which permit making a.c. and audio-frequency measurements.

Push-Pull Drive from a Split-Load Stage

George Fletcher Cooper continues his analyses of transistor circuitry, this time covering the advantages and disadvantages of this arrangement.

Audio Measurements Course—Part I

The first installment of a series by Norman H. Crowhurst. This will introduce measurements and techniques to the audio buff in the author's usual thorough manner.

Profiles

Knight KG-415 Tape Recorder/Amplifier Kit.

Harman - Kardon SC - 440 Music System

Maximus VII Loudspeaker Systems

In the January Issue

On the newsstands, at your favorite audio dealer's, or in your own mailbox.

AUDIO CLINIC

Joseph Giovanelli



Send questions to:

Joseph Giovanelli
2819 Newkirk Ave.
Brooklyn, N. Y.

Include stamped, self-addressed envelope.

Noisy Stereo Amplifier

Q. After two years of use, my stereo amplifier has an unbearably loud background hiss which was happily not present during most of the time I owned the equipment. It is an elusive hiss because it originates in the same stage of both channels, the 12AX7/ECC83 tube which drives the offending stages is not at fault.

I determined which stages were giving me the noise by manipulating the two sets of level controls on the amplifier: one set of level controls is immediately after the low-level amplification stages and the high-level inputs; the other set follows the tone-control circuits and the next stage of amplification. Because the hiss is independent of the first control and dependent on the second, these tone control amplifiers must be at fault. However, interchanging all voltage amplifier tubes (conveniently the same type of tube is used throughout the unit, making this possible) results in no change of hiss level. I don't believe that the cause of the trouble is a noisy tube. Also, curiously enough, this hiss increases when the scratch filter is on, although otherwise the scratch filter works normally. This filter is in the same stage. If this were not enough, the amplifier occasionally emits loud "pops."

Could the hiss be caused by aged carbon resistors in both channels? Are all of my voltage amplifier tubes noisy? Do I have a bad output tube which might cause the "pops"? Laird L. Macomber, W. Lafayette, Indiana.

A. The problem you describe in your letter is a peculiar one. The unusual feature of it is that it appears in both channels. I doubt that the trouble has anything to do with tubes—including the output tubes. The question I asked myself was "What could happen which would affect both channels in this way?" The only answer I could come up with was that something is wrong with the power supply, the only thing common to both channels. Probably one of the decoupling or filter capacitors has become defective. (It probably has opened, or at any rate has lost some capacitance.) Check this by shunting the various capacitors in the decoupling circuit with capacitors known to be good.

If the instruction manual for the equip-

ment includes a voltage and resistance chart, go over the entire circuit for departures from the chart. This may give you a clue to the trouble.

If the gain of the amplifier has increased, you can suspect the decoupling capacitor even more than formerly or you can suspect the major and minor feedback loops. It seems surprising to me, however, that both feedback loops should have changed their characteristics at the same time, so check this possibility as a last resort.

Low-Impedance Recorders to High-Impedance Amplifiers

Q. I have a problem with a recently purchased basic 40-watt amplifier to be used as a monitor with a tape recorder.

The output from the tape recorder can be used with either balanced or unbalanced lines, but I must use it unbalanced.

Everything seems to be fine. I notice, however, in going over some professional audio equipment catalogs that the monitor and bridging amplifiers used a transformer input, balanced, 150/600 ohms, whereas my amplifier uses a resistor-capacitor network directly to the grid of the first stage—(input about 250,000 ohms.)

Frankly, with a professional piece of equipment like this tape recorder, it seems to me that balanced inputs should be used. I am considering the purchase of an amplifier made for this purpose. My question is this: Using my present amplifier, unbalanced, is there any loss of stability or signal quality, and so on? Frankly, it sounds O. K. I'm just trying to keep everything "sound and broadcast studio style."

The tape recorder output is the usual 600 ohms balanced. When used unbalanced, there is a switch on the rear panel which connects a resistor into the circuit for a 600 ohm termination. R. M., Wollaston, Massachusetts.

A. There is absolutely no reason why you should not use your equipment in the manner you are now doing. All that is happening now is that you are delivering voltage to the grid of your amplifier. If you used an amplifier having an input transformer, you would be transferring maximum voltage to the stage. This may give you somewhat higher output, but, from what you can see already, you will not need this extra voltage. Sound quality will not be affected in either case. The important consideration is that the tape recorder be terminated satisfactorily, and the internal resistor provided in your machine takes care of this.

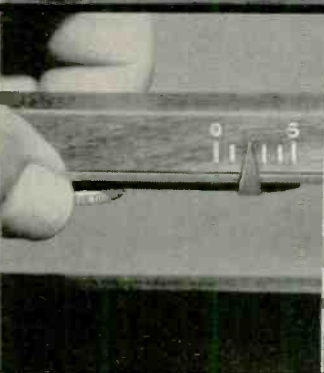
If at any time you find it necessary or

Here's how your dealer can show you what skating force is; how the Lab 80 eliminates it; protects your records; tracks both stereo channels more evenly — more perfectly than any other integrated record playing unit.

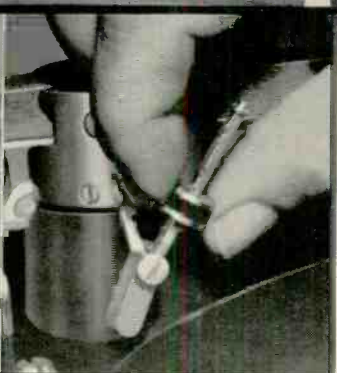
1. "This is a blank record with no grooves. I place it on the Lab 80."



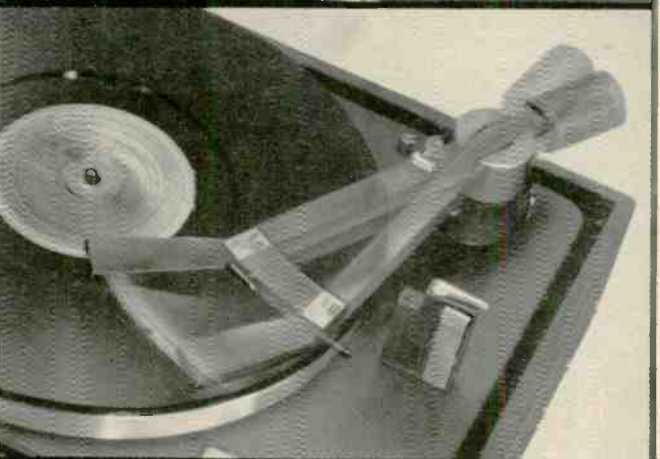
2. (left) "I set the tracking force at 2 grams, (as an example). Since each click of the stylus pressure gauge on the tone arm equals 1/4 gram, I turn it for 8 clicks."



3. (right) "I slide the counterweight on the anti-skating device to the second notch... for a compensation of 2 grams... equivalent to the tracking force I have just set on the tone arm."



4. "Now you can actually watch the strength of the skating force. I start the Lab 80, but flip the anti-skating device over and out of operation. Note that as soon as I put the stylus on the grooveless record, the arm moves rapidly... with force, toward the center."



5. "Now watch me neutralize the skating force. I swing the anti-skating device back into position... and the arm tracks as perfectly as if there were a groove in the record! If I were playing a regular record—with the side pressure gone and resulting distortion eliminated—the sound would be cleaner."



Exclusive! Anti-Skating Demonstration with the Garrard® LAB 80

Due to the offset angle of any cartridge, and the rotation of the record, all tone arms have an inherent tendency to move inward toward the center of the record. This skating force, a definite side pressure against the inner wall of the groove, is a major cause of poor tracking, right channel distortion, and uneven record wear. Now, Garrard dealers have been supplied with grooveless records which make it possible to visualize the skating force and how it is overcome in the Lab 80. The demonstration takes only a few minutes, but it is well worth seeing before you decide on any record playing unit.

Oscilloscope readings (using 1000 cycle, 30 cm per sec. test record as signal source) verify effects of skating force on record reproduction.



Tracking without the anti-skating compensator, sine wave form shows considerable distortion.

Tracking with anti-skating compensator, sine wave form becomes a clean picture of the output of the cartridge.



The patented Garrard method of neutralizing skating force is but one of a number of Lab 80 developments exclusive today but sure to be imitated tomorrow by other manufacturers. Compare! You'll find this Lab 80 feature is simple and fool-proof... works perfectly without springs, balancing devices or other delicate mechanisms.

AUDIO says: "Special features set this arm apart from the other automatics (and quite a few manuals). The first is an adjustable skating-bias control. This can be set for the proper stylus force used. It works effectively, without binding on the arm."

HI-FI/STEREO REVIEW says: "I found that the bias compensator was quite effective... When adjusted, the distortion was very low even at the highest velocities, and was observably lower than when no compensation was used."

HIGH FIDELITY says: "Tracking is well nigh perfect; the machine can handle cartridges of all weights, including the lightest, and of all compliances, including the highest; the assembly has a high immunity to external shock."

Visit your dealer to see the anti-skating device in operation, or send \$1.00 to Garrard for your own grooveless demonstration record. For your complimentary copy of our new 32-page Comparator Guide, write Garrard, Dept. GM-15, Westbury, New York 11591.

Circle 103 on Reader Service Card



Faithfully yours



Model 631 (Mono) \$468 | Model 634 (Stereo) \$597

If you want chromium trim, light weight, eye-catching colours and built-in obsolescence—if you read exciting specifications and pretend they are true—if you acquire a recorder solely to keep up with the Joneses—the Ferrograph is not for you.

Ferrograph tape recorders are built in a tradition of engineering that believes the weight of the instrument, within reason, to be of small moment—that you cannot have quality without amply designed components—that there is no easy way to achieve quality.

The Ferrograph is designed for the man who wants a tape recorder to perform as well some years hence as it does when first delivered to him. He is concerned with the pleasure—the enduring pleasure—a quality instrument adequately designed and well engineered will give him. He is a discerning character who is able to appreciate quality when he hears it, recognize engineering skill when he sees it—in a word, he is a connoisseur.

The Manual of the Ferrograph, a sixty-four page illustrated volume, bound in cloth, and containing full operational and technical data, is supplied to every Ferrograph owner. You can obtain this manual in advance however by sending \$3 with the coupon below to us in London. (Indicate Stereo or Mono).

Please send me a copy of the Ferrograph leaflet.

Please send me a copy of the "Manual of the Ferrograph" for which I enclose \$3. Stereo or Mono

NAME

ADDRESS

.....

.....

The Enduring **Ferrograph**

THE FERROGRAPH CO. LTD. 84, Blackfriars Road, London, S.E.1. England

Circle 101 on Reader Service Card

desirable to use your amplifier with the balanced line arrangements provided by your tape recorder, what you can do is to obtain high-quality transformers—and connect them between your amplifier and the two outputs of your tape machine. Make sure that such transformers are shielded and of good quality. They should have quite a bit of iron in them. I have assumed that the unit is capable of stereophonic reproduction. If it is monophonic, then you will need only one such transformer.

The installation you will have after including the transformers will be professional in every way.

Unless you plan to open a recording studio, however, you do not need the transformers. For your home music system, you will not notice the difference in sound quality with or without the transformers.

FM Antennas

Q. 1. When using a 300-ohm antenna and a 72-ohm coax down lead, is the loss of signal in the cable serious enough to warrant the use of one or two transformers for matching?

2. If a 300-ohm shielded twin lead is used, what is done with the shield?

3. Because of my Long Island location, I receive stations from the New York and New Jersey area on one side. On the other side I receive eastern Long Island and Connecticut stations. I contemplate using a double stack of 2-5 element FM yagis, one beamed in each direction. Can I get by using one down lead or should I use two down leads with a knife switch selector? J. Pushkin, Hempstead, New York

A. 1. The use of the wrong kind of transmission line will cause considerable loss of signal at your tuner's input or to any r.f. device. If you are going to use a transmission line which does not directly match impedances of your tuner and your antenna, you should use a transformer at each end of the line whose turns ratios are worked out to match the antenna to the transmission line and the transmission line to the tuner input. Further, the transformer must act to balance the antenna and tuner's input terminals and yet allow the transmission line to be unbalanced. It is possible to use what is known as a bazooka balun at the antenna end of the line rather than the transformer. This is nothing more than a piece of coaxial cable cut to such a length as to act as an impedance transformer. If such a balun is used, you will still need the transformer at the receiver end of the line.

2. When shielded twin lead is used, ground one end of the shield to the mast, and ground the other end of this shield to the chassis of the tuner. The tuner, itself, should be connected to a good ground. I have found, however, that the loss in this kind of transmission line is quite severe and I recommend the coaxial cable and the use of the transformers as a more preferable arrangement.

3. If the two stacked antennas are used, mounted 180 deg. apart, you will nullify their directional characteristics, especially when they are connected to a common lead-in. It would be best to use two sepa-

(Continued on page 52)

For only \$3.78 per watt you can own the world's first all-silicon stereo receiver!

New **PLAYBACK** series



It's completely new and way ahead of its time! The Altec 711 **PLAYBACK** receiver gives you an honest 100 watts in a rugged, trouble-free all-silicon design that's the best power-per-dollar value on the market!

SOME AMPLIFIER!

It provides 100 hefty watts of clean, undistorted power. The kind you can *use*, not just talk about! Turned up to a roof-lifting 70 watts, this fantastic amplifier has a total harmonic distortion of a mere 0.25%. Even at the full 100 watts, distortion is still only 0.5%!

Three Good Reasons Why You Need Such Power in an Amplifier. If you're lucky enough to own high-efficiency Altec **PLAYBACK** speakers, you can use your power to achieve concert-hall listening levels. Because Altec's **FULL-SIZE** speakers dissipate so little of your power, you can bring the full sound of the orchestra into your home!

On the other hand, if you have ordinary, low-efficiency speakers, you need the 711's

power to coax a good listening level from them. And you'll still have enough reserve power to handle the sudden dynamic changes which are inherent to most music. In fact, the Altec 711 has enough power to help reduce clipping—even with very inefficient speakers!

Third, no matter what kind of speakers you have, an amplifier that's designed to perform so well at 100 watts provides a brilliant fidelity at lower listening levels that low-power amplifiers just can't match. It's like a fine motor car designed to operate at 120 mph. When you cruise at 65, you know you're just loafing along without strain. If your car had a top speed of only 80, however, then 65 mph would be close to the car's endurance.

Other Amplifier Features include frequency response of 20-20,000 cps ± 1 db at 100 watts—and at lower power settings a fantastic 10-100,000 cps response / rocker panel switches / automatically resetting circuit breakers instead of fuses / and no transformers anywhere to cause distortion.

SOME TUNER!

The 711's masterful combination of sensitivity and selectivity picks up even the weakest stations—then hangs onto them like a bulldog. Drift is a problem of the past!

The 711 tuner is extremely sensitive, with a volume sensitivity of 0.9 μ v and usable sensitivity of 2.2 μ v IHF. Other specs that back up the superior performance of this years-ahead tuner include capture ratio of 2.5 db, stereo separation at 1000 cps of 40 db, and a power bandwidth of 20-20,000 cps ± 1 db.

A unique 4-gang tuning condenser makes the 711's special sensitivity-selectivity combination possible. The fully neutralized IF uses the newest high-gain silicon transistors for optimum integration with the tuning gang.

WHAT THE 711's ALL-SILICON DESIGN MEANS TO YOU

Only silicon transistors have the inherent ruggedness, the ability to "take it," that ensures you years of trouble-free listening enjoyment. And by "take it" we mean that silicons can handle at least 200% more heat than germaniums!

The rugged reliability of silicon transistors is why military specifications for critical electronic equipment demand silicon instead of germanium transistors. This is the kind of reliability you get in the new Altec 711!

REALLY CONVINCING YOURSELF—COME SEE THE FANTASTIC ALTEC 711!

It's all silicon—it's all excitement! The 711 comes completely enclosed in a beautiful metal case (walnut case optional), thanks to its no-heat operation! Your Altec dealer is waiting to show you the new 711. Or, for complete information, write Dept. A12.



ALTEC LANSING
A Division of
LTV
Ling Altec, Inc.
ANAHEIM, CALIF.

COMPARE FOR YOURSELF THE 711's POWER-PER-DOLLAR VALUE!

Make	Model	Price	Watts	Dollar-per-watt	All-Silicon Transistors
Altec	711	\$378.00	100	\$3.78	Yes
Bogen	RT 6000	359.95	60	6.00	No
Fisher	500 C	349.50	75	4.66	Tube
Fisher	600 T	459.50	110	4.17	No
Fisher	440 T	329.50	80	4.12	No
Harman-Kardon	SR 300	264.00	36	7.33	No
Harman-Kardon	SR 600	354.00	50	7.08	No
Harman-Kardon	SR 900	434.00	75	5.79	No
Scott	344	429.95	50	8.60	No
Scott	340 B	399.95	70	5.70	Tube
Scott	348	499.95	100	5.00	No
Sherwood	S-8000 IV	312.50	80	3.92	Tube
Kenwood	TK 80	339.95	80	4.22	No
Kenwood	KT 10	269.95	40	6.74	No
Kenwood	KW 55	219.95	40	5.49	Tube

Chart is a cross-section of comparably priced receivers available at the time this advertisement was prepared. Prices and wattage figures are based on information contained in advertisements of the respective manufacturers.

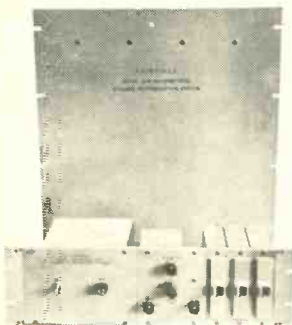
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THAT SELL
START
WITH...**

**The New
Fairchild
F-22
Condenser
Microphone**

By breaking away from traditional condenser microphone design and using the latest in solid state field effect transistor technology and microcircuitry, FAIRCHILD is able to produce this quality condenser microphone at an astonishingly low and sensible price, thereby putting the ultimate microphone quality within the reach of every sound engineer. price **\$160**



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Used by major studios throughout the world for its natural reverberation effects, the FAIRCHILD REVERBERTRON'S reasonable price now makes it possible for every studio to have the production plus of controlled, flexible and natural sounding reverberation.

Unique Features:

Variable reverb • Electronic time control • Solid state components • Rack mountable • Portable • Three time periods instantly and noiselessly selectable • Remote control without expensive servo mechanisms • Mixing network provided.

Priced at only \$985

Write to FAIRCHILD — the pacemaker in professional audio products — for complete details.

FAIRCHILD

RECORDING EQUIPMENT CORPORATION
10-40 45th Ave., Long Island City 1, N. Y.

Circle 109 on Reader Service Card

LETTERS

Words, Words, Words!

SIR:
In reference to the first "Q & A" in Herman Burstein's TAPE GUIDE column in the August, 1965, issue, I doubt seriously if the playback head in question has an impedance of 255 millihenries. It might well have that much inductance, though.

HAROLD J. TURNER, JR.,
1717 R Street, N.W.,
Washington, D.C. 20009

(You're so right. We need more and better proofreading. Ed.)

"El Cheapo" Improvement Suggested

SIR:
A transistor power amplifier was described in the November, 1964, issue in an article by R. R. Moore. I built two of these amplifiers and they worked fine, but the idle current approached the operating current. I put a resistor across D_1 and brought the idle current down to approximately 75 mA. This seems to have absolutely no adverse effect on the amplifiers.

I would like to know if there has been a correction on this amplifier.

M. J. EASTERWOOD,
4090 E. Lynwood Drive,
Beaumont, Texas.

(None has been published so far. We have asked Mr. Moore for his comments. Ed.)

A Pat on Our Back

SIR:
Allow me to congratulate you on R. R. Moore's article "Transistor Transresistance," which appeared in the July, 1965, issue. With a few strokes of the pen, Mr. Moore easily communicates in a novel manner most of the basic facts about simple transistor circuits.

There is, however, an important point which Mr. Moore omitted that is essential to understanding even the most basic transistor circuits—the concept of temperature stability. Since some readers may be encouraged by the article to do some designing on their own, it may be wise to equip them with the one idea which they would lack to make a simple circuit successfully. The problem of temperature variations in semi-conductor circuits is much more severe than in vacuum-tube circuits, and it constitutes a basic part of any design. The main troublemaker in transistor circuits is the leakage current which depends strongly on temperature. For the purpose of specifying the relative stability of a transistor circuit, a "stability factor," originally defined by Shea, is used.

The stability factor of a transistor circuit is simply a number which when multiplied by the leakage current, I_{co} , indicates how much the collector current will change. The stability factor, S is given by

$$S = \frac{\text{change in } I_c}{\text{change in } I_{co}} = \frac{1 + R_e/R_b}{1/\beta + R_e/R_b}$$

where R_e and R_b are the external resistances in the emitter and base circuits, respectively. This expression usually simplifies to a much simpler expression for a given circuit. For instance, if R_e/R_b is very small,

$$S = \beta \quad (1)$$

and if R_e/R_b is very large,

$$S = 1 \quad (2)$$

and if R_e/R_b is small compared to 1 but comparable to $1/\beta$,

$$S = \frac{\beta}{1 + \beta (R_e/R_b)} \quad (3)$$

For the circuit used in Mr. Moore's example, where R_e was 470 ohms and R_b was 1.5 megohms, $\beta = 110$, $R_e/R_b \cong 1/3200$ hence $S \cong \beta = 110$.

Therefore, if the ambient temperature increased 10°C (in increase of 10°C approximately doubles the leakage current, I_{co} , which is $0.5 \mu\text{A}$ in the silicon transistor used by Mr. Moore) the corresponding increase in collector current

$$\Delta I_c = S(\Delta I_{co}) = (110)(0.5) 10^{-6} = 0.055 \text{ mA.}$$

Since the operating point was at an I_c of 1 mA, the changes in operating conditions introduced by a 10°C rise in temperature are negligible. However, in a germanium transistor with an I_{co} of $5 \mu\text{A}$ (which is reasonable) had been placed in the same circuit, the rise in temperature would produce a

$$\Delta I_c = (110)(5) 10^{-6} = 0.55 \text{ mA,}$$

which is enough to saturate the transistor and make the circuit inoperable.

I hope this brief discussion may aid interested readers in using to better advantage what they may have learned from Mr. Moore's article.

MODESTO A. MAIDIQUE,
Mass. Inst. of Tech.,
Cambridge, Mass.

Plus and Minus

SIR:
In the July issue, we noted a circuit for a solid-state oscillator. After building the unit, we noted several capacitors' polarities were reversed. We could not get this circuit to function, and wonder if there is a corrected version?

CLARENCE W. LEININGER,
1200 Studio Lane,
Deerfield, Illinois 60015

(We admit that some polarities are incorrect but we know of some readers who built the unit, correcting this error, and achieving good results.)

Supply Source

SIR:
In the oscillator described in the July issue, a VECO 32A50 thermistor is specified for the feedback loop.

Can you advise where these can be obtained, or if there is a satisfactory substitute?

DOUG VANDERWATER,
53A Catherine Street,
Belleville, Ontario, Canada

(So many people have made this inquiry that we publish the source from which we obtained some: Newark Electronics Center, 160 Fifth Ave., New York, N.Y. 10010. Price is \$6.60 each. Don't open the package in a breeze. The thermistor is really tiny. Ed.)

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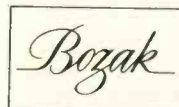
Each summer more great musical organizations are taking to the outdoors where at a single concert their music may reach more people than in an entire indoor season.

A case in point is the series of Central Park concerts by the New York Philharmonic where individual audiences ranged upwards from 70,000.

Naturally, if persons in the last row, a quarter of a mile from the orchestra, are to hear the concert, there must be a sound reinforcement system. If the entire audience is to **enjoy** the music, that system must deliver the music as naturally as possible — nothing added, nothing taken away.

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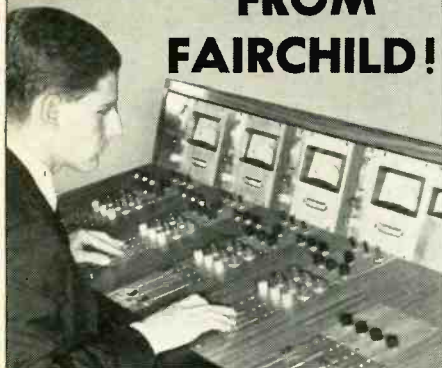


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LIGHT LISTENING

Chester Santon

THE 1965 NEW YORK HIGH FIDELITY SHOW proved once more that temporary glimpses of the Promised Land in the reproduction of sound are the most tantalizing ones. The latest show didn't offer anything in the sound field that matched the news-making features of home video taping but it did offer an assurance, however fleeting, of better things to come in the playback of stereo discs. The disc is still the best buy per dollar spent in playback equipment and shows no sign of going out of vogue with people who value the best in sound. One exhibit at this year's show went a long way to convince me, while a newly-designed stereo pickup was functioning properly, that the Promised Land had opened to all audio fans. The booth I refer to had been set up to promote a deluxe 35 watt-per-channel solid-state amplifier and a matching preamp being shown for the first time this year. The large speaker systems were of conventional design, cannily selected for their 8-ohm impedance. The surprise in the sound quality was provided by a new "solid-state" pickup that in days gone by would have been referred to as a ceramic. In A-B tests during the relative quiet of dealer's day, the new "strain generators of subminiature design" easily outperformed a highly respected, front-rank pickup used in the same exhibit in past years. Frequency response was improved in the new unit and transient-handling ability was far superior. While the new cartridge was functioning at top form, the sound was more than enough to create a new army of converts to solid-state amplifiers, not to mention the transducer in question. The stay in paradise, alas, was of short duration. After sampling four or five records for a half hour or so, a gradual increase in groove surface noise dictated an examination of the cartridge. The trouble, Stylus bar way off at an angle. That is why this column finds me back in a workaday world with the first record of the month being reviewed with a conventional pickup.

Noel Boggs: Western Swing

Repeat RS 310-8

Along with other readers of AUDIO I've been following reports of the direct (no microphone) recording process developed by Barcus-Berry Inc. of Long Beach, California, on their Repeat label. This release gives me the first chance to sample this unique process on my own system under repeated hearing. This technique, when used with certain types of music, can be very impressive from a technical stand-

°12 Forest Ave., Hastings-on-Hudson, N.Y. 10706

point but I hate to think what could happen in musical terms if the process were to fall into the hands of labels that might be tempted to use it indiscriminately. Repeat has wisely chosen very informal Western music in this disc that is just a shade removed from old fashioned hillbilly material. The absence of room ambience doesn't matter too much in a group this small and the three scrape-style fiddles, guitars, drums, and bass were never meant to caress the ear with subtle sound. The transducers making direct contact with the vibrating elements of the instruments carry straight to the tape recorders a signal that is impressively wide in frequency range and low in distortion.

The bass seems to activate long-throw woofers in a region where they've never been tickled substantially before. It is not, however, the sound we hear in a live performance when the vibrations of the instruments make contact only with the air around them. The difference is a fascinating one and makes Repeat's work in this little known field very much worthwhile for its instructive nature alone. Only in listening to instruments under these arbitrary conditions do we realize to what extent the atmosphere around us mellows instrumental transients when they first make contact with air.

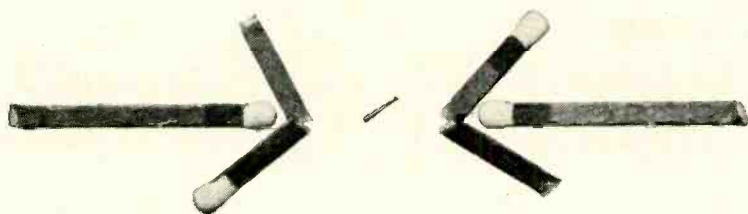
Walt Disney's Fantasia

Vista Stereo Tape BVF 101

Commercial four-track stereo tapes recorded at 3 3/4 ips have been around for some time in the drama field but early autumn of this year marked the first time I received music in a sizable batch of reels. A move to 3 3/4 for musical recordings on the part of Ampex, still the main supplier of ready-to-play tapes, indicates that dealers are going to be expected to stock 3 3/4 in quantity from now on. The decision to push the slower speed should cause few tremors in the retailing field. Compatibility can hardly be considered a problem since most tape recorders have been sold with 3 3/4 as one of the speeds from the inception of the home market. Tape fans today, no matter how recent their interest in commercial tapes, require no explanation of the basic differences the recording medium offers at 3 3/4 as opposed to 7 1/2 ips. On the basis of my experience with both speeds in home taping, I was prepared to dismiss musical 3 3/4 releases when the idea was first put into commercial form some months ago.

That was before I heard them. After careful listening to this recording of the soundtrack from the famous Disney film "Fantasia," I am now prepared not to dis-

(Continued on page 58)



This is all that moves in the new ADC 10/E cartridge

We figure it costs you roughly \$49,000 a lb.

You'll probably never buy anything man-made as costly by weight as this tiny, incredibly rugged moving stylus of the new ADC 10/E cartridge.

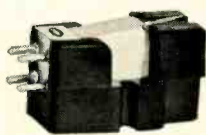
It reduces "moving mass" to about *one-third* that of the best magnetic cartridges.

Moving mass (the weight or inertia of the total moving system as felt at the stylus tip) is what your record has to push around. The groove must move it in one direction, stop it, then push it another direction—thousands of times a second.

Even a few milligrams of moving mass set up such tremendous forces that the record groove *yields* as the stylus passes. . . . So even on the very first play, you hear a distorted groove, not the groove that was pressed in.

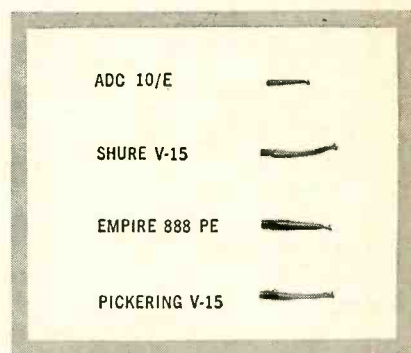
Now, by a major jump forward in de-

sign, the ADC 10/E reduces moving mass well *below* the critical point of groove yield. Result: for the first time ever, you can hear the actual record you bought . . . on the first play, or the 500th. (Wear is negligible.) Listen to a complex passage, piano, operatic or choral selection, and you hear the difference. You get clarity,



brilliance, reality and definition never obtained before. At long last, true "clean-ness"!

How good is the new ADC 10/E? By any test, lab or listening, it is so perfect that any improvement would be pointless. For the first time it can be said: no one will ever make a cartridge that performs perceptibly better.



This actual photo of the moving parts of these popular cartridges contrasts dramatically the much lower "moving mass" of the new ADC 10/E.

SPECIFICATIONS — ADC 10/E

Type	Induced magnet
Sensitivity	4 mv at 5.5 cms/sec recorded velocity
Channel separation	30 db, 50 to 10,000 cps
Frequency response	10 to 20,000 cps. ± 2 db
Stylus tip	Elliptical Stylus Contact radius—.0003" Lateral radius—.0007"
Vertical tracking angle	15°
Tracking force range	1/2 to 1 1/4 grams
I.M. distortion	Less than 1% — 400 & 4,000 cps at 14.3 cms/sec velocity
Compliance	35 x 10 ⁻⁶ cms/dyne
Price	\$59.50

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1. BROADEST FREQUENCY RANGE

MAXIMUS 7 delivers a frequency range of 25 to 35,000 cps at fantastically low distortion levels—virtually flat throughout the entire spectrum. No other system comes close, even at five times the price. It takes this kind of broad range capability to reproduce the harmonics that are present in the original sound. The result is a richness and roundness of sound such as you never heard before.

2. EXTREMELY LOW DISTORTION LEVELS

MAXIMUS 7 delivers its full range of sound at less than 3/4% distortion from

50 cps to 35,000 cps; less than 3% at 30 cps, and provides superior performance even down to 20 cps. What other speaker system can make that statement?

3. ASTOUNDING POWER HANDLING ABILITY

A speaker system's true function is to reproduce sound faithfully without injecting its own personality. Frequently, a sudden clash of cymbals, a roll of kettle drums, and a speaker system loses its control, injecting extra, undesirable sounds of its own. Not so with the MAXIMUS 7. Its 9½ lb. ceramic magnet structure is among the most powerful ever used in a speaker system. It completely controls the magnetic field, which controls the sound output. This power handling ability is reflected in the rich, pure, luxurious sound of the MAXIMUS 7.

4. ADJUSTABLE ACOUSTIC CONTROLS

MAXIMUS 7 features two continuously variable KONToured ACOUSTIC controls, one for mid-ranges, one for treble. Both controls are located on the front panel, accessible in a moment. With them, you can adjust the sound precisely to your own individual taste.

You get perfect personal control of the sound you want to hear.



5. (CAPS®) CUSHIONED AIR PNEUMATIC SUSPENSION

MAXIMUS 7 features a heavy duty 12" pneumatic suspension woofer, based on the famous CAPS principle, an exclusive development of UTC Sound. In addition, it incorporates two shielded, back-loaded, bi-polar, mid-treble wide dispersion lens radiators and a dome lens compression type multi-cellular ultra-high treble horn. The resulting sound quality is simply superb.

6. SNAP-OFF DECORATOR GRILLE

MAXIMUS 7 provides the convenience of a distinctive, decorator-styled front grille that complements any style of decor. Snap off the grille instantly for easy access to front panel controls. Replace grille cloth with fabric of your choice. Cabinet is fully finished on all six sides in exquisite oiled walnut. Here is unquestionably the most distinguished of speaker systems, in an elegant, compact, book-shelf enclosure. Test it yourself very soon, at your favorite audio dealer. MAXIMUS 7 — designed for those who demand nothing less than the Finest.

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ABOUT MUSIC

Harold Lawrence

WHO'S IN CHARGE?

Attempting to stir up controversy and attract a large audience, the National Academy of Recording Arts and Sciences (NARAS) held a panel discussion early this year on the subject of engineers and producers. The title "Who's in Charge?" implied that recording sessions often turned into struggles for power between the two groups. The expected sparks did not fly. Instead, there was talk of teamwork and mutual understanding, and the panel members found more areas of agreement than of conflict. "Some engineers" and "some producers" came under attack, but the criticism never reached the level of Bob Mersey's remark about "those other engineers; you've got to yell at them and hit them over the head before you get what you want." Everyone agreed that the A & R (artists and repertoire) producer should be in charge of the session, just as the film director is in charge of shooting. The evening ended, as it began, on a C-major chord, proving mainly that the people on the dais enjoyed good working relationships with their colleagues and with the artists.

The question of authority in the recording studio seldom arises openly; power has a way of finding its own level. But the artist-producer-engineer team is not always as smooth-working as an outsider might believe.

Ideally, the A & R man should be able to convey to the engineer precisely what he wants in terms of balance, presence, blend, degree of room sound, and so on. The engineer, for his part, must be able to translate these instructions into sonic reality wherever possible, which often can mean saying, "No, you can't do this; you'll lose presence," or "you'll throw off the balance."

Today's producers generally are more sophisticated than their pre-LP counterparts in recording techniques and sound reproduction. They can speak to engineers in the jargon of electronics, but engineers, like doctors who are advised by their patients on how to perform an operation, resent this. They would rather have the producer ask for "a warm, round, full-bodied sound in the trombones," than to be told to switch microphones, roll up a gobo, filter at so many Hz, and change the angle of the pickup. To over-explicit instructions, they may reply: "Sure, anything you say. You want it this way? Here it is!" Unless the A & R man is on

firm technical ground, he may be headed for trouble. Other engineers might react in a manner calculated to unnerve the producer: "Well, all right, if that's what you want, but . . ." voice trailing away as the next take begins.

The opposite of the I-don't-care engineer is the engineer with strong opinions, the would-be producer: a valued partner when his ideas coincide with those of the producer, a fierce antagonist when they don't. Such an engineer, usually a musician-turned-technician who often produces sessions on his own, finds it painful to follow the instructions of a producer whom he believes to be less qualified than he: "I've been engineering sessions for more than a quarter of a century," said one engineer, "and some 23-year-old kid will try to tell me how to record. Harumpf!"

Experienced producers, on the other hand, complain about the routine engineers who are slaves to the VU meter and cringe when the needle goes into the red. A first-class engineer, they claim, uses his eyes *and* ears when he operates the board. He knows that the VU meter can be a not-to-gay deceiver, especially in recording the harpsichord, for example, when the ear level frequently is higher than the excursions of the needle would seem to indicate.

Monitor levels often are a source of disagreement between engineer and producer. Decibelic level to many engineers is like drugs: the more they learn to absorb, the more they require for "kicks." Some producers maintain that the end result of volume addiction is loss of balance and perspective. Others go so far as to imply that the engineer works off his aggression against the producer by drowning out his comments. Listening to playbacks in certain New York studios is like sitting in the front row of a Cinerama theatre. Woody Herman put it this way: "I still let the engineers play back the tapes at such a loud volume that I grow music-punchy. Then when I hear the final record it always sounds entirely different. I guess I'll never learn."

When producers and engineers agree on sound, chances are the artist won't. At the first British Decca sessions in the Concertgebouw, it was decided to record the orchestra in its normal position on the stage. The results were poor: "muddled sound . . . nothing worth keeping," reported the engineer. During a break, the engineers and producers found that the seats in the famous hall could be taken up

(Continued on page 58)

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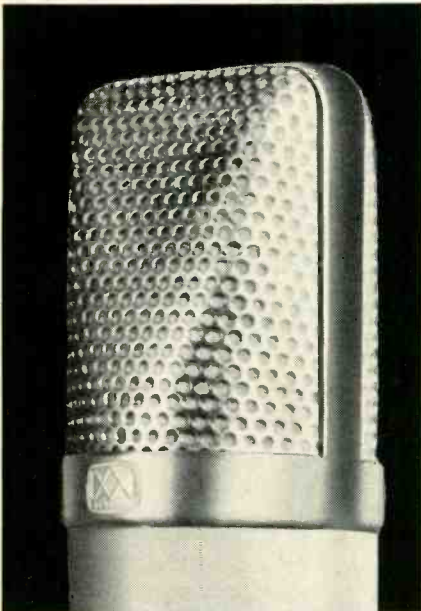
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AUDIO ETC.

Edward Tatnall Canby



THE PLAYABLE PAGE

It's been many a long year since first a "light went on" in some teeming brain among those who work with disc records and an idea sprouted—*why not a plastic record bound like a page into a magazine, or a book, or folded into an envelope like a letter?* That light still keeps going on, periodically. And going off again.

What a splendid idea, at least in theory! Imagine it—what stupendous possibilities! Combining the audible message of the phonograph and the visible message of the printed page, joining two great communications media into one—the old and honorable printed sheet, straight out of the Gutenberg Bible (movable type) many centuries ago, and the new, if not quite so honorable printed disc, not yet three-quarters of a century old. Inspiring thought!

With all the marvelous advantages of modern plastics and bonding, with laminations of paper and impritable vinyls, etcetc, and with Yankee Ingenuity galore and bright-idea men all over the place, the proposition must have seemed fraught with enormous significance. Not to mention advertising potentiality. Just think. Not only magazine pages. You could produce "paper" sample discs, mailable post-card recordings, folding records that would go into an envelope, audible-visible "brochures," catalogues, flyers—Phew! All sorts of lovely possibilities for the inventive mind.

You could even combine visual and audible messages on one and the same "page" or disc, printed with words and pictures, even in full color, upon which you could superimpose your spiral sound track. Wow! Terrific.

Well, all that, as I say, was a long time back. Even before LP and maybe much earlier, for all I know. (Were there flexible celluloid discs back in the twenties and 'teens? Could be. Nitrocellulose, guaranteed to burn fiercely at the slightest excuse!) The idea really took off, however, with modern plastics, after the war and in the late-78 days.

I recall that my friend Albert Grundy, now, of International Electroacoustics (importing microphones and other items for the professional trade) was involved in such a deal at the beginning of his career, around 1947—on 78's, of course. A species of postcard ad message, if I remember rightly. He went on to bigger things. So have many other enthusiasts. But more seem to arise, just as fast as the old ones grow discouraged. It's an oddly undying art.

You'll remember the assorted small

magazines with records printed on their pages which have been tried out over the years. The prototype was from France (I forget its name for the moment), lurid, cheap-looking but evidently quite successful. Its much flossier American counterpart didn't get far off the ground before it died. (Don't remember its name either. *Sic transit gloria.*)

Nope, the theoretically inspiring conjunction of these two great media, audible and visible, hasn't produced the fireworks it ought to. Instead of major upheavals in all sorts of communication projects, both high and low, it has produced mainly a series of semi-duds.

Actually, when you look at the scene, you'll realize that books, magazines and records have got together much more successfully in other ways.

There is, first, the enormous expansion of the book-record "spectacular" album, either in the form of large, lavishly illustrated 13-inch-square books, with standard records in bound-in sleeves, or simply the popular boxed albums, with a big book and a batch of records both loose inside.

Then in another area altogether, there is the equally expansive joining-up of record sales and book sales in the same stores. If I remember well, Doubleday pioneered this idea in its bookstores; but it's now common everywhere in vast numbers of printed-medium sales outlets, not to mention drug stores (with paperbacks next to the records), five-and-dimes, hobby shops, hi-fi outlets and what have you. All of which completely ignores the plastic foldable, printable, insertable disc-page.

WON'T PLAY

Well, I think I know what's been the matter all this time., and still is mostly, with the flexible, insertable, etcetc. record. It doesn't work. It won't play. That's sort of basic, isn't it?

You put one of the darned things on your turntable—which is a double-head-ache when the grooves are pressed on a square page which in turn is a part of a book or magazine with other pages getting in the way. Then you put the stylus in the outside groove—if you can find it—and start the motor (being careful to deactivate all the assorted lift-ups and drop-downs that tend to louse things up); whereupon your magazine begins to turn wildly, knocking over ash trays and bric-a-brac all around in its swathe. Blasted nuisance, to begin with.

And even if the disc is a plain round one, the next thing that happens is—
(Continued on page 63)

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AUDIO • DECEMBER, 1965

Of the 3 automatic turntables priced at 99⁵⁰ only one offers all these features.

Look into it.



a. Hysteresis Motor. The 40H is the only automatic so equipped. Maintains accurate speed even with extreme voltage variations. Uses famous Papst motor, found in professional turntables and tape transports.

b. Dynamically Balanced Tone Arm. Tracks any cartridge at its recommended stylus force setting, as low as 1/2 gram. Calibrated rotating dial provides direct adjustment of stylus force. Cartridge head has interchangeable insert; permits interchanging cartridges without rewiring.

c. Dynamically Balanced Turntable.

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e. Time-Tested Mechanism. The same basic internal mechanism which gave the Miracord 10 and 10H their repu-

tation for trouble-free reliability. Assures smooth, quiet operation even with extended bass response.

The Miracord 40H operates at 4 speeds: 78, 45, 33 and 16 rpm, and handles 7, 10 or 12" records. It plays single records manually or automatically, and stacks of up to 10 in automatic sequence. It is a modern instrument for modern stereo systems.

See it at your hi-fi dealer, or write. Benjamin Electronic Sound Corp., 40 Smith St., Farmingdale, N.Y. 11736

The Miracord 40^{IV}

EDITOR'S REVIEW

IT IS A MORE-OR-LESS standard custom for the editorial page in the December issue of a magazine to be devoted to the developments of the year, the accomplishments of the magazine—oftimes colored by a lack of modesty—and an appraisal of the outlook for the coming year. Not wishing to deviate from the norm, we shall follow the pattern to some extent.

The year 1965 will undoubtedly be remembered as marking the *arrival* of transistorized high-fidelity equipment. Not that it wasn't around before, but only in the lines of relatively few manufacturers, and most were not completely solid-state throughout. But this year practically every manufacturer introduced fully transistorized receivers, as well as tuners and amplifiers. More and more tape recorders are now all-solid-state. Most of the few exceptions among the manufacturers have one or two pieces of equipment that are at least partially transistorized.

Don't get us wrong—we hold no briefs for or against transistorized components, nor do we have any strong feeling for or against tubes in the various units. Both tubes and transistors have their good qualities, and their failings. Either, in properly designed circuits, can perform wonders, and either can be an abomination in poorly designed ones.

The entire controversy between tubes and transistors sounds familiar to us. Ten to fifteen years ago we heard that same sort of controversy between the triode adherents and those who touted pentodes and tetrodes. Then, as now, a good amplifier *can* be made with triodes or with tetrodes or pentodes; today we must agree that a good amplifier can be solid-state just as well as vacuum-tubed. Not all transistorized equipment equals or excels vacuum-tube components—but that is not the fault of transistors. Ten years ago there were good triode amplifiers; there were good tetrode or pentode amplifiers; and there were poor ones in both categories. Today we still have some fine tube equipment, but we also have some equally fine solid-state components.

Nobody asked us, but we are going to volunteer a bit of advice. Much as we would like to encourage everyone to discard all of his present equipment and buy new stuff all around, we say this: don't change over to solid-state just for the sake of change. If something else is demonstrably better than your present equipment, by all means, get it. If you don't find something better than that which you are now using, don't change.

One common fallacy in this sort of advice giving is the attitude indicated by the following: don't buy transistorized equipment—it isn't perfected, and don't buy tube equipment because they might perfect solid-state any day.

A similar parallel exists in the automobile field. We all know that gas turbines are likely to be available in a few years, but we don't hold off buying an internal-combustion car in the meantime.

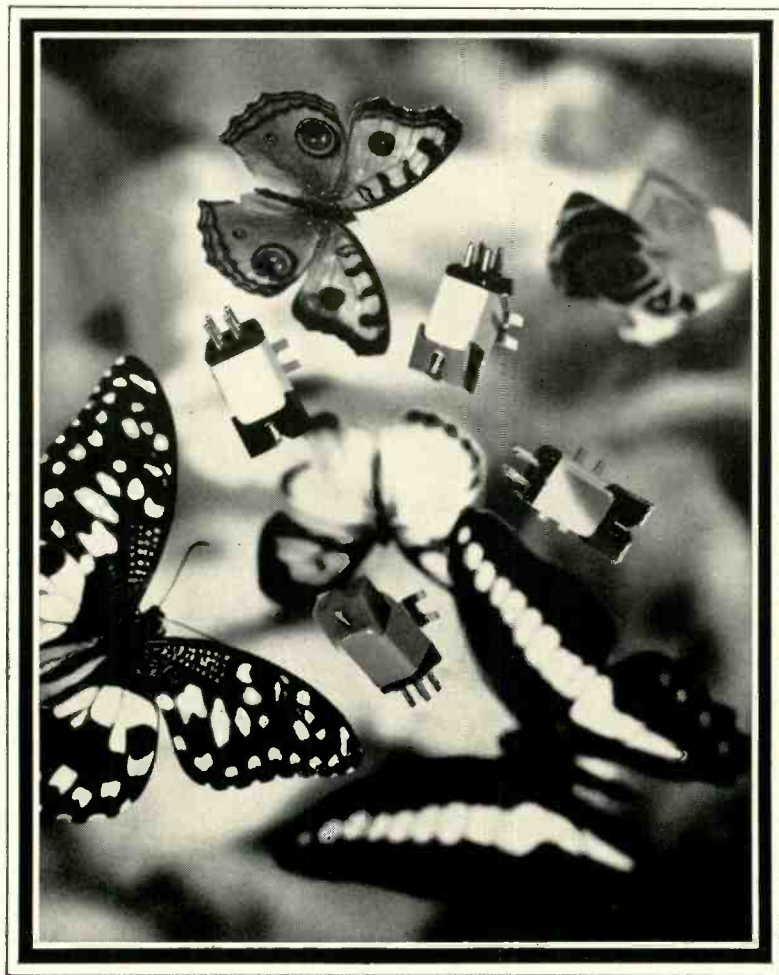
VIDEO IN THE HOME

The second big arrival in 1965 is the video home recorder. It's here—well, almost, anyhow. Some deliveries are being made, others are to be available early in 1966, and undoubtedly many more before 1966 is over. So far, the device struggles along with a long title—video tape recorder—when “visigraph” would be simpler, and in the same family as “phonograph.” If we don't get some better name than the long three-word one, we can just hear the person who now says, “Come and hear my hifi,” a year or so from now inviting you again with, “Come see my video.”

Whatever we will call it, it is still an exciting new toy for those of us who never tire of audio as a main hobby, and who almost universally indulge in photography as a second hobby. Now we can combine the two in a new one, visography. Here's hoping all of you find a VR in your Christmas stocking.

In a more serious vein, however,

**A Merry Christmas and a Happy New
Year from all of us to all of you.**



Capture natural sound with Pickering.

From the softest flutter of the woodwinds to the floor-shaking boom of the bass drum, natural sound begins with Pickering. Right where the stylus meets the groove.

Any of the new Pickering V-15 stereo cartridges will reproduce the groove, the whole groove and nothing but the groove. That's why a Pickering can't help sounding natural if the record and the rest of the equipment are of equally high quality.

To assure compatibility with your stereo equipment, there are four different Pickering V-15 pickups, each designed for a specific application. The new V-15AC-2 is for conventional record changers where high output and heavier tracking forces are required. The new V-15AT-2 is for lighter tracking in high-quality automatic turntables. The even more compliant V-15AM-1 is ideal for professional-type manual turntables. And the V-15AME-1 with elliptical stylus is the choice of the technical sophisticate who demands the last word in tracking ability.

No other pickup design is quite like the Pickering V-15. The cartridge weighs next to nothing (5 grams) in order to take full advantage of low-mass tone arm systems. Pickering's exclusive Floating Stylus and patented replaceable V-Guard stylus assembly protect both the record and the diamond. But the final payoff is in the sound. You will hear the difference.

PICKERING—for those who can hear the difference.

Pickering & Co., Plainview, L.I., N.Y.

Circle 117 on Reader Service Card

Compare these Sherwood features and specs! *ALL-SILICON* reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, front-panel stereo headphone jack, rocker-action switches for tape monitor, mono/stereo, noise filter, speaker disconnect and loudness contour. 100 watts music power (8 ohms) @ 0.3% harm distortion. IM distortion 0.1% @ 10 watts or less. Power bandwidth 12-35,000 cps. Phono sens. 1.8 mv. Hum and noise (phono) -70 db. FM sens. (IHF) 1.6 μ v for 30 db quieting. FM signal-to-noise: 70 db. Capture ratio: 2.4 db. Drift \pm 0.1%. 40 silicon transistors plus 14 silicon diodes and rectifiers. Size: 16½ x 4½ x 14 in. dp.

Model	Vacuum Tube S-ALL-SILICON T-Germanium Transistor	Power (IHF) 2 channels 8 ohms Watts	Max. IM Distortion Below 10 watts	FM Sensitivity Microvolts	Price	Dollars/ Watt
Sherwood S-8800	S	100	0.10%	1.6	\$ 359.50	\$ 3.60
Altec 711	S	100	0.15%	2.2	378.00	3.78
Bogen RT 8000	T	70 (40)	0.3%	2.5	319.95	4.57
Dyna FM-3, PAS-3, & S-70	V	90	0.1%	4.0	394.85	4.38
Fisher 600 T	V & T	120	1.6%*	1.8*	459.50	3.82
Harman-Kardon SR-900	T	75 (40)	0.9%*	3.3*	429.00	5.61
McIntosh MR71 & MA230	V & T	88	0.25%*	1.8*	748.00	8.50
Marantz 8B, 7, & 10B	V	75*	0.2%*	2.0	1170.00	15.60
Scott 348	V & T	100	0.5%	1.9	479.95	4.79

Reference "T" (above) may include some silicon transistors.
 Figures above are manufacturers' published specifications
 except (*) which are published test findings.

SHERWOOD SPECS SPEAK FOR THEMSELVES



S-8800 100-watt FM *ALL-SILICON* Receiver
 \$359.50 for custom mounting
 \$368.50 in walnut leatherette case
 \$387.50 in hand-rubbed walnut cabinet



Sherwood

Sherwood Electronic Laboratories, Inc., 4300 North California Avenue, Chicago, Illinois 60618 Write Dept. 12A

Circle 118 on Reader Service Card

Languages and the Language Laboratory

HAROLD D. WEILER

While primarily a development of World War II, the language laboratory is coming into more prominence in recent years because of its possible applications in many forms of instruction other than practical teaching of languages.

PRIOR TO WORLD WAR II anyone interested in learning a foreign language spent four to six years of plodding through courses primarily concerned with the written rather than the spoken forms. The first two or three years were usually spent learning *about* the language—grammar, pronunciation, and vocabulary. The acquired knowledge was blindly memorized and applied to written composition. The student thus relied on the printed forms of the language and was unable to deal with the spoken forms.

The goal of this old-fashioned and now almost obsolete method of teaching lay in reading and writing. It had as its ultimate aim the appreciation of history, literature, and culture. The interest in conversational command of the second language was practically non-existent. After completing this course the average student was incapable of using the language as a means of communication. Anyone interested in making use of the language for business, scientific, or social reasons did so later by living in an environment where it was in constant use, attending a school abroad, or living for a time with a family where only the desired language was spoken. This was the "traditional" method of "learning" a language.

Immediacy was war-born

From the beginning, World War II demanded instantaneous oral communication

with both our Allies and enemy prisoners. There was not time for the tedious graphic translation techniques then employed. Language specialists were urgently needed and quickly obtained. Just as quickly a shocking fact was discovered. Only a fractional number of these so-called language specialists could understand even the simplest sentences in the language they had "learned" and even fewer were able to carry on a rudimentary conversation. The inadequacy of traditional language teaching was forcibly driven home at a time when it was most needed.

Both the American and British governments were forced to institute crash programs of intensive foreign language training. Large numbers of students were taught to speak and understand foreign languages quickly by what came to be known as the Direct Method. This was not new, but very few schools had at the time used the "conversational approach."

The basic principle of the Direct Method lies in the fact that a language is learned more easily and quickly when the students' exposure to it is total. Any use of the English language was strictly forbidden during these crash courses; only the desired foreign language was employed for classes and *all* other purposes.

The Direct Method primarily stressed the foreign language as a means of oral communication. The student spent more time speaking and listening to the lan-

guage in a single day than he would have in an entire year with the old method, which usually provided three to four hours of classroom work per week, each student actually using the language for perhaps only about five minutes of this time, or a total of about four hours of practical use during a full year's course. The Direct Method, on the other hand, furnished almost four times this amount—about 16 hours *per day*. The results obtained with it were so amazing, particularly in the so-called difficult languages—Russian and Japanese—that many schools and universities adopted it after the war.

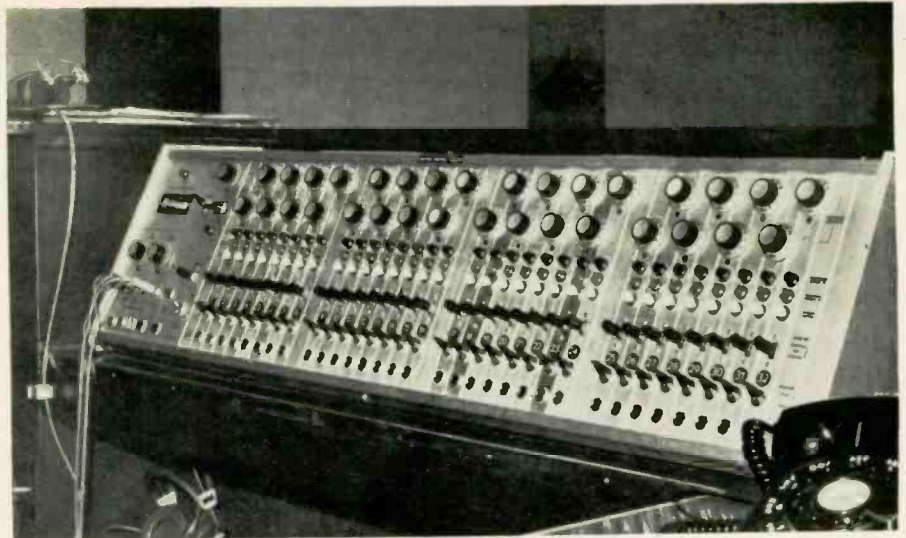
It was later discovered that while the new system was far superior to the old, it also had its disadvantages, primarily because of the manner in which it was employed. The emphasis placed on the oral forms was found detrimental to the graphic forms—reading and writing. A time factor was now also involved; it was found impossible to demand the sixteen hours a day for a period of nine months to a year from each student, as had been compulsory during the war. Compromises were required and adopted.

Young modern teachers who had become interested in foreign languages and language instructions through their exposure to the Direct Method during the war later acquired the graphic forms through the traditional method. The end result was a "new breed" of foreign language teachers who now were familiar with both traditional and direct methods of instruction and in a position to compare the advantages and disadvantages of each. It was they who first combined the best features of both, and in doing so made the sum of the individual parts greater than the whole.

It was also this group of language instructors who first realized that the practical limitations on student time demanded more efficient use of the time that was available. Another war-born device came to their aid—the tape recorder. No innovation since the invention of printing has had such an impact upon teaching and learning. Here was a device which could record and reproduce the human voice instantaneously and with perfect fidelity and thus bring the foreign speaker into the classroom for the first time. The rhythm, pitch, and intonation of the foreign tongue could be reproduced exactly and tirelessly without modification whenever required, an impossible feat for the human voice.



Fig. 1. One of the three language laboratories at The George Washington University showing the isolation of the individual students.



(Left), Bank of three Tandberg tape recorders employed as the master program source and (Right), Master console at The George Washington University showing the instructor's control panel at the left and the thirty-two individual student control strips.

A new teaching technique was developed around the tape recorder. It was quickly discovered that the tape recorder's efficiency also compensated for the necessary reduction of the number of hours required with the direct method; thus was the language laboratory born!

Despite the efforts of these early pioneers, the study of foreign languages was on the decline in the post-war period in the United States. This was strange, particularly since there was an urgent demand for men and women speaking a foreign language.

It was not only in the field of languages that the United States had failed to progress with the rest of the world, but in the natural sciences and mathematics as well.

Then something occurred which startled the entire world and created considerable concern in government circles. This was the launching of Sputnik in the fall of 1957 by the Russians. The fact that this event was so unexpected was in itself a sad reflection of the ignorance of our scientists about the activities of their Russian colleagues, and revealed their inability to read scientific abstracts in Russian. Had

our scientists been able to do so they could have learned of Sputnik *five months earlier!* It was a classic example of how our national safety is imperiled by the lack of personnel trained in foreign languages. An immediate solution was required and forthcoming.

Education Boosted by Law

In 1958, Congress passed the National Defense Education Act which, in essence, declared that mathematics, natural sciences, and modern foreign languages were three areas in need of special support in the interests of national defense. Under the provisions of the act, federal funds become available to state education agencies, on a matching basis, for strengthening instructions in these three subjects. These funds are still available today for these purposes.

This act completely changed the teaching of foreign languages by prescribing a set of reforms. The use of "new teaching methods and instructional material" was particularly stressed. The act went further, the beginnings of language study were to be oral and aural. The pupils should first understand and speak—reading, writing

could follow later. This was a logical method for a number of reasons: First, this was the order which would most benefit the security of the United States. Second, it was the order in which the use of the language would be employed in science, industry, and business. Third, it had been discovered by the early experimenters that an oral working knowledge of a language greatly increased the students' ability to absorb the graphic forms.

One of the most beneficial results of the National Defense Education Act was that it made possible the installation of language laboratories in many schools and universities throughout the country. To provide our reader with some idea of how a language laboratory operates, we visited The George Washington University in Washington, D.C. This school has three laboratories operating under the supervision of William Ausman. Their laboratories are used 8 to 9 hours each day and handle some 1800 students per week. Russian, Chinese (both Cantonese and Mandarin), French, Spanish, and Italian are taught.

A language laboratory is a classroom which, instead of desks, contains individual sound-proof booths for thirty or more stu-



(Left), The control panel and master program source of the original language laboratory at The George Washington University which was one of the earliest in the country. (Right), One of the student booths employed in the original installation.

Tape Duplication at Ampex

Making high-quality recorded tapes commercially isn't as simple as dubbing a record at home. One of the industry's leading practitioners in this art tells how his company does it. But don't expect to do likewise—like us, you probably do not have a 120-ips machine, nor even a 60 or a 30.

ED ZDOBINSKI*

IN A SENSE, recorded-tape duplication begins when the first master tape is cut in the recording studio. This original recording is the closest link between subsequent duplications—both disc and tape—and the live recording session.

In making disc recordings, an electrical transcription is first produced from the master tape. The electrical transcription is then used to produce the recorded discs. At this point, if the particular selection is chosen by Ampex for tape duplication, the master tape is loaned to Ampex's recorded-tape production center in Hackensack, New Jersey.

Ampex's tape facility is the largest producer of recorded tapes in the world. Five tape-production lines, each consisting of a master recorder and ten slave recorders, are in operation two

shifts each day. Between 4000 and 6000 recorded tapes are turned out each day. Selections vary from educational language tapes to popular music to classical music.

Because of the recording company's need to preserve the original master tape, Ampex creates a second master using precise recording techniques and equipment. Making the second master from the original is probably the most critical phase of recorded-tape production. Original master tapes are monitored to establish side timings, duplication levels and necessary equalizations. Each original master is then copied on four-track master tape at 15 inches per second using the highest quality Ampex professional tape recording equipment.


Second Master Tape

The result is a second master tape as close to being identical with the original master as possible. From the second master, as many as 20,000 consumer duplicates must be made. The original

master is then returned to the appropriate recording company. Labels which Ampex records include Atlantic, Command, Warner Brothers, London, D.G.C., Kapp, Mercury, and Verve.

The highly precise recording techniques used in producing the second master tape are also used in making the duplicates. As in mastering, tape duplication demands the best in tape, tape recorders, and slaves. The master recorder runs at 120 ips. In producing 7½ ips tapes, slaves run at 60 ips; for 3¾ ips tapes, slaves run at 30 ips. Recording is constantly monitored during duplication and the final product is spot-checked.

From the duplicating area, tapes are transferred to the packaging area. Here, tapes are placed in boxes, labeled and vacuum-wrapped to prevent deterioration or contamination in shipment or storage.

Finally, Ampex recorded tapes are shipped to one of our regional distribution depots (Los Angeles, Elk Grove Village, Ill., and Hackensack, N.J.) 

*Ampex Engineering Manager—Tape Duplication



Left, mastering section, where duplicates are made of the original masters. These duplicates serve as the actual working masters from which as many as ten final "release" tapes are made. Below, one of five tape-mastering lines at the Ampex Stereo Tape production facility in Hackensack, N.J., where more than 3000 recorded tapes are produced daily. The second master is placed on the Ampex professional magnetic tape duplicator (left) which is electronically connected to 10 slave recorders which produce copies on blank tape.



New Tape Types

LARRY ZIDE

Everyone who uses a tape recorder uses raw tape at some time or other. With so many types of coatings, base material, and thickness, the recordists should become thoroughly familiar with all of their characteristics.

RAW TAPE IS THE LIFEblood of tape recording. That statement, on the surface, is so obvious that it would seem to need no restating, yet how many tape fans are truly aware of how vital a link in the overall picture raw tape actually is?

Tape manufacturers are offering an almost bewildering array of tape types—each designed (it says in the advertising) to best do a specific job. Well, some do, and some don't. Or, to be more accurate, some do their special job to the detriment of another parameter that may be important to you. Only that isn't mentioned in the ads.

Consider that tape is actually a three-part affair. There is the base material, the magnetic oxide coating and finally, the binder that holds oxide to base. Each of these basics is subject to wide technical variations in type or quality. And, it is these factors that determine the ultimate value of a specific tape for a specific need.

This is not an article to determine if one company is making a superior product. Our investigations indicate quite clearly that no manufacturer has a monopoly on superiority. At the same time, none of the manufacturers we have surveyed has come up with defective merchandise either. Any of the recognized brand names offer a product that is qualitatively acceptable. Further, we found that any of the manufacturers could be depended upon to hold a tight line of consistency from reel to reel of a particular tape type. No tape ran over 0.75 dB reel-to-reel variation. Some ran as little as 0.25 dB. So, from best to worst is no more than a discountable 0.5 dB.

Tape researchers are constantly striving to improve their product. That reel of standard Scotch III or Audio-tape is not the same stock that you may have bought a few years back. All of these companies have been quietly improving the basic product.

Regular readers of *AUDIO* have seen reports of tape recorders with legitimate 25,000 Hz response at 7½ inches per second. These figures are being achieved with *standard* tapes. The special extended high-end stocks have not

been used (more about them, presently). Such high-end response would not have been possible a few years ago. True, improved tape heads play an important part, but the simple fact is that tape, and not the machines, is the limiting factor in recording. Manufacturers are close, but they have not yet reached the theoretical limitations for any given tape speed.

So, sound quality is one tape factor. And what is involved in tape sound quality? Frequency response, noise level, distortion, and print-through. Each must be minimized to improve the qualities of the finished recording.

All of the recently released formulations are offering improved potential for high-frequency response. There seems to be no clear-cut superiority here that would tend to suggest that any one manufacturer has a better product on this score alone.

Noise level is something else again. This is one area where manufacturers have been busy. Increased noise suppression means better dynamic range and this is something demonstrable. Audio Devices, Scotch, Kodak, and Sony-Superscope are offering new "low-noise" tapes. Just what are these?

Audio Formula 15 and Scotch #201-202-203 exemplify these new tapes. Both offer about a 5-dB improvement over "standard" tapes when it comes to reduction of background noise. And both claim, and apparently succeed, in holding other tape parameters to equal or better values. But neither tape will provide superior performance to standard tapes without changes in recording practice. Full advantage of low-noise characteristics requires an increase in recording bias of about 20 per cent. Further, an increase in recording level of about 2 dB is called for.

The Sony-Superscope low-noise tape is just being introduced. At present we have no technical details on it. However, it is likely that it will require the same adjustments to achieve the same results.

Kodak does not market a specific low-noise tape. Their claim is that their standard formulation has certain low-noise characteristics, yet conforms more

closely to standard bias and level considerations. Our limited tests tend to confirm this.

These low-noise tapes offer other side benefits to the user of top-notch recording equipment. As side effects of their characteristics they allow lower distortion recording (sometimes significantly so). Used on unmodified machines they will perform no worse than standard tape and may show slight increase in dynamic range and high-end response.

Are they of value to the average recordist? That depends on your definition of average. Many home type machines they will perform no worse than standard tape and may show slight improvement. And a few will be able to achieve the full advantages that these new tapes offer. Certainly the professional will find increased dynamic range and reduced distortion of real value.

Is it really necessary to write again about print-through *vs.* tape thickness, time, and temperature? 1.5-mil thickness should always be used except, and only except, when greater time is the vital factor. And then, avoid oven-like storage.

Most modern tapes have print-through characteristics that are considerably better than those of the recent past. And most of the manufacturers offer low-print tapes for applications where this item is a specific problem. In addition to the companies already mentioned, Burgess and BASF offer formulations that minimize print-through of signal. Using these tapes does result in a slight loss of signal output too, but the print-through loss is greater than the gain loss thus improving the over-all ratio.

By the same token there have been several new high-output tapes introduced. These increase the output for a given signal all right, but they also increase the distortion. And, they may increase the print-through.

Tape Backing Material

Plastic and Mylar® have been around for a long time and really

(Continued on page 60)

*TM Registered, DuPont Co.

Tape Recorder Compendium

When Christmas rolls around, there is always the problem of what we are going to give somebody, or even ourselves. And since Christmas is a time when most of us buy something we can't afford any other time of the year—either—this may just be the month to purchase a, or another, tape recorder. This article gives you some pointers on choosing one, and then describes most of those considered acceptable by the serious audio buff.

ANY COMPILATION of facts regarding tape recorders is subject to the inevitable weaknesses (and strengths) of such projects. We have tried to be as accurate and complete as possible, but we are, after all, as human and fallible as anyone. Between editorial, typewriter, and typographer many an error can creep in. We can only hope that we have been successful in catching every one of them.

No attempt is made herein to list every machine that is being distributed. We have deliberately left out those blocks of manufacturers that do not offer equipment primarily to the components field. However, we have included non-component type machines when they are products of makers that do primarily service this market.

The layout is simple. All listings are alphabetical by manufacturer's name. Nothing original here. What is unique about this tabulation is that we have left out the usual specifications found in advertising copy for tape recorders. All machines today seem to have identical frequency response, flutter, wow, and distortion. In the few cases where a specification is truly unusual, it has been mentioned.

So, the paragraphs under each of the pictures contain relevant information on the operation and special characteristics of the machine in question. Thus, each paragraph provides the following information. In the interests of space economy and ready readability these paragraphs are filled only with the basic facts. Some interpretation is required and this too, is about to be explained.

1. Speeds—given in inches-per-second.

2. Record—tells what record facilities are available. Certain assumptions can safely be made from the listings. If a machine is shown as recording $\frac{1}{2}$ -track stereo it will not record $\frac{1}{4}$ -track stereo, unless this is specifically stated. However, a *stereo* recorder can be assumed to be also a *mono* recorder of whatever track facilities it has. So, a listing as a $\frac{1}{4}$ -track *stereo* recorder also means that it is a $\frac{1}{4}$ -track *mono* recorder.

3. Play—that which has been said about record applies equally to play. Add this fact, too. Any $\frac{1}{4}$ -track stereo play head will also play (and properly, too) recorded $\frac{1}{2}$ -track mono or stereo tapes.

4. Heads—If a recorder is listed as having *erase, record, play* heads (or more) it may safely be assumed that this three-head configuration means that the machine has monitoring-while-recording facility. Indication of a *record/play* head is indicative of a combined head and no playback-while-recording monitoring. In the case of reversing-type machines you must note the following. Six heads (*erase, record, play, play, record, erase*) are required to allow two-way *recording*. Most of these recorders are equipped with only four heads (*erase, record, play, play*); these can only *play back* in their reverse mode. They can, of course, record a two-way $\frac{1}{4}$ -track tape if the reels are mechanically turned over.

5. Motors—how many are required? This battle goes on among manufacturers, and will probably continue without resolution forever. Our feelings? Three-motor machines are definitely capable of more precise tape handling; however, this is expensive. A good, well-designed, one-motor machine with a drive motor of sufficient torque to handle all of its jobs can well outperform a three-motor job that has been severely price-compromised.

6. Type—here again *quality* may prove more important than theoretical type. The primary advantage to an hysteresis synchronous motor is speed accuracy independent of household current fluctuations. But, for most home-type tape recorders, *torque* capabilities are far more important. These figures are simply unavailable.

7. Maximum Reel—stands to reason that the larger the reel-size capability, the longer the potential recording time. So it would be logical to assume that a 10 $\frac{1}{2}$ -inch reel capability is most desirable. However, most of the large machines are not the best for the ultra-thin tapes because of the high holdback tensions required for large reels; thus a 10 $\frac{1}{2}$ -inch reel deck may have no greater time capacity than a 7-inch machine.

8. Indicators—again, controversy rages over which type—neon, magic eye, or meter—is best. Actually, given proper design, any of these types can provide equivalent value to the home recordist. The professional will require a VU meter with proper VU ballistics in order to match broadcast levels.

9. Features—here we list what the manufacturer (and we) feel are the salient special attributes of the machine. We have used several combinations of language to mean specific things. If the paragraph reads “microphone *and* hi-level inputs” it is so stated to mean there are mixing facilities between microphone and line inputs. If the conjunction *or* appears between the two input types there is no mixing facility.

Mention of carrying cases, speaker outputs, and speakers, will mean that this is not a deck model. However, if it has preamp outputs, it can be used in deck fashion. If no statement of complete facility is made, the unit under discussion is a basic deck-with-electronics. Headphone outputs will usually not accommodate the usual low-impedance earphones unless this is specifically stated in the listings.

10. Weight—If you plan to move about with a machine this can be an important category. Also, remember that high-torque motors and heavy-duty parts are heavy.

11. Price—these are advertised list or selling prices. Some may be discounted, others will not. The only advice is to shop as much for price as for quality. Remember that tape recorders are highly complex components. Something can be wrong with a new machine. Be as sure of the reliability of your dealer as of the price.



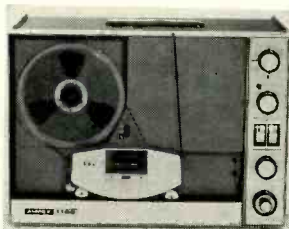
AMPEX 860

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: one, induction. Max. Reel: 7". Indicators: Dual meters. Features: Self-contained carrying case, dual microphone or hi-level inputs, dual headphone and speaker outputs, all solid-state design. Weight: 37 lbs. Price: \$289; model 850, deck with preamps only, \$269.



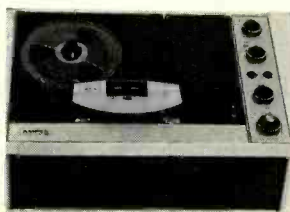
AMPEX 1070

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play, reverse play. Motors: One, Induction. Max. Reel: 7". Indicators: Dual neon. Features: Manual reverse play without turning reels, self-contained carrying case with dual speakers, dual microphone or hi-level inputs, dual headphone and external speaker outputs, tape-runout shutoff switch. Weight: 38 lbs. Price: \$399; model 1050, deck only with preamplifiers, \$349; model 1080, as 1050 except in walnut cabinet, \$369.



AMPEX 1160

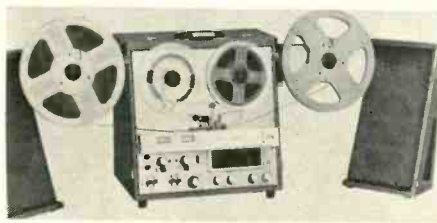
Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play, reverse play. Motors: One, induction. Max. Reel: 7". Indicators: dual meters. Features: Automatic loading of take up reel, manual reverse play without turning reels, self-contained carrying case, two microphone or hi-level inputs, two speaker outputs, dual preamp outputs, facility for slide synchronization, headphone outputs. Weight: 38 lbs. Price: \$449; model 1150 is deck only, has no power amplifiers, \$339.



AMPEX 2070

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase,

record/play, reverse play. Motors: One, hys. syn. Max. Reel: 7". Indicators: dual neon lights. Features: Automatic sub-sonic signal-keyed reverse play, self-contained carrying case with built-in speakers, automatic loading of take up reel, two microphone or hi-level inputs, dual preamp, dual headphone, dual speaker outputs, facility for slide synchronization. Weight: 39 lbs. Price \$499; 2050 model is deck only with preamps, \$439; 2080, same as 2050 except in walnut cabinet, \$469.



BELL RT 360

Speeds: 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: Three, induction. Max. Reel: 7" (with duplicating accessory, 10 $\frac{1}{2}$ "). Indicators: Dual meters. Features: Tape duplicating with accessory DK-1 add-on kit, two microphone and two hi-level inputs, dual speaker, stereo earphone, and dual preamp outputs sound-on-sound facility. Weight: 48 lbs. Price: \$369.95 with preamps only; \$449.50 complete with carrying case and speakers in split cover.



CIPHER I

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Neon bulb. Features: Microphone or hi-level inputs, self-contained carrying case with built-in speaker, earphone and external speaker outputs. Weight: 2 $\frac{1}{2}$ lbs. Price: \$139.95.



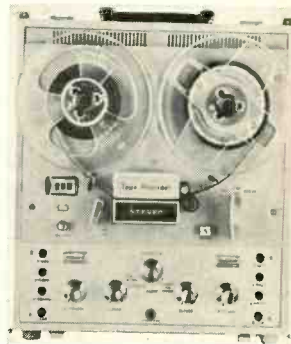
CIPHER II

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicator: meter. Features: All-transistor, self-contained carrying case with built-in speaker, microphone or hi-level inputs, earphone and external speaker outputs, pause control. Weight: 17 lbs. Price: \$128.95.

CIPHER VIII-T

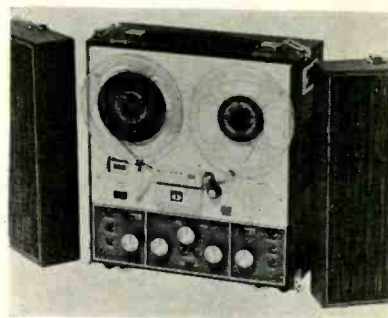
Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: dual meters. Features: All-transistor; dual microphone and hi-level inputs, self-contained carrying case with speakers in split-case cover; dual speaker,

preamp, and headphone outputs, sound-on-sound, sound-with-sound. Weight: 42 lbs. Price: \$350.00.



CIPHER VI

Speeds: 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One four-pole. Max. Reel 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in speakers in split-case cover, dual speaker and stereo earphone outputs. Weight: 38 lbs. Price: \$239.95.



CIPHER VII-T

Speeds: 1 $\frac{1}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: dual meters. Features: All-transistor; self-contained carrying case with speakers in split-case cover, dual microphone or hi-level inputs, dual speaker, earphone, and preamp outputs, automatic run-out shutoff, sound-on-sound. Weight: 40 lbs. Price: \$299.95.



CONCERTONE 805

Speeds: 3 $\frac{3}{4}$, 7 $\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Two erase, two record, two play. Motors: Three, four-pole. Max. Reel: 7". Indicators: dual meters. Features: Automatic reverse play and record, self-contained walnut enclosure, dual speakers in separate walnut bookshelf-type enclosures, sound-on-sound, sound-with-sound, dual microphone and hi-level inputs, dual speaker, preamp, and earphone outputs. Weight: 60 lbs. Price: \$599.95. Also available as model 806, a deck only. Price: \$499.95.



CONCERTONE 404

Speeds: 1 7/8, 7 1/2. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 5". Indicator: Meter. Features: All-transistor; battery operated, contains built-in 3x4 speaker, accepts microphone or hi-level input. Weight: 3 3/4 lbs. Price: \$179.95. Model 405 is identical with the addition of built-in AM radio. Price: \$197.95.



CONCORD 994

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Two erase, two record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Automatic reverse for both record and playback. Dual microphone and dual hi-level inputs, self-contained carrying case with built-in speakers in split-case cover, sound-on-sound, semi-automatic threading, dual preamp, speaker, and headphone outputs. Weight: 44 lbs. Price: \$449.95.



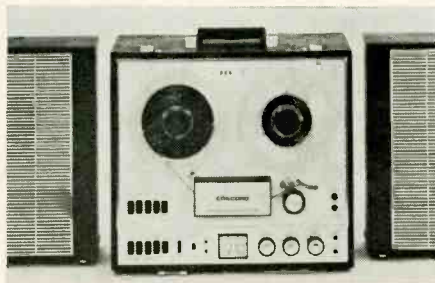
CONCORD 350

Speeds: 1 7/8, 3 3/4. Record: 1/4-track mono. Playback: 1/2-track mono. Heads: Erase, record/play. Motor: One, d.c. Max. Reel: 5". Indicator: Meter. Features: All-transistor; battery operation, power is from 6 "D" cells or a.c. adapter, remote-control microphone input, voice-actuated recording facility, automatic reverse external speaker output, special photographic features include speed adjustment manual control and slide synchronization. Weight: 10 pounds. Price: \$200.00. Also available as model 320 without slide synch. Price: \$129.95.



CONCORD 444

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: Three, two induction, one hys. syn. Max. Reel: 10 1/2". Indicators: Two 5" VU meters. Features: All-silicon-transistor design. Full plug-in facility to match broadcast-type lines and low impedance microphones, dual mike inputs and dual hi-level inputs, full solenoid operation, preamp and headphone outputs. Weight: 50 lbs. Price: \$995.00. Also available same price as model SS722 1/2-track stereo record and play. Model SS702 is full-track mono record and play. Weight: 46 lbs. Price: \$795.



CONCORD R-1100

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, two playback. Motors: Three, two induction, one hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; automatic reverse play (not record), remote start-stop option, electric push-button operation, dual microphone and dual hi-level inputs, self-contained carrying case with built-in speakers in split case cover, dual speaker, preamps and headphone outputs, sound-on-sound, echo. Weight: 38 lbs. Price: \$495.00. Also available as R-1000 deck only. Price: \$450.00.



CROWN SS824

Specifications and appearance is identical to the SS724. Special features include deluxe electronics, premium heads. This is the 1/4-track model. Weight: 55 lbs. Price: \$1295.00. Also available as SS822 a 1/2-track stereo unit and as SS801, a full-track mono machine. The SS822 is priced the same as the SS824. The SS801 is \$1080.



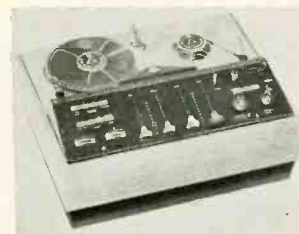
CONCORD 555

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in speakers in split-case lid, dual preamp and speaker outputs, sound-on-sound. Weight: 34 1/2 lbs. Price: \$249.95.



CONCORD R-2000

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, two playback. Motors: Three, two induction, one hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; automatic reverse play (not record); full remote-control operation option, electric push-button and solenoid control, dual microphone and hi-level inputs, self-contained carrying case, sound-on-sound, dual preamplifier outputs. Weight: 46 lbs. Price: (deck): \$795.00.



DYNACO BEOCORD 2000

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motor: One, hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone and hi-level inputs, gain control by low-noise sliders, remote-control facility option, sound-on-sound, echo, slide synchronization, dual preamp and headphone outputs. Weight: 38 lbs. (as wood console model). Price: \$498.00. Portable in self-contained case. Price: \$525.00.

Perfection results from CHOICE...NOT CHANCE

Since no single phono cartridge can be all things to all people, we earnestly recommend that you employ these individual criteria in selecting your personal cartridge from the broad Shure Stereo Dynetic group:

YOUR EAR: First and foremost, listen. There are subtle differences in tonality that beggar description and are quite unrelated to "bare" specifications—yet add immeasurably to your personal listening pleasure.

YOUR EQUIPMENT: Consider first your tone arm's range of

tracking forces. Too, keep in mind that the cartridge ordinarily represents the smallest monetary investment in the system, yet the ultimate sound delivered depends *first* on the signal reproduced by the cartridge . . . "skimping" here downgrades your entire system.

YOUR EXCHEQUER: Shure cartridges cover the entire economic spectrum. And they are ALL Shure in quality, all Shure in performance. Even the least costly has received copious critical acclaim.

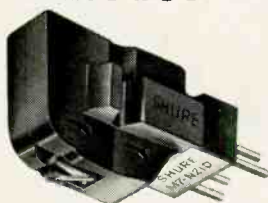
BEST SELLER



MODEL M3D

Where cost is the dominant factor, the M3D provides extremely musical and transparent sound at a rock-bottom price. The original, famous Shure Stereo Dynetic Cartridge . . . with almost universal application. Tracks at pressures as low as 3 grams, as high as 6 grams. For any changer. Only \$15.75

MUSICAL BEST-BUY



MODEL M7/N21D

Top-rated cartridge featuring the highly compliant N21D tubular stylus. Because of unusually clean mid-range (where most music really "happens") it is especially recommended if your present system sounds "muddy." For 2-gram optimum tracking (not to be used over 2½ grams). Only \$17.95 (Also, if you own an M3D or M7D, you can upgrade it for higher compliance, if tracking force does not exceed 2½ grams, with the N21D stylus for only \$12.50.)

ALL THE MOST WANTED FEATURES

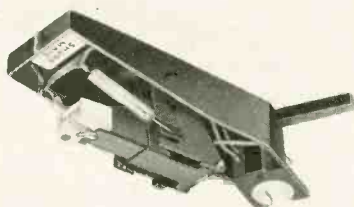


M55E

15° TRACKING, ELLIPTICAL STYLUS

Professional performance at a modest price. Compares favorably to the incomparable Shure V-15, except that it is produced under standard Shure quality control and manufacturing techniques. Remarkable freedom from IM, Harmonic and tracing distortion. Will definitely and audibly improve the sound of monaural as well as stereo records. A special value at \$35.50. Upgrade M44 cartridge (if you can track at 1½ grams or less) with N55E stylus, \$20.00

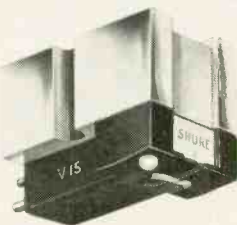
THE "FLOATING" CARTRIDGE



**M80E GARD-A-MATIC®
WITH ELLIPTICAL STYLUS**

Bounce-proof, scratch-proof performance for Garrard Lab 80 and Model A70 Series automatic turntables. Especially useful for applications where floor vibration is a problem. Spring-mounted in tone arm shell. Unique safety feature retracts stylus and cartridge when force exceeds 1½ grams . . . prevents scratching record and damaging stylus. \$38.00

THE ULTIMATE!

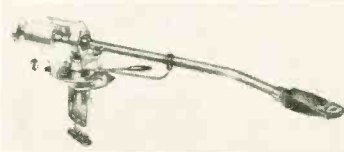


**V-15
WITH**

BI-RADIAL ELLIPTICAL STYLUS

For the purist who wants the very best, regardless of price. Reduces tracing (pinch effect), IM and Harmonic distortion to unprecedented lows. 15° tracking. Scratch-proof, too. Produced under famed Shure Master Quality Control Program . . . literally hand-made and individually tested. In a class by itself for mono as well as stereo discs. For manual or automatic turntables tracking at ¾ to 1½ grams. \$62.50

"THE BEST PICK-UP ARM IN THE WORLD"



SHURE SME

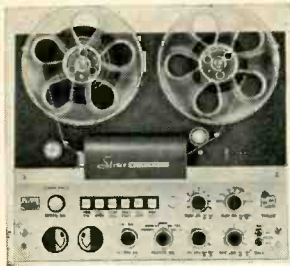
Provides features and quality unattainable in ANY other tone arm. Made by British craftsmen to singularly close tolerances and standards. Utterly accurate adjustments for every critical factor relating to perfect tracking . . . it realizes the *full* potential of the cartridge and record. Model 3012 for 16" records \$110.50; Model 3009 for 12" records \$100.50

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EICO RP100

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: Three, two induction, one synchronous. Max. Reel: 7". Indicators: Two meters. Features: All-transistor; full electric push-button operation, dual microphone and hi-level inputs, sound-on sound, dual preamp and headphone outputs. Weight: 48 lbs. Price: as a semi-kit, electronics only: \$299.95.



KORTING 2000

Speeds: 3 3/4, 7 1/2. Record: 1/4-track mono. Play: 1/4-track mono; adaptable to stereo with addition of external electronics. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicator: Magic eye. Features: Self-contained carrying case with built-in speaker, dual play head outputs, single microphone or hi-level input. Weight: 22 lbs. Price: \$199.95.



LAFAYETTE 1000B

Speeds: 1 1/2, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Enclosed in teakwood cabinet with built-in dual speakers and deflectors, dual microphone and hi-level inputs, sound-with-sound, dual speaker outputs. Weight: 43 1/2 lbs. Price: \$199.50.



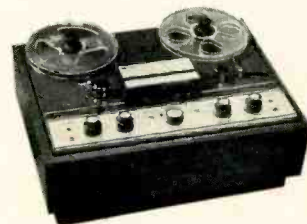
KNIGHT 4401

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, preamp outputs. Weight: 31 lbs. Price: \$169.95.



KORTING 4000

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual electric eyes. Features: Dual microphone and hi-level inputs, self-contained carrying case, sound-on-sound, sound-with-sound, echo, built-in speakers, tape head, speaker, preamp, and headphone outputs. Weight: 33 lbs. Price: \$399.95.



MAGNECORD 1020

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: Three, two four-pole, one hys. syn. Max. Reel: 8 1/2". Indicators: Dual VU meters. Features: Dual microphone and hi-level inputs, all-transistor; solenoid brakes, dual pair medium impedance output for headphones, dual preamp outputs. Weight: 35 lbs. Price: \$570. Optional walnut base; price: \$25.



KNIGHT-KIT KG-415

Speeds: 3 3/4, 7 1/2. Records 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: Two, induction. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor, kit consists of fully assembled transport and modular design kit electronics, sound-on-sound, echo, illuminated mode windows, dual microphone and hi-level inputs, dual preamp and low-impedance headphone outputs, has built-in 1000-Hz test oscillator. Weight: 30 lbs. Price: \$249.95.



LAFAYETTE RK-137A

Speeds: 3 3/4, 7 1/2. Record: 1/4-track mono. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: meter. Features: Microphone or hi-level input, self-contained carrying case with built-in speaker, stereo tape head, external speaker, and headphone outputs. Weight: 18 lbs. Price: \$89.50.



LAFAYETTE RK-675

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Single magic eye. Features: Self-contained carrying case with built-in dual speakers at either end, dual microphone and hi-level inputs, sound-on-sound, dual preamp, speaker, tape head, and headphone outputs, slide synchronization facility. Weight: 30 lbs. Price: \$299.95.

KORTING TR-3000



MAGNECORD 1021

Speeds: 7 1/2, 15. Record: Full-track mono. Play: Full-track mono. Heads: Erase, record, play. Motors: Three, two 8-pole induction, one hys. syn. Max. Reel: 8". Indicator: VU meter. Features: All-transistor; full plug-in type broadcast line and input matching, dual microphone and hi-level inputs, full solenoid mechanical operation, remote start-stop, provision for fourth head, earphone monitoring, balanced and unbalanced line outputs. Weight: Transport, 33 lbs, amplifier, 14 lbs. Standard rack mount. Price: \$708.00.



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Engineer Edward Wille depends on Rek-O-Kut turntables, as he has for over a decade to deliver the finest in recorded sound for his disc jockey shows. Hundreds of radio stations use Rek-O-Kut turntables. They operate with the same clock-like precision for many years. Owning a Rek-O-Kut is a long-term love affair.

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Three speed. Noise level: -59 db below average recording level. Wow and flutter: 0.085% RMS. Custom-built, heavy duty Hysteresis Synchronous motor for constant speed and "hush" performance. On-off signal indicator. Less tone arm and base.



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MAGNECORD 1024

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record, play. Motors: Three, two 8-pole induction, one hys. syn. Max. Reel: 8". Indicators: Dual VU meters. Features: All-transistor; dual microphone and hi-level inputs, full solenoid mechanical operation, remote start-up option, fourth play-head position (two-track stereo play head installed is \$25.00), standard rack mount, dual emitter follower and auxiliary emitter follower outputs, standard hi-fi type connectors. Weight: Transport, 33 lbs. amplifier, 14 lbs. Price: \$648.00. Half-track operation available. Also $7\frac{1}{2}$, 15 speeds.



NEWCOMB TX-10-4

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record, play. Motors: One, Hys. syn. Max. Reel: $10\frac{1}{2}$ ". Indicators: Dual meters. Features: Dual microphone and hi-level inputs, sound-on-sound, single lever motion control, dual preamp and headphone outputs. Weight: 36 $\frac{1}{2}$ lbs. Price: \$750.00. Model TX-10-215 $\frac{1}{2}$ -track stereo record and play with $7\frac{1}{2}$ -15 speeds; price: \$825.00.



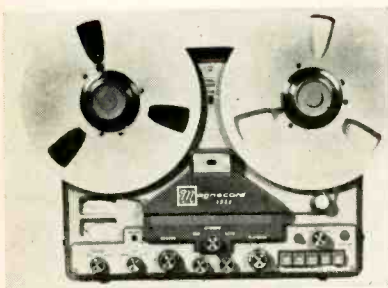
NORELCO 101

Speed $1\frac{1}{8}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 4". Indicator: Meter. Features: Battery operated portable, microphone or hi-level input, built-in speaker. Weight: 7 lbs. Price: \$99.50.



NORELCO 150 CARRYCORDER

Speed: $1\frac{1}{8}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: Special cartridge, 3000 ft. tape. Indicator: Meter. Features: All-transistor; battery operated portable, powered with 5 "D" cells or a.c. adapter, special Norelco tape cartridge—using $\frac{1}{8}$ " wide tape—must be used, remote control operation from microphone, microphone and hi-level inputs, built-in speaker. Weight: 3 lbs. Price: \$119.50.



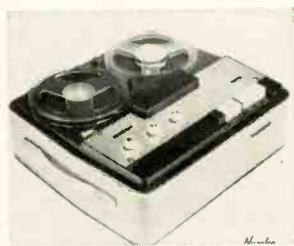
MAGNECORD 1028

Speeds: $7\frac{1}{2}$, 15. Record: $\frac{1}{2}$ -track stereo. Play: $\frac{1}{2}$ -track stereo, $\frac{1}{4}$ -track stereo play-head option addition. Heads: Erase, record, play. Motors: Three, two 8-pole induction, one hys. syn. Max. Reel: $10\frac{1}{2}$ ". Indicators: Dual VU meters. Features: Full professional broadcast capabilities and connections, standard rack mount, with adapter panel option, reel tension adjustment, dual microphone or hi-level inputs with plug-in transformer options for matching inputs or lines, full solenoid mechanical operation, fourth head position, dual low impedance balanced outputs. Weight: 47 lbs. Price: \$995.00. Carrying case price: \$19.00.



NORELCO 95

Speeds $3\frac{3}{4}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 5". Indicator: Magic eye. Features: Microphone or hi-level input, self-contained carrying case with built-in 4" speaker, preamp output. Weight: 12 lbs. Price: \$80.00.



NORELCO 201

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track mono. Play: $\frac{1}{4}$ -track stereo with auxiliary preamp and speaker otherwise $\frac{1}{4}$ -track mono only. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Magic eye. Features: Microphone or hi-level inputs, self-contained carrying case with built-in speaker, dual tape head, single speaker and headphone outputs. Weight: 18 lbs. Price: \$149.



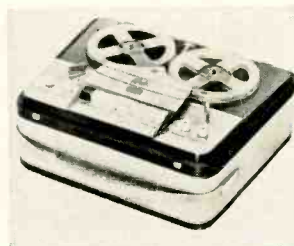
OKI 111

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{2}$ -track mono. Play: $\frac{1}{2}$ -track mono. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Meter. Features: All-transistor; microphone or hi-level inputs, self-contained carrying case with built-in speaker, speaker and preamp outputs. Weight: 14 lbs. Price: \$129.95.



NAGRA 111P

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$, 15. Record: Full-track mono. Play: Full-track mono. Heads: Erase, record, play, motion picture sync. Motor: One, d.c. Max. Reel 5". Indicators: Three meters for level and battery condition. Features: Battery operated (12 "D" cells) professional portable, 30-18,000 Hz. response at 15. Four low-impedance microphone inputs, monitor output, built-in facility for camera generator motion picture synchronization. Weight: 15 lbs. Price: \$1049.00.



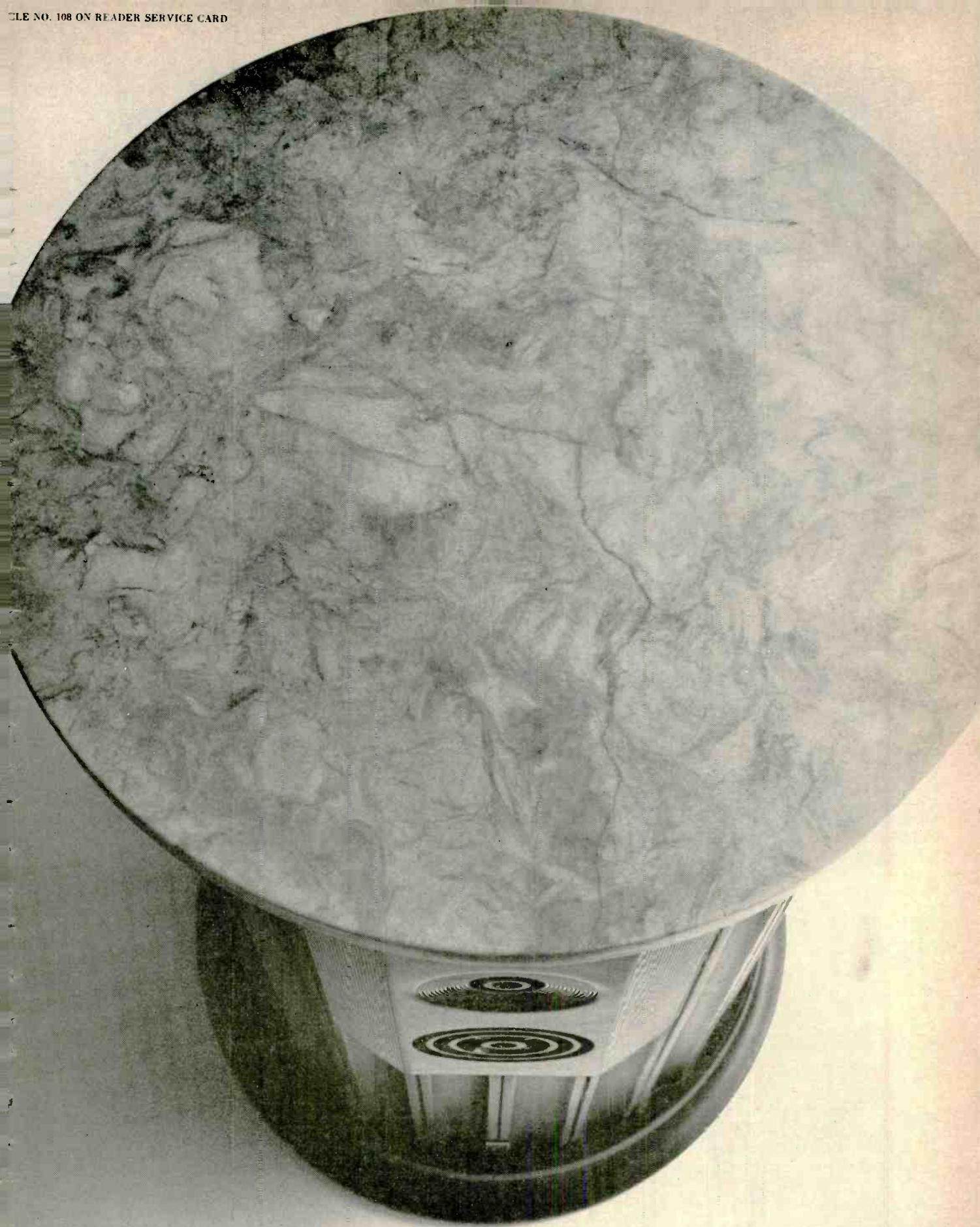
NORELCO 401

Speeds: 15/16, $1\frac{1}{8}$, $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicators: Meter. Features: Dual microphone or hi-level inputs, self-contained carrying case with speakers built-in—one in the unit—one in the cover, sound-on-sound, dual preamp and speaker outputs. Weight: 39 lbs. Price \$299.50.



OKI 222

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track mono. Play: $\frac{1}{4}$ -track stereo with external amplifier/speaker. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Meter. Features: All-transistor; microphone or hi-level inputs, self-contained carrying case with built-in speaker, sound-on-sound, sound-with-sound, dual preamp and tape-head outputs. Weight: 16 lbs. Price: \$179.95.



Irresistible from any angle.

The new Empire 8000P Grenadier speaker system is the most significant advance in stereophonic reproduction from no matter where you sit or stand. Empire's new Dynamic reflex stop system allows you to adjust the bass and treble response of your 8000P Grenadier speaker system to suit your individual room acoustics. **EMPIRE**



OKI 300

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: One, induction. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in speakers in split-case cover, sound-on-sound, sound-with-sound, dual speaker, preamplifier outputs. Weight: 16½ lbs. Price: \$219.95. Also available as model 800D deck only, price: \$159.95.



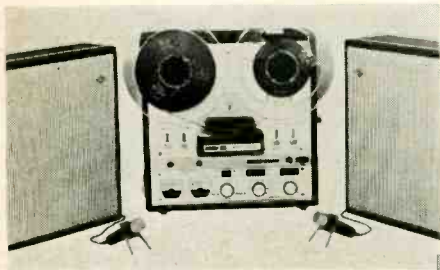
ROBERTS 1600

Speeds: 1½, 3¾, 7½. Record: ¼-track mono. Play: ¼-track mono. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Meter. Features: microphone or hi-level input, self-contained carrying case with built-in speaker, speaker output. Weight: 22 lbs. Price: \$169.95.



ROBERTS 770

Speeds: 15/16, 1¾, 3¾, 7½, 15 option. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record, play. Motors: One, hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: Cross-field head for increased high-end response at lower speeds, dual microphone or hi-level inputs, self-contained carrying case with built-in speakers, dual tape head, headphone, speaker and preamp outputs. Weight: 49 lbs. Price: \$449.95.



OKI 333

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with speakers as front and rear lid covers, sound-on-sound, sound-with-sound, dual preamp and speaker outputs. Weight: 22 lbs. Price: \$289.95.



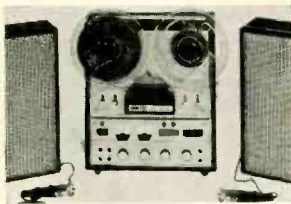
ROBERTS 1620

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Single meter. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in dual speakers, preamp outputs. Weight: 25 lbs. Price: \$199.95.



ROBERTS 4000-X

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play, reverse play. Motors: Three, two induction, one hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; cross-field head, dual microphone or hi-level inputs, self-contained carrying case with built-in dual speakers, sound-on-sound, sound-with-sound, dual preamp, speaker, and headphone outputs. Weight: 62 lbs. Price: \$699.95. Also available as a deck only, model 4000-D; price: \$599.95.



OKI 555

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with speakers built-in to removable lids, sound-on-sound, sound-with-sound, dual speaker, preamplifier outputs. Weight: 24½ lbs. Price: \$349.95.



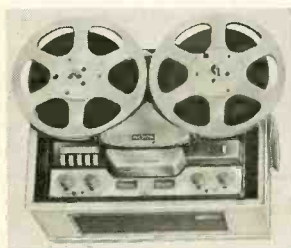
ROBERTS 1630W

Speeds: 1½, 3¾, 7½, 15 optional. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicator: Single meter. Features: Dual microphone or hi-level inputs, self-contained walnut enclosure (portable option) with built-in speakers, dual preamp, speaker and headphone outputs. Weight: 34 lbs. Price: \$249.95.



ROBERTS 5000

Speeds: 3¾, 7½, 15 option. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record, play. Motors: Three, two induction, one hys. syn. Max. Reel: 10½". Indicators: Dual meters. Features: Cross-field head, dual microphone and hi-level inputs, all transistor, self-contained carrying case with built-in dual speakers, sound-on-sound, dual preamp, speaker, and headphone outputs. Price: \$699.95.



REVOX G-35

Speeds: 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record, play. Motors: Three, two induction, one hys. syn. Max. Reel: 10½". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, built-in monitor amplifiers but no speakers, sound-on-sound, sound-with-sound, dual preamp and monitor outputs. Weight: 45 lbs. Price: \$500.00.

ROBERTS 1670

Speeds: 3¾, 7½, 15 option. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, induction. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in detachable wing speakers, sound-with-sound, dual preamp, speaker and headphone outputs. Weight: 33 lbs. Price: \$359.00. Also available as model 1650 without wing speakers (built into case); price: \$299.95.

ROBERTS 720

Speeds: 1½, 3¾, 7½. Record: ¼-track stereo. Play: ¼-track stereo. Heads: Erase, record/play. Motors: One, hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in speaker and headphone outputs. Weight: 34 lbs. Price: \$249.95.



Carry-Corder '150' shown 80% of actual size

Norelco® Cordless Tape Recorders



Norelco Carry-Corder® '150'

Tiny tape cartridge loads in seconds, records for an hour

Revolutionary tape recorder, features reusable snap-in cartridges, one button control to start, stop, wind-/re-wind tape. Separate volume controls for record and playback. Weighs only 3 lbs. with 5 flashlight batteries. 1 1/2 ips constant speed capstan drive. Has dynamic microphone with detachable remote switch. Superior sound quality with frequency response of 100 to 7000 cps. Connections for recording and playback directly with radio, phono, TV or another tape recorder. 7 3/4" x 4 1/2" x 2 1/4".

Prepacked in Deluxe Case with 4 cartridges (each in a dust proof container with index card), microphone, fitted carrying case, mike pouch, patchcord and tape mailer.



Norelco Continental '101'

100% transistorized for on the spot record/playback... up to 2 hours on a single reel. 2 track 1 1/2 ips constant speed machine weighs 8 lbs. with 6 flashlight batteries. Features dynamic microphone, tone control, record/level/battery condition indicator. Includes direct recording patch-cord. Frequency response 80 to 8000 cps. 11" x 3 3/4" x 8".

Norelco Continental Tape Recorders

Norelco Continental '401'

The recording studio in a suitcase

Fully self contained 4 track stereo record/playback. 4 speeds, 7½, 3¾, 1½, ¾ ips — up to 32 hours on a 7 inch reel. Has dual preamps, power amplifiers, stereo matched speakers. (2nd speaker in lid). Ganged stereo controls eliminate need for dual knobs and microphones. Special facilities include monitoring, mixing, sound on sound, portable P.A. Frequency response 50 to 18,000 cps; wow and flutter less than 0.14% at 7½ ips. Signal to noise ratio better than —48 db. Weighs 39 lbs. 18¼" x 15" x 10".



Norelco Continental '201'

New marvel of tape recording versatility

Multi-purpose 4 track tape recorder has every built-in feature for quality recording and playback; 2 speeds, 7½ or 3¾ ips provide up to 8 hours playing time on a single 7 inch reel. Fully self contained. Has dual preamps for stereo playback with external hi-fi system. Special facilities include parallel operation, mixing, pause control, tone control, portable P.A. Frequency response 60 to 16,000 cps. Weighs 18 lbs. 15¾" x 13¾" x 6¾"



Norelco Continental '95'

Quality engineered, budget priced tape recorder

Compact 3¾ ips speed machine provides up to 3 hours playing time. New automatic record control electronically sets correct recording volume. Make a perfect tape everytime. Has simple pushbuttons to record, playback, wind, rewind, tape pause and stop; adjustable controls for on/off, volume and tone. Frequency response 80 to 12,000 cps. Weighs 12 lbs. 14¼" x 10" x 5".



All specifications subject to change without notification.

Norelco Tape Recorder Accessories

FOR MODEL	DESCRIPTION	FOR MODEL	DESCRIPTION
'101'	DL 86 Leather Carrying Case	'95', '101', '150'	TP 86 Telephone Pickup Coil
'101'	CC 86 Texon Carrying Case	'150'	TC 2 x 30 Tape Cartridge
'101'	BE 86 AC Adapter	'201'	EL 3775/21 Monitoring Headset
'101'	RS 86 Remote Mike Switch	'201', '401'	EL 3984/15 Foot Control
'150'	BE 50 AC Adapter	'201', '401'	TP 34/49 Telephone Pickup Coil
'101', '150'	FP 86 Foot Pedal	'401'	EL 3775/37 Stereo Headset
'101', '150'	HP 86 EL 3775/85 Listening Headset	'401'	2A1048 Mike Adapter
'101', '150'	GTM 86 Close Talking Mike		

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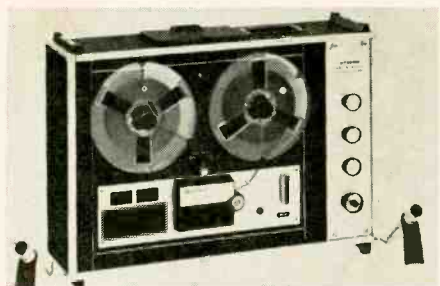
ROBERTS 6000-S

Speeds: 15/16, 1 1/8, 3 3/4, 7 1/2. Record 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 5". Indicators: Dual meters. Features: All-transistor battery portable utilizing 16-volt rechargeable battery or provided ac adapter, cross-field head, self-contained carrying case with built-in speaker, external speaker, headphone outputs. Weight: 11 lbs. Price: \$359.95. Also available as a mono recorder, model 6000-M; price: \$299.95.



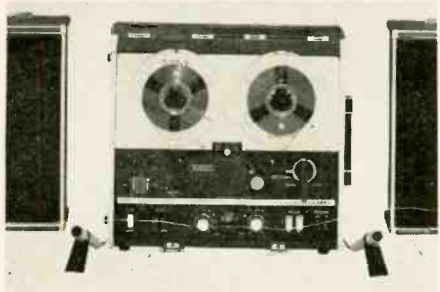
SONY 250A

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: dual meters. Features: Dual microphone or hi-level inputs, walnut base, dual preamp outputs. Weight: 16 lbs. Price: \$139.50.



SONY 260

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in speakers, dual speaker outputs. Weight: 32 lbs. Price: \$239.50.



SONY 500-A

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo.

Circle 121 on Reader Service Card

Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone and hi-level inputs, self-contained carrying case with built-in speakers in split-case cover, sound-on-sound, dual preamp, headphone, and speaker outputs. Weight: 56 lbs. Price: \$399.50.

SONY 102

Speeds: 3 3/4, 7 1/2. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motor: One, induction. Max. Reel 7". Indicator: Meter. Features: Microphone or hi-level input, self-contained carrying case with built-in speaker, preamp and speaker outputs. Weight: 13 lbs. Price: \$129.95.



SONY 660

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads Erase, record, play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Automatic reverse play, dual microphone or mag. phono and hi-level inputs, self-contained carrying case, with speakers in split cover sound-on-sound, dual preamps, speaker and headphone outputs. Weight: 44 lbs. Price: \$575.00.



SONY 777-S4

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: Three, two induction, one hys. syn. Max. Reel: 7". Indicators: Dual VU meters. Features: All-transistor; full solenoid mechanical and electronic operation, remote control option, dual microphone and hi-level inputs, self-contained carrying case, matching amplifier/speakers available, sound-on-sound, dual preamp and headphone outputs. Weight: 43 lbs. Price: \$695.00



SONY 800

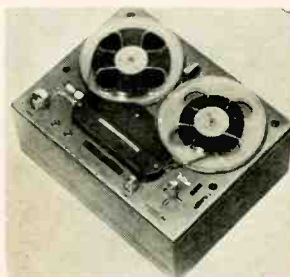
Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motors: One, d.c. Max Reel: 5". Indicator: Meter. Features: All-transistor; battery portable, four "D" batteries or a.c. automatic record level circuit (AVC), microphone input with remote control, built-

in speaker, headphone output. Weight: 13 lbs. Price: \$225.00.



SONY 900

Speeds: 1 7/8, 3 3/4. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 3 3/4". Indicator: None—has automatic volume control. Features: All-transistor; battery portable, a.c. adapter available, microphone with start-stop switch, tone control. Weight: 5 1/2 lbs. Price: \$67.50.



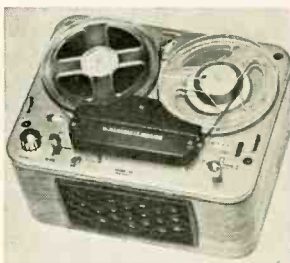
TANDBERG 64

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: One, hys. syn. Max. Reel: 7". Indicators: Dual magic eyes. Features: Dual microphone and hi-level (two pairs) inputs, sound-on-sound, sound-with-sound, echo, dual preamp outputs, teakwood base. Weight: 33 lbs. Price: \$498.00.



TANDBERG 74

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual magic eyes. Features: Dual microphone and hi-level (two pair), teakwood base with built-in speakers, sound-on-sound, dual preamp and speaker outputs. Weight: 33 lbs. Price: \$449.50.



TANDBERG 923F

Speeds: 1 7/8, 3 3/4, 7 1/2. Record: 1/2-track mono. Play: 1/2-track mono. Head: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicator: Magic eye. Features: Microphone and hi-level inputs, teak case with built-in speaker, remote control facility, speaker outputs. Weight: 22 lbs. Price: \$269.50. With foot pedal remote control, price: \$344.50.

Development of Pulse Modulated Audio Amplification

NORMAN H. CROWHURST
Four Parts—Part 4

In this concluding installment, the author delves into some of the vagaries of circuit performance, and offers a number of curative principles which may point the way to obtaining high-quality performance with exceptionally high efficiency.

THE INSTABILITY we ran into at the end of last month's installment was a surprise at first. We had assumed that, as it had shown instability with the extra stage which we had now removed, the same circuit with one stage less would be inherently stable. But when you analyze what can happen on a time basis, rather than with frequency and phase, you'll find that phase reversal does not necessarily ensure freedom from instability.

In this case, we need to consider what happens within the ultrasonic period, to understand how instability can build up. After the pulse has been initiated, nothing can change the discharge current from the multivibrator until the next half period initiates another pulse. But the current drawn by the output transistors can and does drop the supply voltage reaching the "top end" of the bias resistors, through the negative feedback transistor.

This goes on for a number of successive pulses, until the voltage is depleted to a point where no pulses start. Then the fact that voltage is rising

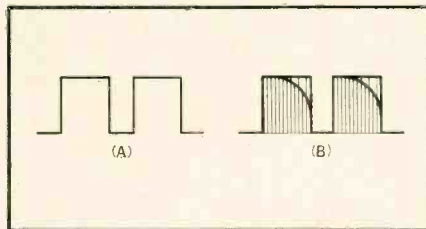


Fig. 4-2. The fault with the feedback arrangement of Fig. 4-1, at higher power levels: (A), the kind of pulse that should be delivered; (B), the kind that was.

means that the bias is always a little higher than the equivalent sawtooth that should produce a pulse, until the rate of rise slows enough to allow pulses to start, when the process repeats.

After this had been figured out, it seemed that one way to control it would be to combine a signal at the base of the negative feedback transistor that would produce a voltage drop to offset this voltage change, so the pulse feedback always has a chance to work. A

number of ways were tried to derive a voltage for this purpose and the final successful one derived the signal needed from the output transistors themselves.

Diodes separated the positive-going active pulse from the negative-going switch-off pulse (inductively produced due to leakage inductance, which is a part of the filtering) and used this to charge capacitor C negatively, using resistor R₁ to produce an integrating action, so the charge reached is proportional to the strength and duration of the positive-going pulse (Fig. 4-1).

At first two resistors were used, as well as two diodes, for charging C, but later it was found that only one resistor was necessary, because the diodes never conduct at the same time. The voltage built up on this capacitor was then fed through another resistor, R₂, to produce a component of base current for the feedback transistor that would control the basic voltage at the top of the bias resistors, before the negative feedback pulse acts to control the pulse itself.

For quiescent signal, this worked exactly according to plan. But when an audio signal was put in to start modulation, it was found that, whatever values were chosen for the pulse-operated negative feedback, the circuit went into oscillation for the duration of the pulse. Instead of one width-modulated pulse (beyond the amplitude-modulated range for low levels) a multiplicity of much higher frequency pulses was produced (Fig. 4-2), which naturally increased the dissipation of the output transistors, as well as of the drive transistors, defeating the purpose of the design.

The reason for this spurious multivibrator action proved to be the time difference between the signals received from the two points for feeding to the base of the feedback transistor. First received is the pulse from the collector of the drive stage, and then a lower-value, slower pulse comes from the output stage, which had the effect of mo-

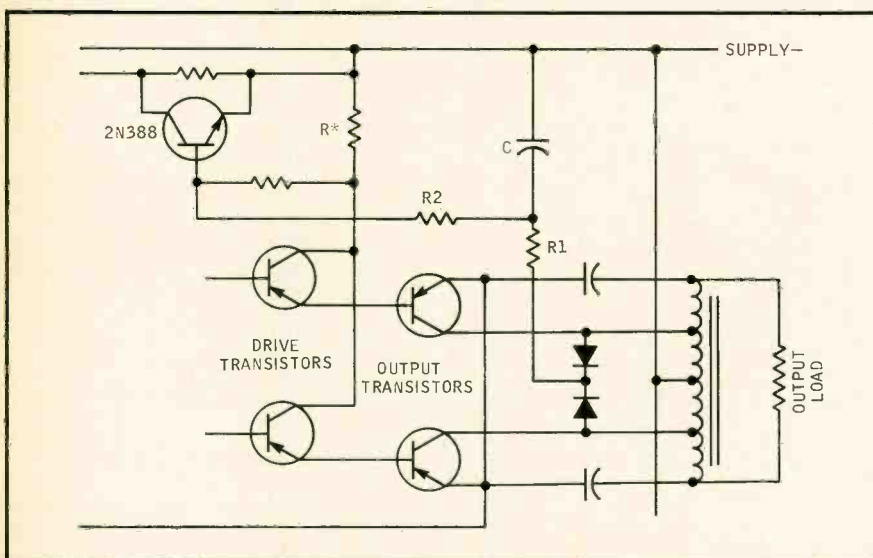
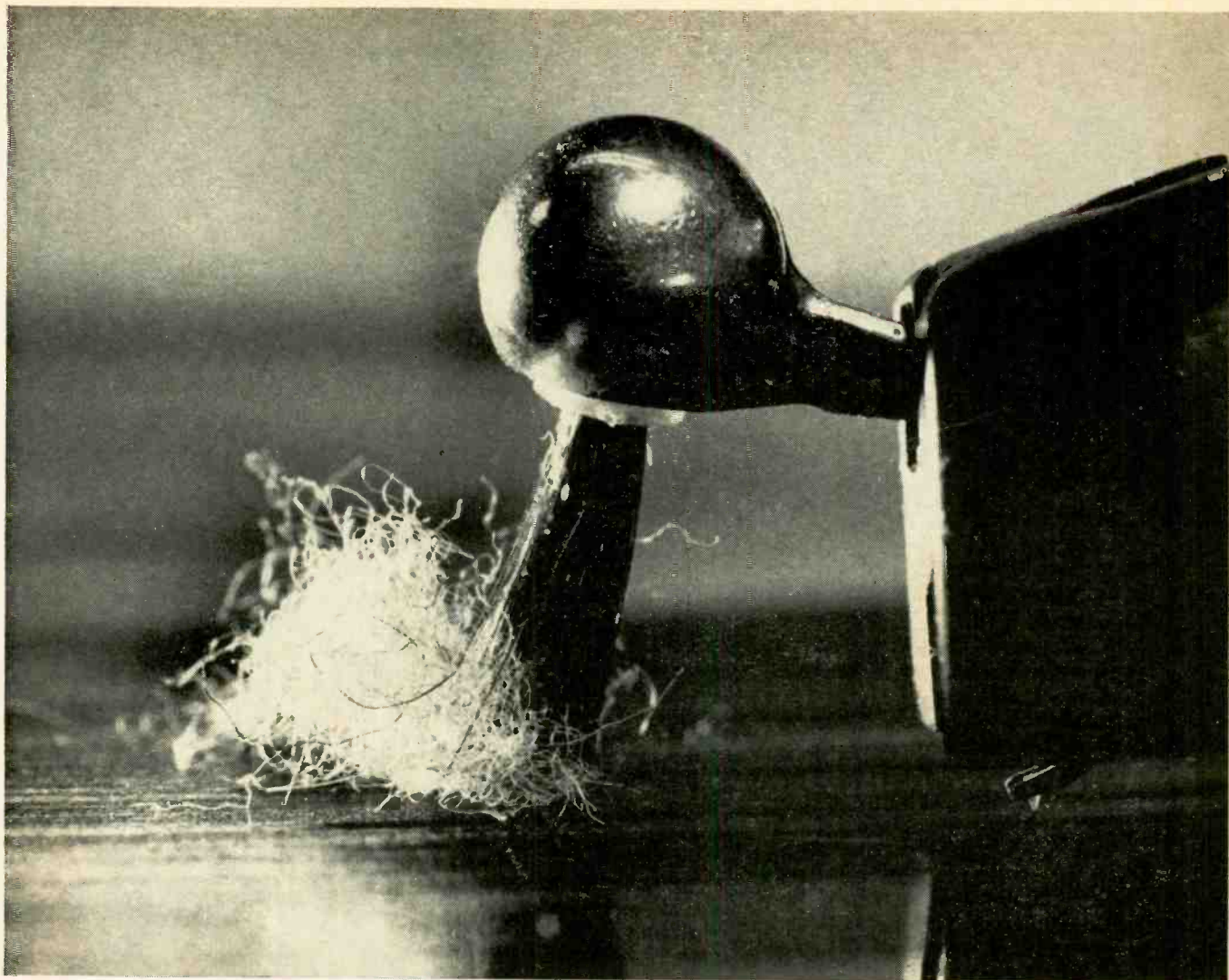


Fig. 4-1 Revised feedback to regain stability following the revision introduced at the end of the previous installment.



You are looking at the world's only true **longhair** cartridge.

In this unretouched photograph, the long, black hair of the brush built into the new Stanton 581 is shown in action on a rather dusty record. Note that all the loose lint, fuzz and dust are kept out of the groove and away from the stylus. That's why the Longhair is the ideal stereo cartridge for your Gesualdo madrigals and Frescobaldi toccatas. Its protective action is completely automatic, every time you play the record, without extra gadgets or accessories.

The stem of the brush is ingeniously hinged on an off-center pivot, so that, regardless of the stylus force, the bristles never exert a pressure greater than 1 gram and always stay the right number of grooves ahead of the stylus point. The bristles provide just the right amount

of resistance to skating, too.

But even without the brush, the Stanton 581 Longhair is today's most desirable stereo cartridge. Like its predecessors in the Stanton Calibration Standard series, it is built to the uniquely stringent tolerances of Stanton professional audio products. Its amazingly small size and light weight (only 5 grams!) make it possible to take full advantage of the new low-mass tone arms. And its frequency response is factory calibrated within 1 db from 20 to 10,000 cps and within 2 db from 10,000 to 20,000 cps. Available with 0.5-mil diamond (581AA) or elliptical diamond (581EL); price \$49.50.

For free literature, write to Stanton Magnetics, Inc., Plainview, L.I., N.Y.

Stanton

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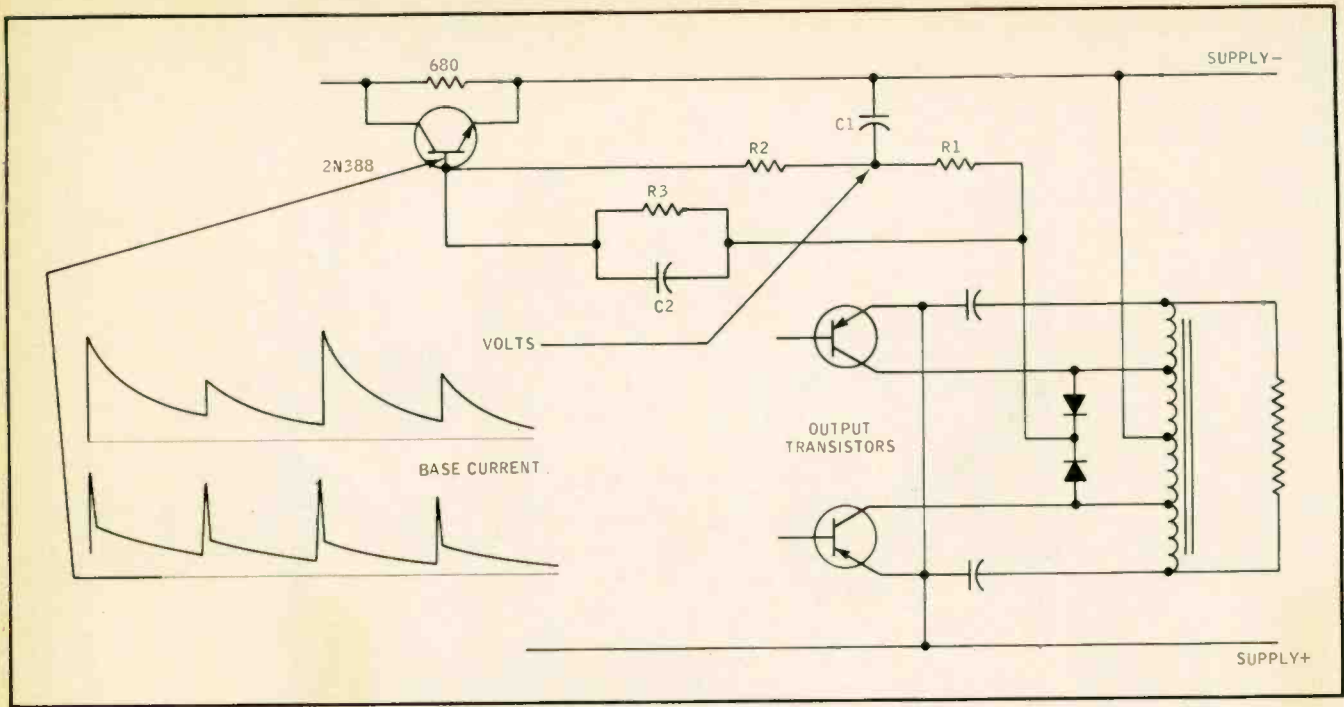


Fig. 4-3. The successful circuit for taking feedback from the output to control pulses.

mentarily knocking off the pulse before it was due to terminate. Having knocked it off, the reversed negative feedback from the drive stage would let it come back on again, and so on, until its proper time to terminate arrived.

The solution to this problem proved to be in taking the negative feedback for pulse control from the output stage as well. Now the voltage reaching the base of the negative-feedback transistor is just the result of a forming network from a single pulse take-off point. It can be explained as follows (Fig. 4-3).

Through R_1 , capacitor C_1 is charged by every pulse to a degree dependent on the magnitude of that pulse; this then discharges into the feedback transistor base via R_2 , producing a diminishing bias current, until the next pulse recharges C_1 through R_1 . Now, against this bias the actual pulse feedback goes through R_3 , C_2 to the same base.

When this was first tried, some irregularity of output circuit pulsing at quiescent was observed. Sometimes only one side of the output would be pulsed; sometimes one side would pulse all the time and the other side only every alternate pulse for that side; sometimes both sides would pulse only on alternate periods of the multivibrator.

Time Constant Choice

The remedy proved to be in careful correct choice of time constants in this network. The satisfactory ones proved to be: the pulse capacitor and its discharge resistor, 1 microsecond ($R_3 = 33 \text{ K}$ and $C_2 = 33 \text{ pf}$), allowing virtually complete recovery for the next

pulse; the charge resistor for integrating pulses from the diodes 1.5 microseconds ($R_1 = 15 \text{ K}$, $C_1 = 100 \text{ pf}$); while the discharge from the same capacitor is 47 microseconds ($R_2 = 470 \text{ K}$).

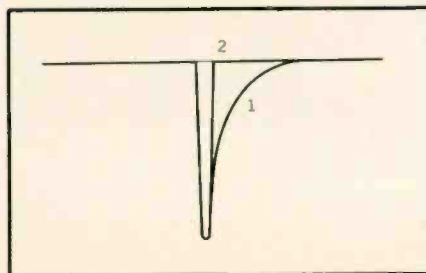


Fig. 4-4. Effect of adding a base to emitter resistor on the output stage: 1, pulse shape without resistor; 2, pulse shape with resistor.

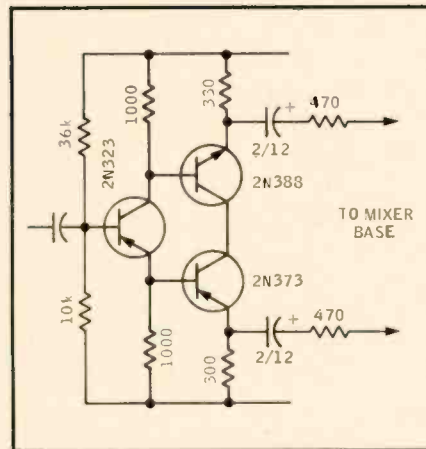


Fig. 4-5. Back-to-back emitter followers inserted between phase inverter and mixer stage, to make sure of adequate audio current drive.

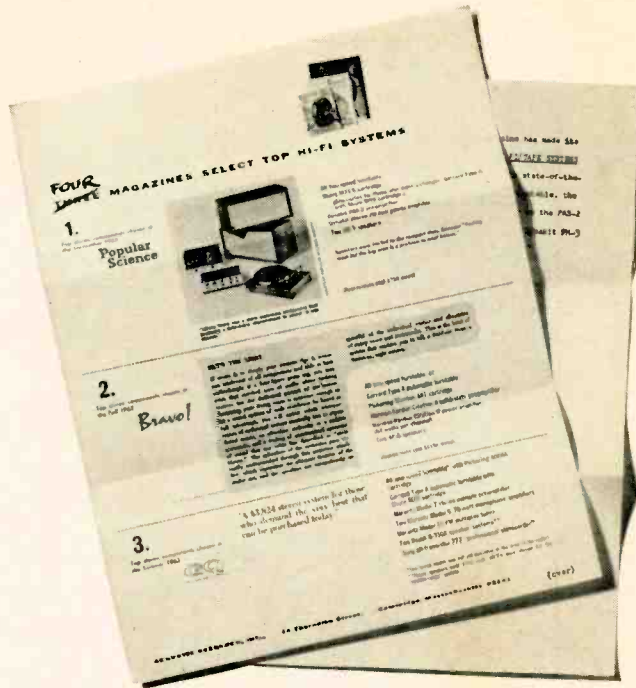
Then, with 60 kHz pulse frequency, the combined effect of these five elements results in a stable pulsing of the output transistors that is quite regular. With different output transistors, some of these time constants need changing to suit the different time constants inherent in the transistors. Also the collector resistor of the drive stage needs varying to suit the characteristics of the output transistor.

Some output transistors showed improved pulse sharpness in the quiescent region by using a bypass capacitor across the drive-stage collector resistor of about $0.01 \mu\text{f}$. A larger value would push too large a pulse through the drive-stage collector, as well as the output-stage base. However, not all output transistors tried benefited from using such a capacitor. Some give better pulses without it.

Transistors we tried in the circuit were Motorola 2N2832, Texas Instruments 2N1046 and RCA 2N1905 and 2N1906. All of them worked satisfactorily with minor circuit-value changes.

When an audio signal is introduced, the drop in the negative feedback transistor is reduced; as the audio signal returns toward zero, the time constant of C_1 , R_2 allows the level to rise again so that proper amplitude control is available by the time it is needed.

Most output transistors give a more satisfactory trailing edge to the pulse by using a base-to-emitter resistor (about 18 ohms). This value is many times the base input resistance and has virtually no effect on drive, except to terminate collector current more rapidly when base current ceases. Without



This is a survey (*available for the asking*) of the hi-fi equipment recommendations of four magazines.

These four lists of equipment choices, from stereo cartridge to speakers, were compiled independently by each of four national magazines — *Gentlemen's Quarterly*, a men's clothing magazine for the carriage trade; *Bravo!*, a concert program "wrapper" with a circulation of almost a million; *Popular Science*, the leading high-circulation science magazine; and *Hi-Fi/Tape Systems*, a hi-fi annual.

AR-3 speakers were the top choice of three of the four.

The fourth magazine, *Gentlemen's Quarterly*, chose speakers costing \$770 each for its most expensive stereo system; AR-3's were relegated to the "middle-range" (\$1,273) system.

The AR turntable was the top choice of all four.

The AR turntable is \$78 including arm, oiled walnut base, and transparent dust cover. The AR-3 is \$203 — \$225, depending on finish (other speaker models from \$51). AR's catalog is available on request.

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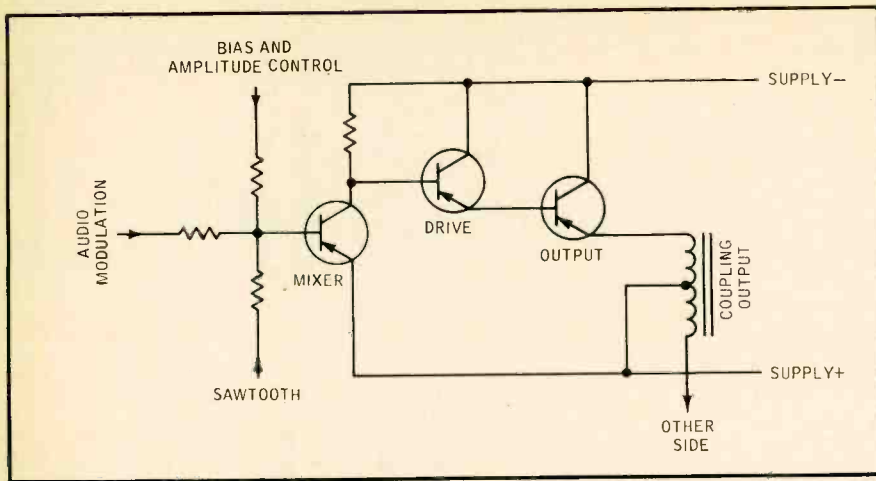


Fig. 4-6. Change in drive connections to permit follower—instead of collector—coupled output.

it, the collector current of some transistors' falls off quite slowly, or shows a skirt to the trailing edge (Fig. 4-4), while others just do not cut completely off, and leak indefinitely once they have been switched on.

With some types, some samples may work without the base-to-emitter resistor, but if they become heated they will cease to do so, and exhibit a "run-away" phenomenon. Other samples of the type may show a leak right from the start, without the base-to-emitter resistor. So it is a good safety precaution for all types, unless you use a circuit configuration that applies a reverse voltage at pulse termination, with output transistors for which this works better.

Circuit Variations

One thing made possible by changing the negative-feedback take-off point from drive collectors to output collectors was elimination of the extra diode-and-resistor combination between the mixer transistors and the drive-transistor bases. The simple resistor-capacitor parallel combination produces excellently shaped pulses at the output stage with this revision in pulse negative feedback arrangements.

With the direct coupling from phase-inverter to mixer transistors, obtaining sufficient drive to push the circuit to full output was a marginal possibility. Sometimes it would and sometimes it wouldn't. This deficiency was overcome by inserting a pair of back-to-back emitter followers (Fig. 4-5). Use of back-to-back enables each to use only half the supply voltage and to work at heavier current with reasonable dissipation, to give adequate audio drive.

This circuit has proven very stable and has been applied to a variety of applications, battery operated and a.c. powered, capable of delivering 50 watts into a 16-ohm load from a 12-volt supply unit. With higher voltage transistors,

capable of this speed of switching at these currents, much higher-power-output circuits are under development, approaching the maximum switching capacity of the transistors.

The same basic circuit can feed col-

lector-coupled output stages, as this one was, or emitter-coupled variations (Fig. 4-6). All these circuits used pnp type multivibrators giving a positive-going sawtooth as a starting point for generating the waveform. The npn type work equally well, with reversal of drive phasing.

One embodiment of such phase reversal, in this case based on pnp multivibrator and mixer, uses the npn type to drive the emitter-follower pair of a bridge (Fig. 4-7). In this circuit, four output transistors, rated at 50 volts, 10 amps, can deliver peak powers of 500 watts, which is an average power rating of 250 watts. This has the advantage that the natural output impedance is just correct for 70-volt line working without need for an output transformer, and the circuit is naturally balanced. All that is needed are relatively inexpensive filters to serve the dual purpose of removing residual switching frequency and protecting the switching characteristics of the output transistors.

(Continued on page 59)

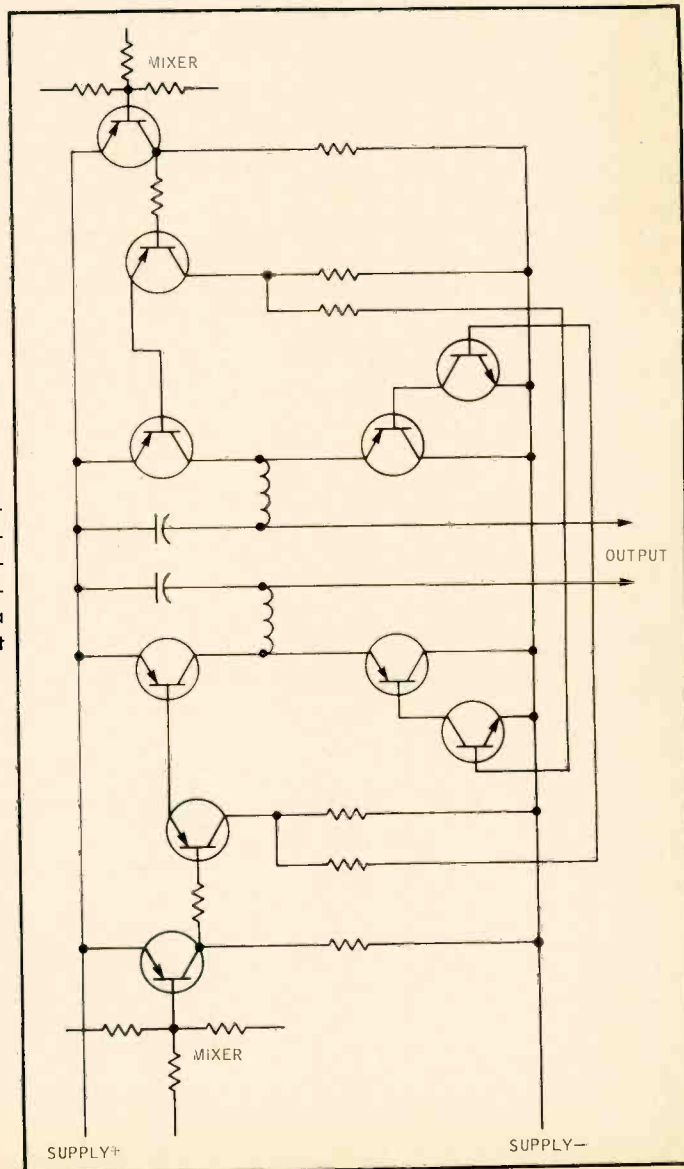


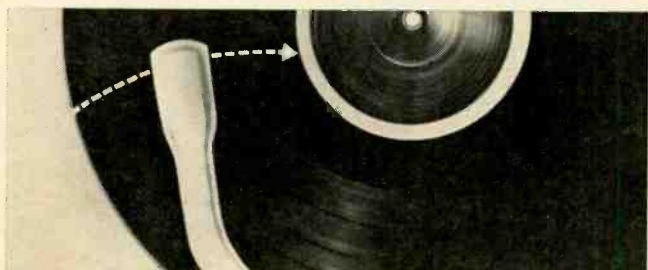
Fig. 4-7. A complete skeleton arrangement for delivering high power by means of a bridge of output transistors.

marantz

believes you should know the facts!

THE PROBLEM:

Achieving the total signal of a stereo recording.



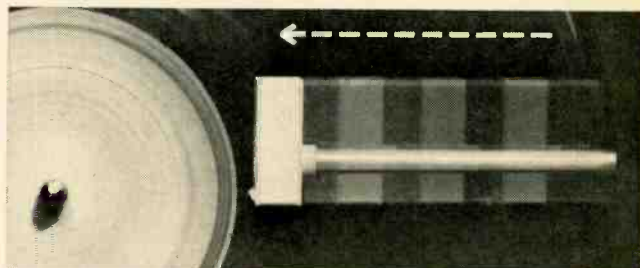
When the master disc is cut, the cutting head travels across the disc in a straight line. The grooves are cut proportionately to the volume of the sound; as the sound ebbs, the grooves narrow — as the sound swells, they broaden. Each side of the groove carries a separate track — one for each stereo channel. These grooves carry the total sound originally recorded.

To reproduce the original sound faithfully, the stylus must pick up the full track created by the cutting head on each side of the groove. In order to achieve this result the tone arm must travel the same straight line created by the recording cutting head.

During conventional tracking the tone arm moves in an arc across the surface of the record — completely opposed to the straight path created by the cutting head. Dynamically the stylus is drawn against the inner side of the groove and away from the outer. The result is a clear signal on the inner channel, distortion and loss of signal on the neglected outer channel. Consequently, conventional tracking can never faithfully reproduce the sound as it was originally recorded.

THE SOLUTION:

Straight Line Tracking by Marantz.



The Marantz SLT-12 tone arm tracks across the disc in a straight line following the path originally created by the cutting head. Thus the stylus, always tangent to the grooves, receives the full signal *incised on each side of the groove*. It is the only system available which *faithfully reproduces the sound that was originally recorded*.

The critical elements of the Marantz SLT-12 Turntable provide maximum precision and stability in support of the tone arm assembly. The free-floating stylus is always fully positioned in the groove by counter-balancing the tone arm assembly. A 12 lb. cast and dynamically balanced turntable rest upon a massive, precision-ground tungsten carbide thrust bearing to produce low friction, dimensional stability. Power is derived from a hysteresis-synchronous motor. The precision-ground uscothane drive belt is noted for its uniquely stable elasticity. Push-button controls have been installed for convenience, while the cueing device eliminates the necessity of ever touching the tone arm. *SLT-12 Turntable \$295 complete.*

THE SOUND OF MARANTZ IS THE SOUND OF MUSIC AT ITS VERY BEST!



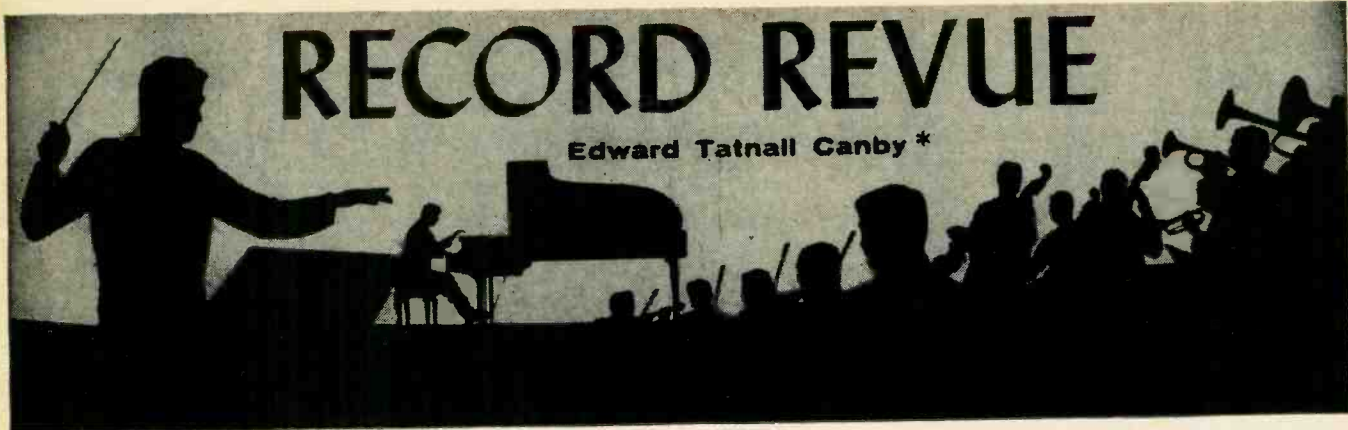
marantz

MARANTZ, INC. SUBSIDIARY OF SUPERSCOPE INC.
25-14 BROADWAY, LONG ISLAND CITY, NEW YORK

Circle 124 on Reader Service Card

RECORD REVUE

Edward Tatnall Canby *



MUSIC OF OUR TIME—WOW!

Leonard Bernstein Conducts Music of Our Time. Jazz soloists, N.Y. Philharmonic, Bernstein.

Columbia MS 6733 stereo

Look fellas—here's a chance for some real sonic fun. *Don't* take Columbia's pompous-like introduction too seriously—about how, after all, Beethoven's "Eroica" was controversial in its day and so was "The Rite of Spring" and now—this stuff. It isn't *that* bad. Nor, very probably, that good. It's merely outrageous—so outrageous that the whole disc is immensely interesting.

This is a segment of a set of concerts Bernstein bravely presented to the "live" Philharmonic audiences last year. (Though Bernstein is much too conservative for the avant-garde moderns, who profess to hate his guts, he's much too radical for his own Brahms-loving audience.) So much for "live" concerts—but on records, believe me, it's very different. And much more fun.

First—"Atmosphères," by one Ligeti, going to one extreme. The composer claims he has moved on "beyond" mere 12-tone, or serial, music; his is written out on 87 separate lines—imagine it—for a texture so "dense" that, as he says, individual instruments are "absorbed into the general texture" of sound. In my words, that means planned orchestral mud. And what mud! It uncannily like tape-recorder music. But it's played "live."

Then we have big Morton Feldman's "Last Pieces," a nerve-racking composition by a potent musical thinker and shocker. Most of his music drives you nuts with endless silences. Not this! You can't help sensing the power of this beautifully-tailored controlled hysteria for orchestra. Especially the insane brass outbursts. Shivers down the back. He's good. Feldman. There's also a work by Austin for jazz soloists plus orchestra, including improvisations. It's a semi-cool jazz piece, atonal as all get out, and it makes the Philharmonic sound like midnite in a svelte nitery. Nice listening.

But the pay-off—and maybe an indirect humorous slap at Mr. Ligeti's 87 staves of super-planned mud, above—is the group of four short on-the-spot and totally unplanned improvisations by the ENTIRE N. Y. Philharmonic. I almost did! WHAT a sound!! Just delightful, and the best musical parlor trick of the year. FOR XMAS...??

BRACE OF REAL CLASSICS

Bach: Toccata and Fugue in D Minor, Organ Trio Sonata No. 2 in C Minor, Prelude & Fugue in D, Fantasia and Fugue in G Minor. Karl Richter, Organ at Jaegersborg, Denmark.

Deutsche Grammophon
138 907 stereo

This is a really splendid organ record in every sense. The organ is a brand new tracker-action (mechanical) "Baroque" instrument; the music includes the two big drama-pieces, the Toccata and Fugue in D Minor, and the huge G Minor Fantasia and Fugue—and the organist has a first-rate modern sense of musical drama, rare indeed today. Best of all, the recording is the sort you can whomp up until the windows rattle. Clean and lovely, if a bit close to the organ. (It is not a large instrument nor is the church very large.)

Large or no, this man-and-instrument combo can make your spine tingle with Bach such as we seldom get to hear. Nothing stoozy in *this* Bach! It really rocks, swings, palpitates. I betcha the Old Man played it like this himself: full of pep, full of motion, full of drama. Great!

Mendelssohn: Symphony No. 4, "Italian"; Incidental Music to "A Midsummer Night's Dream".

- a) Vienna State Opera Orch., Golschmann
Vanguard SRV 1615D stereo
- b) Philadelphia Orch., Ormandy.

Columbia MS 6628 stereo

Two identical discs in content—one from Vienna and the other from the U.S.A. The Viennese offering is on Vanguard's low-cost Everyman label, the local product from the top-bracket Philadelphia Orchestra on Columbia's regular label. The Philly plays more accurately, has more and fancier strings and a much bigger sound. But I like the Vienna version better.

What is it about the endless series of Philadelphia "standards," the repertory warhorses, that is so often much less than good? Like this one. It isn't precision in the playing. Nobody can beat the Philadelphia. It isn't musical taste and style, for in most music the Philadelphia is impeccably stylish. And yet—

Whatever the trouble is, here you have it. The Mendelssohn is too slick, too big, lacking in inner "spirit," in conviction and honesty, smacking somehow of the too-often-played repertory routine, done by rote rather than by feeling. It's very hard to pin this down in any scientific way. But these two discs bring it out ever so clearly.

Try a few short passages on both—the Philly wins immediately. In comparison, the Vienna record seems almost inept, with poor ensemble and uneven detail work in the playing as well as a smallness in the sound of the recording itself. In any record store (or hi fi store)

demonstration, the Philly would sell itself.

But just play the Viennese record for a whole uninterrupted side. Then the difference begins to lean the other way. For you'll hear that very spirit, conviction, honesty, and truth of musical enthusiasm that is so subtly lacking in the Philadelphia version. The old Mendelssohn music really sounds brand new and fresh in Vienna—there's no better way to put it.

Note that neither of these includes the several vocal-choral items that are part of the "Midsummer Night's Dream" music. You'll find them on Angel and DG recordings if you miss them here.

Haydn: String Quartets, Op. 76 No. 2 ("Quintet"); Op. 76 No. 5. Hungarian String Quartet.
Turnabout TV 340125 stereo

Here's one of the major older European string-quartet ensembles, transferred to Vox's new low-price Turnabout label, following the Nonesuch lead.

The Hungarian Quartet is an oddly blowsy-sounding outfit on first hearing. The ensemble is a vividly quavery one, all palpitations, full of rich vibrato, bright and wiry in sound and seeming—at first—to be rather inaccurate in detail. Not really. It's just a style. A good one, once you get used to it. These are excellent performances.

It takes about a full side of listening to get adjusted. Then you realize that behind all these quaverings the group knows its Haydn perfectly and treats the music not only with respect but with very skillful dramatics. The Hungarian Quartet is worth the regular Vox price; it's just as good in every way on Turnabout.

Handel: Complete Flute Sonatas. Jean-Pierre Rampal, Robert Veyron-Lacroix.

Epic BBS 153 (2) stereo

Jean-Pierre Rampal is by all odds the finest "Baroque" and "Classic" flautist alive today. It is always a pleasure to hear his work, and especially with his habitual co-worker Robert Veyron-Lacroix at the harpsichord. The two have made many a recording, appearing on various labels.

This one isn't quite the best I know of, which (I think) is their Haydn for flute, on Nonesuch. But it still ranks very high and the Handel music is as dependable as Gibraltar and almost as British.

Note the crazy economics of recording, these days. As delighted collectors are beginning to discover, the more "esoteric" the music, the less it costs to buy! These famous-name Handel works on Epic go for a list price that is more than twice that of the very same pair of performers, in the same recorded quality, on the previously mentioned Haydn disc put out by Nonesuch. Nevertheless, plenty of us would consider these discs well worth their price, even so.

**This was the E-V Model 635.
It started a tradition
of excellence in
dynamic microphones.**



**This is the new
E-V Model 635A.
It's better
in every way!**



Model 635A Dynamic Microphone—\$82.00 List. (Normal trade discounts apply.)

E-V How can a microphone as good as the E-V Model 635 be made obsolete? By making it better! It wasn't easy. After all, professional sound engineers have depended on the 635 since 1947.

During this time, the 635 earned a reputation for toughness and dependability that was unrivalled by other omnidirectional dynamics. And internal changes through the years have kept the 635 well in the forefront of microphone design.

But now the time has come for an all new 635: the Electro-Voice Model 635A. It's slimmer, for easier hand-held use. Lighter, too. With a slip-in mount (or accessory snap-on Model 311 mount) for maximum versatility on desk or floor stands. The new, stronger steel case re-

duces hum pickup, and offers a matte, satin chromium finish perfect for films or TV.

The new 635A is totally new inside, too—and all for the best. A new four-stage filter keeps "pops" and wind noise out of the sound track, while guarding against dirt and moisture in the microphone, completely eliminating any need for external wind protection. Of course you still get high output (—55db) and smooth, crisp response. And you can still depend on the exclusive E-V Acoustalloy® diaphragm that is guaranteed against failure for life* (it's that tough!)

We expect to see plenty of the "old" 635's in daily use for years. But more and more, the new 635A will take over as the new standard. It's easy to find out

why: just ask your E-V Professional Microphone distributor for a free demonstration in your studio. Or write us today for complete data. We'll be proud to tell you how much better the new Model 635A really is!

*The E-V Professional Microphone Guarantee: All E-V professional microphones are guaranteed UNCONDITIONALLY against malfunction for two years from date of purchase. Within this period, Electro-Voice will repair or replace, at no charge, any microphone exhibiting any malfunction, regardless of cause, including accidental abuse. In addition, all E-V microphones are GUARANTEED FOR LIFE against defects in the original workmanship and materials.

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Electro-Voice®
SETTING NEW STANDARDS IN SOUND

SUPER-VARIETY

The Renaissance Band. New York Pro Musica, Greenberg.

Decca DL 79424 stereo

The N.Y. Pro Musica, for all its mass production of old music, still has managed to be a pioneer and leader in the resurrection of really old instruments and the re-training of modern performers to bring out the old playing techniques, to show off the instruments as they ought to sound. Here you have an amazing collection of them, from wooden cornetts, to a lovely little thing that looks like a hookah and sounds like a bassoon inside a sofa cushion, called the rackets. Some rackets! Also, shawms, sackbuts, rauschpfeifes, krummhorns, dulcian, regal, portative, not to mention the usual old flutes, recorders, harpsichord, viola da gamba. And all of these are divided into "choirs," or consort, family-style and mixed, and into soft and loud instrumental groupings.

The album is interestingly educational—not only in the lively written material and pictures, and the systematic division of the instruments into their proper groups but, on Side 2, for a running demonstration (with spoken identification) of each instrument and each group.

Musical performance? Typically "Pro Musica," which means that it is professional, precise, efficient, forceful, high-tension and about as warm as the proverbial iceberg. Almost everything is fast and bumpy; the slow movements somehow seem far and few between.

However, the recorder-krummhorn group of players seems to get in a good deal more humanity and good musical phrasing than the rest—perhaps because recorder playing is now relatively an ancient "revived" tradition and it's beginning to mellow and ripen into something musical, as well as authentically musicological.

The Baby Sitters Family Album. Alan Arkin, Barbara Dana, Lee Hays, Doris Kaplan, assorted children.

Vanguard VRS 9173 mono

Here's one of the most delightful children-and-parent albums I've ever heard. (There are two earlier of a similar sort.) Children's songs and games—lots of them.

What you have is a batch of professionals, parents, plus children, having a busman's holiday at home in front of a tape recorder. It's totally informal, right in the living room, just as it happened. That's the way it comes over, anyhow. These being show people, of course, it is even better than life—minus the studied, clumsy stiffness of the usual home recording! This is the way all home recordings ought to be.

And this is the way parents and kids ought to be, too. What hits you above everything else in this record is—*parenthood*. For these are people who love and understand children and know how to entertain and get along with them without being patronizing. Easy to tell—just listen to the kids' reactions. They're part of the record.

What does it matter that Doris Kaplan can't sing half a verse in tune ("Two little blackbirds, sittin' on a fence . . ."); her children love it. And you have good old Lee Hays of the Weavers who, after all, *can* sing in tune, and does. What does it matter that some of the guitar playing is as inept as the average home product, while some is extremely expert? It all blends together without the slightest trouble, because the people are so obviously congenial, so entirely genuine and, plainly, so loving.

The children, of course, almost steal the show with their own contributions. But they don't steal it. They are never objectionable. That is part of the excellent taste in which this unique semi-

musical project is conceived. If you like your kids, take it home with you. And learn some human relationships from it, if you're wise. Christmas ones.

Songs for Children. Mary Rowland, Pat Shaw, James Blades, Joan Rimmer.

Argo ZDA 32 stereo

This one is from England and features two singers plus an odd collection of noise-makers for accompaniment—xylophone, marimba, bells, bongos, glockenspiel, etc.—used discreetly along with guitar and harp. The standout performer is the baritone Pat Shaw, who sings like a pleasant old man of seventy or so with a crackling voice, is completely intelligible and does a very nice creole act—both in English and French—as well as some excellent French French. The lady singer somehow muffs her sibilants and her accent is very British—you can't make a word of what she's saying (singing), nor is her personality projected. The disc is all Pat Shaw, who is somebody to watch, as the phrase goes.

I guess it's a Beatlish commentary on folkish children's music that so many of these offerings, aside from the Creole and French, are American. Imagine "Ginny Crack Corn" from England! (Pat manages to say it "corrrn") Not to mention "Ground Hawg," which is mildly cleaned up for British consumption. English folk songs used to dominate the musical scene—now they're borrowing ours, like the Beatles and Stones and the rest.

Piano Music of Alkan. Raymond Lewenthal.

RCA Victor LSC 2815 stereo

If you move in New York musical circles (which you probably don't), you may have heard much to-do of late concerning this "unknown" and rediscovered Romantic composer, of the generation of Mendelssohn, Chopin, Schumann, Wagner, Verdi,—he knew them all, but somehow got forgot.

Well, the to-do is easily explained by this sensational disc. It's a dual excitement. First, Alkan is a good old-fashioned thunderer-composer. He writes music designed to shake the grand piano to its foundation, like Liszt, and like, say, the "Revolutionary" Etude of Chopin. *Wham! Bang! Crash!* The music wouldn't go at all on anything less than a 20-foot Steinway super-grand.

Second—or maybe first (in the hearts of his listeners) is the pianist, a man who has systematically made Alkan his special "thing." He's something, this Lewenthal. I don't remember hearing such piano-shaking virtuosity, such steel-mill, rock-crushing, string-breaking, finger-splitting, ear-stretching roars from a piano since the early days of old Artur Rubinstein (who now, in his seventies, has learned to play gently at last!).

Third—there never was a record company like RCA Victor for recording a huge, wham-bang piano sound. Nuff said.

The Blues at Newport 1964 (2 discs).

Vanguard VSD 79180/1 stereo

Traditional Music at Newport 1964 (2 discs).

Vanguard VSD 79162/3 stereo

Newport Folk Festival 1964—The Evening Concerts.

Vanguard VSD 79184/5 stereo.

The tail almost wags the dog in this series. As Vanguard's annual Newport Folk Festival records go, so goes the Folk Movement itself.

As can be seen on these cover photos, the average age of the huge "live" festival audience is maybe 19 years, and the same is true, we can guess, for the recorded audience. In these surroundings, a 30-year-old is a fossil. So these are for your kids, not you. Or your grandchildren, if you're as antique as I am.

Nevertheless, in the privacy of my home, I heard a considerable cross-section of these discs and got a good bang out of most of them. They are beautifully recorded, considering the incredible difficulties of crowds, P.A., weather, temperamental personalities and general big-time showmanship. And the music on the whole is surprisingly well performed for a set of "live" concerts under such hectic circumstances.

The 1964 records show graphically where the Folk Movement was going, back then. In the big-time—with six big LPs worth. And into various streams of separate thought, too, in a headlong course towards—what? Who knows? But the split into blues, traditional music and the big-name Evening Concert series accurately reflects the 1964 situation. And note the economics: the Evening Concert discs have shiny covers in color; the others are dull black and white. I.e., the old authentic, or true, folk artist are already a bit on the esoteric side.

Things are changing fast in Folk. So far, on these authoritative Newport discs, there has been no trace of the Big Noise that comes out of electric guitars and electric bass and is played with long hair. Impure! Non-authentic. And yet since 1964 the entire Folk Movement has been in an irresistible change of orbit, straight in that very direction. Kids who used to play "authentic" guitar now whang away on the electric bass, and if it isn't authentic, then who gives a so-and-so. More important, the oldest and newest are now coming together—blues with a rock, tradition with a roll.

And so by 1966, maybe 1967, I expect that Traditional folk music at Newport will be limited to a very small segment which still can be performed *minus electronics*. There won't be much.

The old folks are going to have a hard time, I tell you. Most will be going back where they came from, to sing and play in the old way in peace and quiet, back home in the back woods, the shanty towns, the convict gangs. The kids' allegiance will have moved on to newer things.

And whatever they call their new music—folk or no folk—it's going to be played on electric instruments and belted out (or crooned) through multiple mikes and reverbs. Always. That's the future of the Folk Movement, I'm guessing.

I'm sorry for the old folks who are going to be left out in the cold, who can't adapt. But I'm not musically unhappy. It's a new musical Synthesis, coming up now, and it's going to take off on its own, whether we approve or not—"rooted" in the folk but flowering into—who knows what? Big things are coming to Newport—if Newport can keep on wagging.

Vince Guaraldi at Grace Cathedral (San Francisco).

Fantasy 3367 mono

Well, here we go again. More jazz in church. This is an *Episcopal* jazz Mass—not a Catholic Mass. It's preceded by much introducing and explaining, both on the jacket and via the voice of the famed Bishop Pike of California, as though it really were going to shock. The after-effects, on me, at least, were anticlimactic. For this is surely the mildest jazz ever composed! You might call it timid.

Mr. Vince Guaraldi, the jazzist, plays an extremely bland supper-club piano, of that rather impressionist, backgroundish sort heard in very proper establishments. They looked far and wide for the right man, it says—and they sure found him. This stuff couldn't hurt a fly, even in a cathedral. What happens is, the choir mostly sings hymns or (English) Gregorian chants in unison and Mr. G. accompanies discreetly on

(Continued on page 54)

Kodak
TRADEMARK

Some plain talk from Kodak about tape:

The meat of the matter... and some boxing news

Undistorted output from a tape—as from any other link in the chain of audio components—is at the very heart of high fidelity enjoyment. Distortion (or the lack of it) is in theory simple enough to evaluate. You start out with something measurable, or worth listening to, and you reproduce it. Everything added, subtracted or modified by the reproduction, that can be measured or heard, is distortion. Since most kinds of distortion increase as you push any component of your system closer to its maximum power capability, you have to label your distortion value to tell whether you did this while coasting or at a hard pant.

Cry “uncle”

To make the distortions contributed by the tape itself big enough to measure and control, we simply drive the tape until it hollers “uncle” and use that power reference as our benchmark. Here’s the procedure. Record a 400-cycle signal (37.5-mil wavelength at 15 ips) and increase its level until in a playback, which is itself pristine, you can measure enough 1200-cycle signal (third harmonic) to represent 2% of

the 400-cycle signal level. This spells “uncle!” We use 400 cycles for convenience, but insist upon a reasonably long wavelength because we want to affect the entire oxide depth.

The more output level we can get (holding the reproduce gain constant, of course) before reaching “uncle,” the higher the undistorted output potential of the tape.

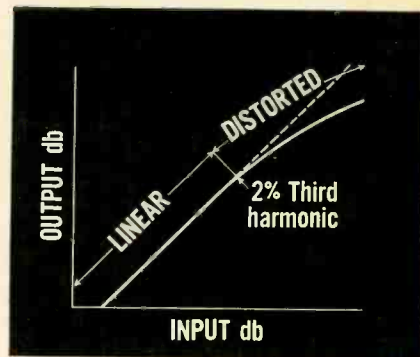
Simple, what?

“Wadayamean — undistorted output at two percent?”

That’s what makes a Miss America Contest. Two percent third harmonic is a reference point that we like to contemplate for a picture of oxide performance. Since distortion changes the original sound, it becomes a matter of acumen and definition how little a change is recognizable. If you’re listening, two percent is a compromise between a trained and an untrained ear. If you’re measuring, it comes at a convenient point on the meter. It’s like a manufacturer testing all sports cars at 150 mph, even though some cars are driven by connoisseurs and some by cowboys. Same goes for tape. Two per-

cent tells us a lot about a tape even if, on the average, you never exceed the 0.5% level.

Because undistorted output helps to define the upper limit of the dynamic range, it has a further effect on the realism of the recording. The higher the undistorted output, the easier it is to reproduce the massed timpani and the solo triangle each at its own concert hall level. And this is just another area where Kodak tapes excel... our general-purpose/low-print tape (Type 31A) gives you up to 3 decibels more crisp, clean output range than conventional tapes.



2% third harmonic distortion represents the practical limit to linear recording.

Kodak tapes—in the five- and seven-inch sizes—now look as good as they sound. We’ve put package identification on a removable sleeve and designed a tape library box with a smart new look. This box features durable one-piece construction, full index space, plus detailed tape use instructions on the inside. Kodak Sound Recording Tapes are available at most electronic, camera, and department stores.

New 24-page, comprehensive “Plain Talk” booklet covers all the important aspects of tape performance, and is free on request. Write: Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

The great unveiling — Kodak’s new library box with removable sleeve!



EASTMAN KODAK COMPANY, Rochester, N. Y.

Circle 126 on Reader Service Card

SOUND AND SIGHT

HAROLD D. WEILER

First, an apology. The November issue of SOUND AND SIGHT contained the following paragraph:

"Incidentally, this Century Magazine article written in 1894 makes most interesting reading for it contains descriptions which better fit the modern home video recorder than they did the Edison kinesiograph of the period. For those of our readers who are interested, this most prophetic article appeared in the June, 1894, issue, and can be seen in most larger public libraries. It is also one of the best contemporary accounts of Edison's invention of the kine-to-phonograph, and as such should be of interest to anyone in the video tape or motion picture field."

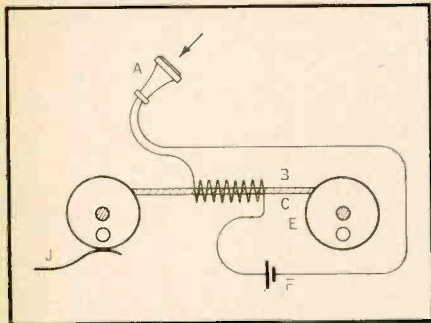
Unfortunately, this particular issue of Century Magazine is not, as we stated, available in most public libraries. In fact, the issue is evidently quite rare, if we are to judge by the large number of interested readers who attempted unsuccessfully to look at it or obtain photostatic copies.

We are surveying the available sources and will shortly be in a position to provide a list of libraries who definitely have this issue and will provide copies to those interested.

While on the subject of research on the historical aspect of recording, we recently chanced on a casual mention of an article on the subject of magnetic recording which was said to have appeared in *Electronics World* of September 8, 1888. Since this date preceded the work of Valdemar Poulsen, the acknowledged inventor of magnetic recording, by about five years, we were extremely curious and investigated further. The article entitled "Some Possible Forms of Recording," by Oberlin Smith, is we believe, the first public mention of recording and reproducing sound magnetically.

Since this article was extremely important to anyone interested in magnetic recording and its offspring video recording, and since this is AUDIO's annual tape issue, we thought it would be fitting to honor its writer and reprint the portion devoted to magnetic recording.

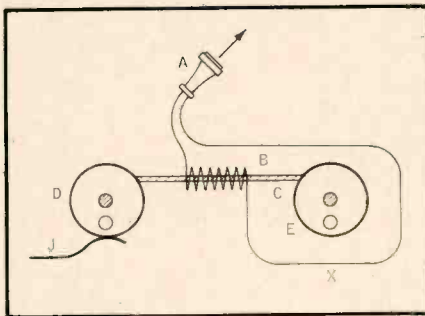
"The above two methods are, of course, wholly mechanical, as in the ordi-



The recording circuit suggested by Mr. Smith for employing a carbon microphone.

nary phonograph. The following proposed apparatus is, however, *purely electrical*, and is, as far as is known to the writer, the only one fulfilling such conditions that has been suggested. Figure 4 is the recording part of an electrical phonograph. Figure 5 is the talking part of the same. Many of the pieces, as D, E, B, C, etc., can be the same ones as are used in Figure 4. Figure 6 shows the same ideas applied to a telephone line wire, so as to speak at a distance and at the same time record what is said, thus making a *recording telephone*. The sketches show only the essential parts, without the supporting framework, etc.

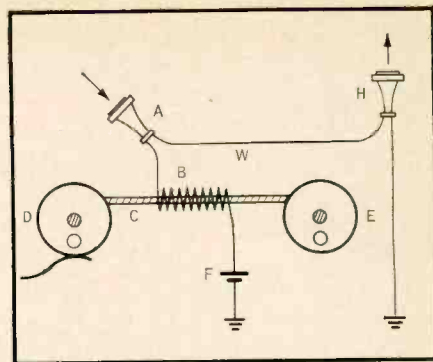
"In Figure 4 the voice or other sound is delivered into an ordinary telephone (A).



The suggested circuit for reproducing previously recorded material employing a telephone receiver.

Preferably, this should be a carbon transmitter so as to have a battery (F) in the circuit, and thus use as strong a current as practicable. Possibly, however, a Bell telephone without a battery would answer the purpose. In either case the current, broken into waves of varying lengths and intensities corresponding with the vibrations of the diaphragm in the telephone, passes in its circuit through the helix (B), converting into a permanent magnet any piece of hardened steel which may be at the time within the helix. Through this helix (B) passes a cord, string, thread, ribbon, chain, or wire (C), made wholly or partly of hardened steel, and kept in motion by being wound on to the reel (E) from off the reel (D), (E) being revolved by hand, clock-work, or other means. (J) is a tension spring or brake pressing against (D) to keep the cord (C) taut.

"When in operation with the undulatory current from the telephone (A) passing through the helix, the cord (C) becomes, so to speak, a series of short magnets grouped into alternate swellings and attenuations of magnetism. The actual lengths of these groups depends upon the speed of their motion, but their *relative lengths* depend upon the *relative lengths* of the sound wave; and their *relative intensities* depend upon the *relative amplitudes* of these waves. The cord (C) therefore contains a perfect record of the sound, far more delicate than the indentations in the tin-foil of the mechanical phonograph. The



Illustrates Mr. Smith's device as a means of recording telephone conversations.

probable construction of (C) would be a cotton, silk or other thread, among whose fibres would be spun (or otherwise mixed) *hard steel*, dust, or short clipping of very fine steel wire, hardened. Each piece would, of course, become a complete magnet. Other forms of (C) might be a brass, lead, or other wire or ribbon through which the steel dust was mixed in melting — being hardened afterwards in the case of brass or any metal with a high melting point. Another (but too expensive) form of (C) would be a chain with each link a magnet; or, if the magnets affected each other too much when in contact, each alternate link could be of non-magnetic material. This chain would not be as delicate as the dust magnets, because the effects of a given vibration might extend but part way along a link. Another imaginable form of (C) would be simply a hard steel wire, but it is scarcely possible that it would divide itself up properly into a number of short magnets. The magnetic influence would probably be distributed along the wire in a most totally depraved way, with nodal points just where they were not wanted. If it could be made to work it would obviously be the simplest thing yet suggested.

"The cotton thread above mentioned would seem to be preferable to anything else on account of its cheapness, lightness, and flexibility. The Lord's Prayer could be written upon a few feet of thread or string, while a young lady receiving a small spool of cotton from her lover would think herself abominably neglected if it was not "warranted 200 yards long."

"In Figure 6 the arrangement is precisely the same as in Figure 4, except that the circuit is made through the telegraph wire (W) and the receiving telephone (H) in Boston or some other distant place. Of course the record might be made at the receiving instead of the transmitting end of the line, and thus our hypothetical young lady might, while listening to the impassioned pleadings of her chosen young man, be preparing the evidence for a future breach-of-promise suit.

"To make the thread or cord (C) "talk back" it is, after having been rewound on to reel (D) again drawn through a helix (B), Figure 5, in whose circuit is the "talking" telephone (A), probably a Bell receiver. Of course it is drawn through at approximately the same speed as before.

(Continued on page 61)



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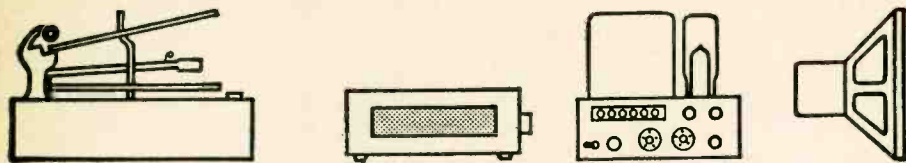
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EQUIPMENT



PROFILE

ERRATUM

In the PROFILE on the Viking Studio 96/RP 120 which appeared in the November issue, we inadvertently stated that the outputs from the RP 120 were at high impedance and unbalanced, with plug-in accessories to convert to broadcast-line applications. Actually, the standard RP 120 output is at an impedance of 600 ohms, and is balanced; a plug-in transformer is available to provide balanced 150/200 ohm outputs when required. For feeding into unbalanced high-impedance circuits, such as the usual AUX input of a hi-fi amplifier, the output could be terminated with 600 ohms, and either terminal could be used to feed into a high-impedance input. This would give a nominal maximum output of around 0.6 volts. Our thanks to Viking for suggesting this correction.

SCOTT 2300 SYSTEM

As Fig. 1 indicates, this is really a complete music system rather than individual components. True, the speakers are in separate enclosures and the tuner section is an option, but these units are tailored to each other, rather than for general component use. As a result we have decided to look at this unit as an entity, rather than as a number of component parts.

However, a description must mention these parts. The record player is the Garrard AT60, the cartridge is the Pickering V-15/AT-1. This is built into a handsome wood shelf-type cabinet that also contains the control amplifier and the FM-Stereo tuner. Covering the record player section is a smoked-grey lift-up top of lucite-type plastic that, to us at least, enhances significantly the appearance of this set.

The speakers are in separate, matching walnut boxes. Each is a two-way system with a tweeter level control. They are supplied with RCA-type jack connections. Long cords and similar connectors are on the underside of the parent unit. Phasing of speakers is, as a result, automatic.

We have made some measurements on the system if only to offer some comparative evaluation method. Actually, there is nothing with which to compare this system—other than other similar-type systems on which we do not yet have comparative

figures. And, in any case, what matter the relative bench measurements? Any such system will not be any better than its weakest part and that part is likely to be the speakers.

This is indeed what we have found here. Our measurements indicate a good amplifier of moderate power (just under 10 watts per channel into 8 ohms) with a wide power bandwidth (3 dB down at 20 and 20,000 Hz at full power) and moderately low IM distortion (under 1 per cent at listening levels and 2.4 per cent at full power). Over-all frequency response is +0, -2 db from 10 to 28,000 Hz.

The tuner offers excellent fringe sensitivity and low-distortion mono or stereo performance. Separation is equally excellent.

But all of these figures are still meaningless since you will buy this system, and listen to it, as a total package. As such we made extensive listening tests. A test record test proved most interesting. With this we were able to measure cartridge-to-amplifier-output response of ± 3 dB from 15,000 Hz down to 50 Hz. *Listening* tests with the speakers indicated that the over-all system could handle this range with good quality. The high end was smooth and well extended to about 15,000 Hz. The mid-range was smooth, slightly depressed, not at all grating or harsh. The bass end did not hump as we would have expected from the tiny speakers. Instead it smoothly descended to about 120 Hz, began its rolloff, was still making sounds at about 60 Hz and finally lapsed into total silence below that. Not bad, not bad at all.

This is actually tailored response since at normal volume settings the amplifier is not flat. The volume control is in fact a bass-compensated loudness control with this bass contouring designed to complete the normal losses of the small woofer. At full-volume setting the compensation is defeated. This is, of course, much louder than any sort of normal listening level.

Listening tests with standard program material offer the only true evaluation of this system. As a whole, H.H. Scott offers a package which is in keeping with the reputation which this firm has built through the years. The 2300 listens well. Musical balance is good. High-frequency dispersion is also good and contributes considerably to

the excellent stereo effect this system offers. Granted, if this set is judged by absolute standards against the best componentry, the Scott suffers. Sound is comparatively tubby, rather heavy on the mid-bass side. But these are *relative* terms.

Let's put the 2300 where it belongs—as a complete music system of moderate price (\$399.90 including tuner) that offers legitimate high-fidelity sound. Certainly what is offered is miles ahead of what we have heard from the bulk of packaged consoles offered to the mass market. And this, we suspect, is exactly what this set is intended to be.

Circle 201

EICO MODEL 250

A.C. V-T VOLTMETER

Perhaps the most basic tool in the audiophile's test gear collection is the ac-vtm. This instrument is called upon to make more meaningful measurements than any other. However, run-of-the-mill vtvm's will not do a proper job. Rarely does a general-purpose instrument have the bandwidth and linearity necessary for audio measurements. Thus, the EICO 250.

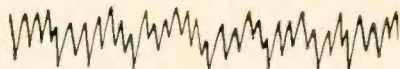
This meter is designed to measure alternating current voltages over a wide amplitude and frequency range. Specifically, it offers a maximum sensitivity of 1 mV full scale with accurate 10-dB increments up to a full scale of 300 volts. This is accomplished in twelve steps: 1 mV, 3 mV, .01 V, .03 V, 0.1 V, 0.3 V, 1.0 V, 3.0 V, 10 V, 30 V, 100 V, and 300 V.

An audio instrument must measure decibels. So the EICO is calibrated from -60 dB to +50 dB. The total measurable range is -80 to +52 dB in the same twelve ranges available for voltage ranges. The meter is face calibrated to read directly in dbm across 600 ohms. The instruction manual contains a nomograph for dbm conversions vs. load.

A good audio measurement instrument should be able to cover, with minimum variations, the full width of audio frequencies likely to be encountered. The EICO is specified as +0, -3 dB from 8 Hz to 800,000 Hz. We did not completely verify this since our generator only reaches to 600,000 Hz. Thus, we actually measured our sample as down 2 dB at 6 Hz. and down 1.5 dB at 600,000 Hz. Between these extremes the meter is flat to the thickness of its meter pointer.

This instrument has one other useful feature; one not usually found on a vtvm. Reasoning that the instrument contains a high-gain and wide-band amplifier, EICO has provided a meter movement by-pass switch and a pair of output binding posts that convert the meter to an amplifier. A gain-control pot is provided in the output. In this position, of course, the meter movement is stilled.

Our tests of this feature showed that this instrument could indeed provide this service of up to 60 dB gain with outputs up to 5 volts. However, it is necessary to attenuate the incoming signal with the range switch in order to avoid overloading



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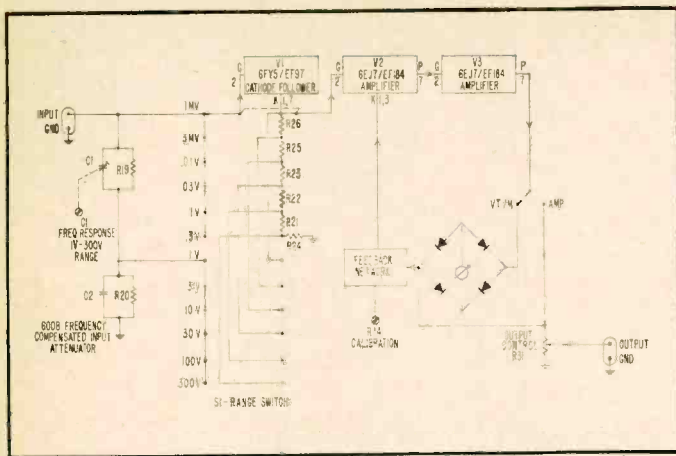
Your dealer has a demonstration tape that lets you hear the excellence of this new tape at slow speed. Costs a little more. But you need buy only half as much—and can save 25% or more in tape costs. Or, if you use this new tape at fast speed, you'll discover fidelity you didn't know your recorder had.

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Magnetic Products Division 



Block schematic of EICO Model 250 VTVM

the amplifier. In other words, for lowest distortion, the range switch should be set as low as possible and the amplifier output as high as possible, considering the signal being amplified. This, we feel, is a feature that many audiobuffs will find useful. Most conventional preamplifiers do not offer high-gain non-equalized inputs as does this meter.

Technical Description

The block diagram shows the range switching and essential details of the signal path through the instrument. Notice that on the lower six ranges, the voltage applied to the input binding posts is coupled directly to the grid of a cathode follower. The six higher ranges are first attenuated 1000:1 by a frequency-compensated attenuator before coupling to the cathode-follower grid.

The output circuit of the cathode follower has a six-tap voltage divider. From this divider the voltage is fed to a two-stage amplifier. This is in turn fed to the arm of the amp-meter switch.

At the meter position, the amplifier output is fed to a full-wave bridge rectifier with the meter connected as the load. The opposite side of the bridge contains a degenerative feedback network back to the cathode of the first amplifier. A calibration control is incorporated in the feedback network.

If the amp-meter switch is moved to amplifier position, the amplifier output is directly fed to the output level control and then to the output binding posts.

The power supply is straightforward. It has a full-wave tube rectifier, a pi-type RC filter and a voltage-regulator tube that provides regulated B+ to all stages. The B+ is applied, through a voltage divider, to the arm of a hum-balancing potentiometer connected across the filament windings. This provides d.c. bias for the tube filaments valuable for suppressing hum arising from a cathode-heater leakage. An electrolytic capacitor provides the necessary a.c. ground return.

The tube complement is 2-6EJ7/EF84 frame-grid pentodes, 1 6FY5/EC97 frame-grid triode, 1 6X4 rectifier, and 1 0A2 voltage regulator.

The 250 is available factory wired or in kit form. Our sample was factory wired but examination of the kit manual indicated that there should be no constructional problems encountered. The 250 wired lists at \$79.95; the kit is \$49.95.

It is also worthy of note that this same instrument is available for about five dollars less as the Model 255. This instrument lacks only the amplifier output feature. Either one will more than prove its worth on your bench.

Circle 202

ALTEC 844A MONITOR SPEAKER SYSTEM

Designed primarily for monitor use in broadcast and recording studios, the Altec 844A has that undefinable sound one normally associates with studio monitoring loudspeakers—smooth, peakless and realistic bass, clean midrange, crisp high end, with excellent separation of instruments. In appearance, it is obvious that it is planned for wall mounting above eye level, as it might be, for example, above the window looking into the studio proper. In fact, if one were to acquire a 844A and wish to use it in a living room, he

should turn it upside down and rest it on its top.

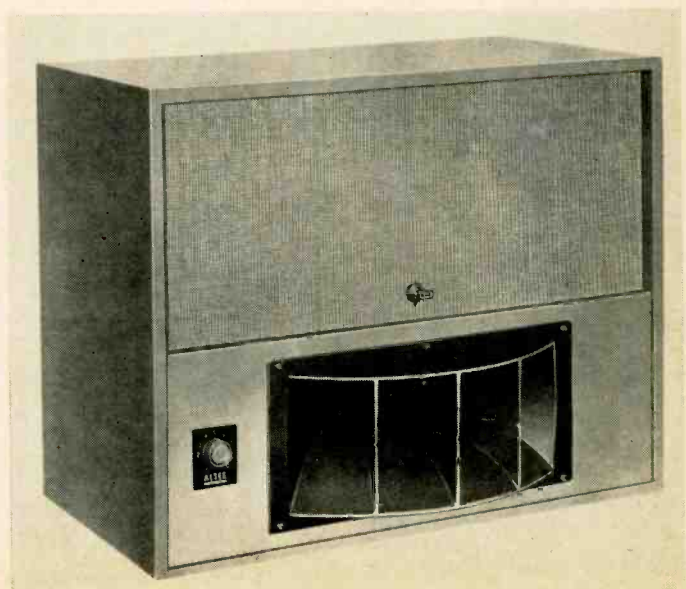
This unit is not a bookshelf model—it measures 31 in. wide by 24 in. high by 16 in. deep, and weighs 90 lbs. It could not be much smaller and accommodate two 12-in. high-compliance woofers, the high-frequency driver unit, and the sectoral horn which gives it a 90-deg. horizontal coverage and a 40-deg. vertical. The 414-type woofers each have 1.6-lb. Alnico V magnets, with 3-in. voice coils edgewise-wound with copper ribbon to maintain the highest possible current-carrying capacity. The high-frequency compression driver uses a 1½-in. voice coil wound with aluminum ribbon, and covers the range from 800 to 22,000 cps, the frequency division accomplished by a dual full-section network, with a variable control to adjust high-frequency shelving.

PERFORMANCE

As closely as could be determined, the acoustic output of the 844A is exceptionally flat over the entire range—even beyond audibility, as we have said before, and been taken to task for it. Most adult humans fail in their hearing above around 15,000 Hz, but good condenser microphones continue to indicate appreciable sound output up to at least 22,000 Hz, which is claimed as the upper limit of the 844A. Actually, it is not, since we could hear (with the microphone) signals up to over 24,000 Hz.

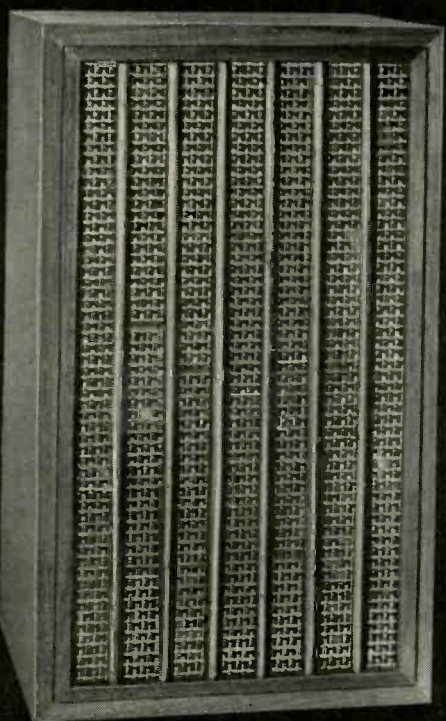
While the 844A is designed as a broadcast monitor loudspeaker, it boasts the same components as the "Carmel," Model 838A, which was reviewed in these pages in April, 1961. This was what is commonly known as a "rave" review when applied to a movie or stage production, but equally applicable to a loudspeaker. And to anyone who wants a home loudspeaker of the broadcast-monitor quality in a furniture cabinet, rather than the usual "utility gray" of the professional speaker, we would unhesitatingly suggest the 838A. For studio use, though, the 844A is an ideal choice.

Circle 203



Altec 844A Monitor Speaker System

Total Sound Spectrum



An exciting journey
into the World of Sound . . .

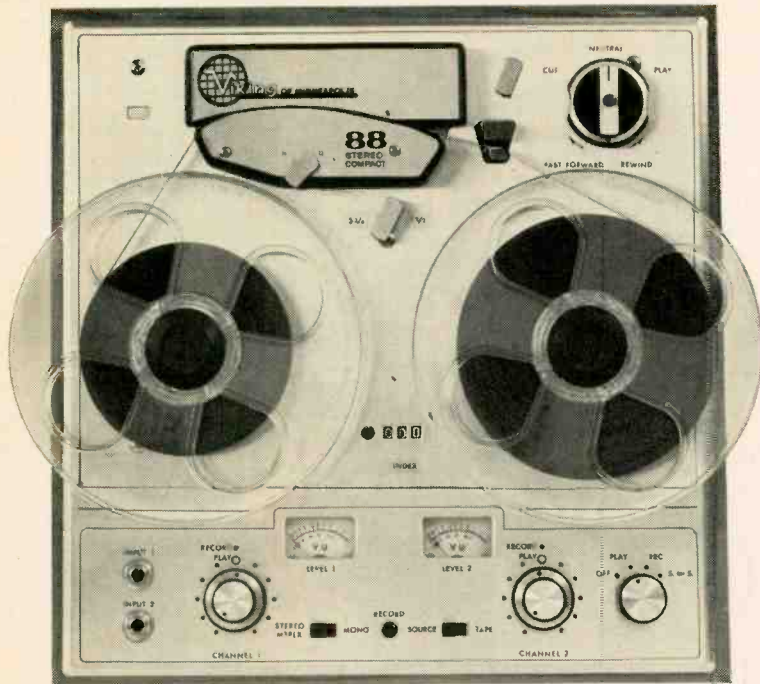
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SOME SHAPES NEVER CHANGE

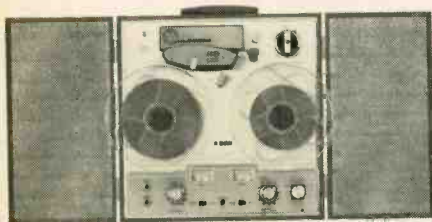


For example, a spoon, a VW or an 88 Stereo Compact. They are made for a specific purpose and fulfill it so well, the basic design never changes.

Improvements are made though. Spoons are better balanced. VW's have larger tail lights. We've added a pause control to the 88 Stereo Compact. We've improved the automatic stop, included a pilot light and put a push-button on the counter - but we haven't changed the basic design. An 88 is still only 13 x 13 x 7" and fits into most hi fi consoles. 88 Stereo Compacts always deliver smooth tape handling, excellent frequency response, feature off the tape monitoring and separate hyperbolic heads for erase, record and playback.

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Circle 131 on Reader Service Card

AUDIO CLINIC

(from page 4)

rate lead-in cables. The use of a knife switch is possible, provided that the material of which it is made is a high-grade ceramic to prevent losses of r.f. signal and that you are using 300-ohm twin lead. If coaxial transmission line is used, the best method of switching the two lead-in cables is to use a coaxial switch between the cables and the transformer feeding the tuner.

Instead of the two separate antennas you now contemplate, why not use just one? Use a rotator to turn it. The amount of cables running down to your operating position will be the same as for two separate antennas but you will have the added flexibility of being able to pinpoint a station more exactly, thus improving the reception of some of the weaker signals.

Q. I live in the New York Metropolitan area. My antenna is on a 10-foot mast on my roof. There are no tall buildings in a 5-mile radius. I receive some stations perfectly but others are terrible. It seems that whenever I try to tape a stereo broadcast I get an extraordinary amount of static, especially noticeable during quiet passages. Frank Proto, Brooklyn, New York.

A. I don't really know why you are getting poor FM reception but I can venture some guesses which might help you. First, make sure that you have connected your antenna properly. Is your rotator (if you have one) lined up with the control box as to compass heading? If you use shielded line, do you use a balun or transformer at each end of the transmission line? You should have done so in order to match impedances between tuner, transmission line, and antenna.

If the antenna is not the culprit, you should investigate the tuner itself. Possibly it is not aligned properly and, therefore, does not capture the stations as it should. I tend to suspect your antenna, however.

If the antenna was one which was not preassembled, possibly you assembled the elements in the wrong places. Possibly you used the reflector as one of the directors and vice versa. This would seriously degrade the antenna's performance.

The static you hear when trying to record FM-stereo broadcasts is a further extension of your problem with reception. By whatever method necessary, you must increase the strength of the FM signals into the limiters of your tuner. Æ

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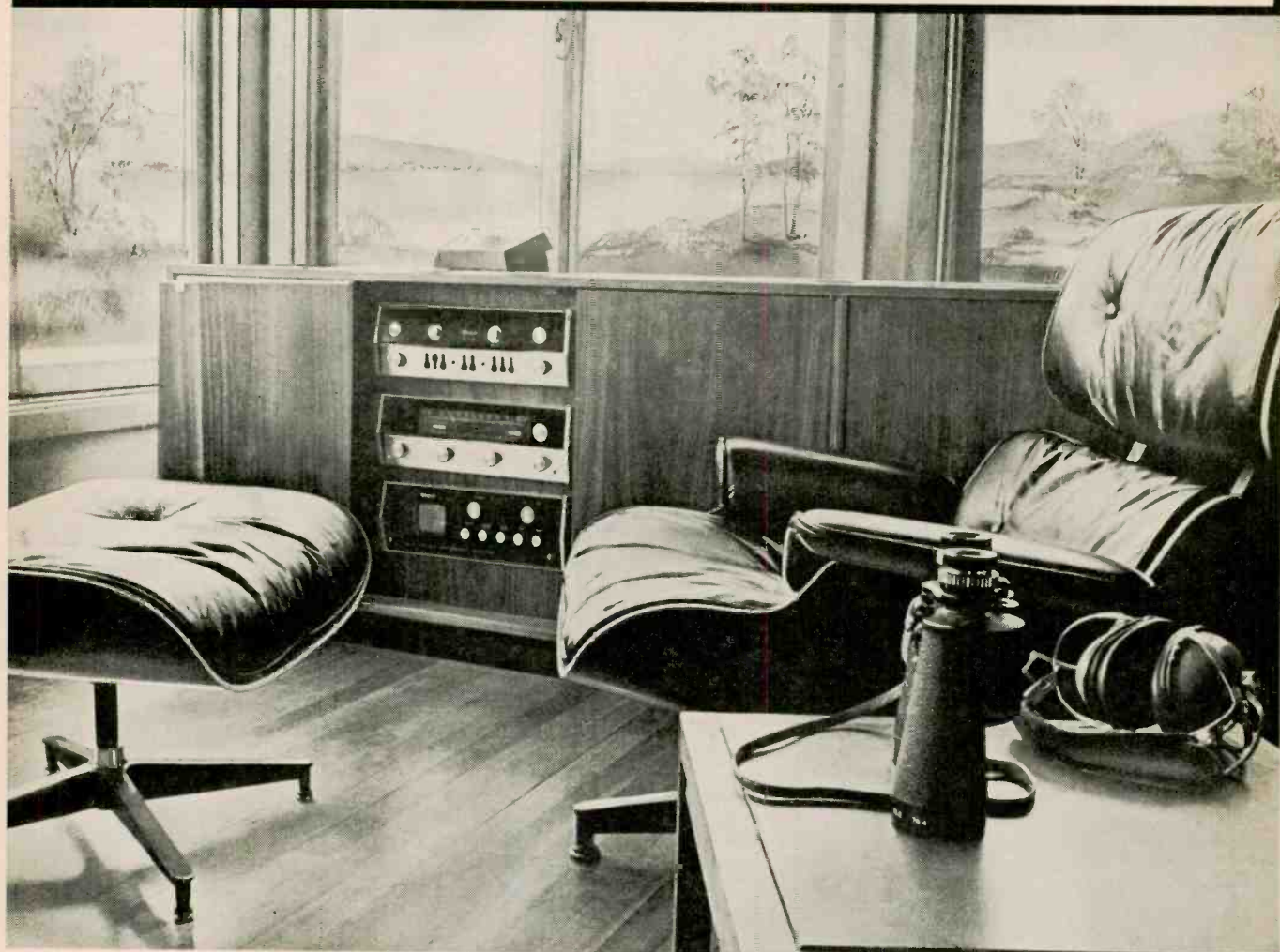
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RECORD REVUE

(from page 44)

the piano, with a *very* discreet touch of a cymbal and drum section to help. Nothing all-out, you realize. Just real church-like. High-church Episcopal.

(One of the hymns, oddly, turns out to be borrowed from the Lutherans. It's Bach's "Jesu, Joy of Man's Desiring," with watered-down jazz harmony.)

Nope, I'm not enthusiastic. For not only is this music very thin stuff, if quite innocuously pleasant, but it doesn't cut even a trace of skin off the usual American convention of the church-so-pure, unsullied by any expression with real force to it. Musically, anyhow.

The trouble is that the jazz idiom is inherently too potent for that atmosphere. Now when the Negroes shout religion, or the Baptists wail, they put real power into their music, for sacred ends, and the feeling is genuine. But this, here, is merely mamby-paniby stuff, more shocking (in such a sanctified, if not sanctimonious place) than expressive in any deep musical fashion. It's all quite sincere and everybody worked hard; but it still comes out weak-kneed.

The whole thing is summed up by a story on the record jacket. When some

worshippers were reminded of supper-club music, they were told—of course: isn't our Communion Service concerned with the Last Supper of Jesus and His Disciples? Well, I just can't hear this polite, innocuous music as worthy of *that* occasion, myself.

If you're going to put jazz into the church, I say, then put the best—i.e. the most expressive and musically powerful. Nothing less is worth the trouble. If not, then forget the whole idea.

Ravel: *L'Heure Espagnole*. Soloists, Orch. Nationale, Paris, Lorin Maazel.

Deutsche Grammophon
138 970 stereo

This amusing early-Ravel operetta about a clockmaker's wife in Spain is both lush and comic. The wife entertains assorted male guests in the absence of her husband, going so far as to hide one of them inside a grandfather clock. With the triple-language libretto in front of your eyes, you can't go wrong—and the story follows along charmingly. (It's sung in French.)

The French singers are witty if not always musically 100 per cent in respect to accurate pitch—no matter. They "enter into the spirit" beautifully, which is enough. In the DGG stereo they are a bit at a distance and somewhat metallic, a rather off-mike sound; but this is normal in most opera recordings today and is, indeed, no real handicap, since it affords a better balance between voice and orchestral accompaniment than we ever could have in the close-up mono days of opera vocalizing.

Read What Audio Says About The Whitecrest W-2 Speaker System

*(as appeared in November, 1965, issue of AUDIO)

*"THE WHITECREST W-2 CAME SOMEWHAT AS A SURPRISE"

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*"IT WAS SO COMPLETELY FREE FROM THE USUAL MID-RANGE DEFICIENCY WHICH IS COMMON IN SMALL ENCLOSURES—"

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*"—QUITE AUDIBLE AT 14,000 Hz, ABOVE WHICH WE DON'T HEAR MUCH FROM ANY SPEAKER."

*"TWO INDEPENDENT FREQUENCY-DIVIDING NETWORKS ARE EMPLOYED—"

A unique contribution for listening at any level.

*"THE CABINET IS WELL DAMPED TO PREVENT ANY RESONANCES."

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THIS MONTH'S COVER

Pictured on the cover of this issue is the installation created and executed by Ronald Welmeier, Cincinnati, Ohio. Originally submitted in color—which we do not use on our covers—this system provides practically every facility required. By now he is probably planning for a video tape recorder.

From left to right, Mr. Welmeier's system contains the following: Knight-Kit KG-70 tape record and playback amplifier, a Viking 85 tape deck, a Bogen four-channel mixer, and way on top is the control for a CDR rotor which mounts a Finco FM-5 antenna.

Down the center section are a Fairchild Compaider, a Heathkit AM/FM tuner with multiplex adapter at its left, a Citation IV preamp, built from a kit, and a Bell 3030 stereo amplifier. To the right is the main control panel for speaker systems, amplifier selection, and so on. Above it is a Lafayette audio level meter, and below, a line voltmeter. To the extreme right is a 5-inch Heathkit scope.

In the lower section there is space for records and tapes, an EICO 377 oscillator, the Citation II power amplifier (also built from a kit) a Rek-O-Kut L-34 turntable equipped with ADC arm and cartridge, a Knight-Kit VTVM, a Garrard Type A changer with an Empire 108 cartridge.

Mr. Welmeier also enjoys two Bozak speaker systems, each consisting of two B-207A's and two B1209 midrange speakers.

Some lucky dealer in Cincinnati certainly has a desirable customer!

TAPE RECORDERS

(from page 35)



TELEFUNKEN 97

Speeds: 1 1/4, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicator: Magic eye. (two pair) inputs, self-contained carrying case with speakers, one in case, other in detachable lid, sound-on-sound, sound-with-sound, dual speaker and headphone outputs. Weight: 29 lbs. Price: \$279.00. Model 96 is similar except that it is restricted to 1/4-track mono record and play. One speaker built-in. Weight: 24 lbs. Price: \$249.00.



TELEFUNKEN 300

Speed: 3 3/4. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 5". Indicator:

Meter. Features: All-transistor; battery portable, powered by five "D" cells or a.c. microphone or hi-level inputs, built-in speaker, pre-amp and headphone outputs. Weight: 7 1/2 lbs. Price: \$109.95.



UHER 6000

Speed: 7 1/2. Record: 1/2-track mono. Play: 1/2-track mono. Heads: Erase, record/play. Motors: One, hys. syn. Max. Reel: 7". Indicator: Meter. Features: Microphone or hi-level input, self-contained carrying case with built-in speaker, speaker and pre-amp output. Weight: 13 lbs. Price: \$160.00.



UHER 7000

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, hys. syn. Max. Reel: 7". Indicator: Meter. Features: Dual microphone

or hi-level inputs, sound-on-sound, self-contained carrying case with dual built-in speakers, dual pre-amp and headphone outputs. Weight: 16 lbs. Price: \$250.00.



UHER 8000

Speeds: 15/16, 1 1/8, 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play, slide sync. Motors: One, hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; dual microphone, mag. phono, and hi-level inputs, sound-on-sound, sound-with-sound, built-in automatic slide projector synchronization, self-contained carrying case with dual built-in speakers, dual outputs for pre-amp, speakers, or headphones. Weight: 19 lbs. Price: \$420.00.



UHER 9000

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: One, hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; dual low-impedance microphone, mag. phono, or hi-level inputs, voice actuated re-



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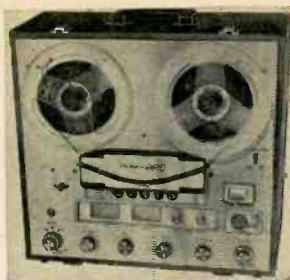
UHER 4000-L

Speeds: 15/16, 1 1/2, 3 3/4, 7 1/2. Record: 1/2-track mono. Play: 1/4-track mono. Heads: Erase, record/play. Motors: One, d.c. Max. Reel: 5". Indicator: Meter. Features: All-transistor; battery portable utilizing storage battery included a.c. adapter/charger, five "D" cells or remote control microphone or hi-level inputs, slide projector synchronization provision, built-in speaker, voice control provision, preamp and external speaker outputs. Weight: 9 lbs. Price \$440.00.



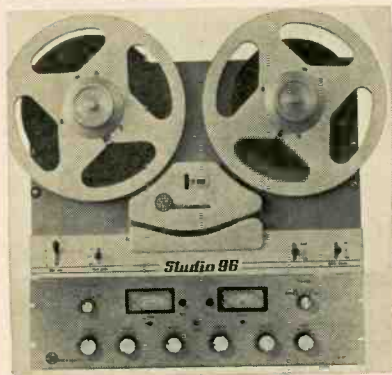
VIKING 88

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: Two, four-pole. Max. Reel 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, hyperbolic heads, dual preamp outputs. Weight: 22 lbs. Price: \$339.95. Also available as model 880 in self-contained carrying case with built-in dual speakers/amplifiers. Price: \$425.00.



VIKING 220

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play, reverse play. Motors: Three, two four-pole, one hys. syn. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; full solenoid mechanical operation, automatic reverse play, dual microphone and hi-level inputs, full remote control provision, sound-with-sound, dual preamp, speaker, and headphone outputs (no speakers provided with this deck). Weight: 45 lbs. Price: \$860.00.



VIKING 96/RP-120

Speeds: 3 3/4, 7 1/2 or (special order) 7 1/2 15. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record, play. Motors: Three, two four-pole, one hys. syn. Max. Reel: 10 1/2". Indicators: Dual VU meters. Features: All-transistor; full solenoid operation, safety brakes in event of power failure, screw-secured reel holders, dual microphone and hi-level inputs, plug-in provision to match inputs to low-impedance microphones, outputs to balanced or unbalanced, dual preamp outputs, photoelectric tape shutoff. Weight: Transport only 50 lbs; preamp: 70 lbs. Price: Transport: \$598.95; preamp: \$399.00. Provision for mounting of other head configurations up to a maximum of four heads.



WOLLENSAK 1288

Speeds: 3 3/4, 7 1/2. Record: 1/4-track stereo. Play: 1/4-track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, walnut enclosure with two speakers in separate book-self type enclosures, dual preamp and speaker outputs. Weight: 23 lbs. Price: \$259.95.

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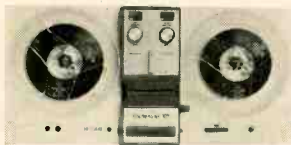
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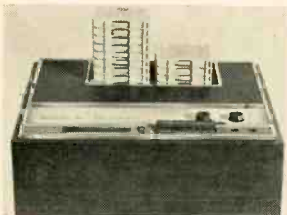
WOLLENSAK 1980

Speeds: $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: Dual microphone or hi-level inputs, self-contained carrying case with built-in dual speakers, sound-with-sound, dual preamp and speaker outputs. Weight: 42 lbs. Price: \$839.95.



WOLLENSAK 5200

Speeds: $15/16$, $1\frac{1}{4}$, $3\frac{3}{4}$, $7\frac{1}{2}$. Record: $\frac{1}{4}$ -track stereo. Play: $\frac{1}{4}$ -track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: 7". Indicators: Dual meters. Features: All-transistor; dual microphone or hi-level inputs, dual preamp outputs. Weight: 18 lbs. Price: \$179.95. Other models using the same basic mechanism include: model 5150— $\frac{1}{2}$ -track mono in carrying case with built-in speaker, price: \$149.95. Model 5250—complete $\frac{1}{4}$ -track stereo recorder (cassette, speakers), price: \$189.95. Model 5300—full $\frac{1}{4}$ -track stereo operation in three furniture-grade enclosures; price: \$279.95.



WOLLENSAK 7000

Speeds: $1\frac{1}{4}$. Record: $\frac{1}{2}$ -track stereo. Play: $\frac{1}{2}$ -track stereo. Heads: Erase, record/play. Motors: One, four-pole. Max. Reel: Cart-ridge only. Indicators: Dual neon bulbs. Features: Automatic cartridge players (60-second change cycle), use special 0.146" wide tape, dual microphone or hi-level inputs, sound-with-sound, dual preamp outputs. Weight: 32 lbs. deck. Price: \$339.95. Also model 7100 complete unit in case with speakers, price: \$399.95. Model 7200—same except has separate speakers; price: \$459.95.

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Wollensak (see *Revere-Mincom Div.*)

LIGHT LISTENING

(from page 8)

miss out of hand a system of 3% for commercial reels. I'm indulgent in this case because the 3%'s arriving this month sound no more artificial to the ear than many 7% commercial tapes I've heard. The reason, so far as I can determine, seems to lie in the amount of equalization used in processing each speed and the degree to which the faster speed reveals excesses in equalization. In this Disney album the ear is aware of very little departure from normal equalization. Response is quite smooth to the upper limit which appears to extend slightly above 10kHz. Originally, Stokowski and the Philadelphia orchestra recorded this varied collection of music for stereo playback in theatres and 10 kHz in pre-Cinerama days was considered quite a feat. The original film track didn't contain all the background hiss audible on this tape. On the other hand, I wouldn't say this reel presents much more tape hiss than did the pioneer 7% releases. With a little extra sales effort on the part of the industry, it might

be possible to charge a little more for 3% tapes so long as the customer gets twice as much music for his money than he does at 7%. This extra money could then be earmarked for raw tape stock capable of giving 3% a response even closer to that of 7% ips.

Sasha Polinoff: Russian Cabaret

Monitor Stereo MFS 432

Balalaika performer Sasha Polinoff is backed by the Russian Gypsy Ensemble of Kostya Poliansky in a bright, gay collection of traditional folk melodies and songs of New Russia. At a time when banjo and guitar have rocketed to an all time high in popularity, it is more than likely that their Russian cousin the balalaika will receive a well-deserved share of additional attention. Certainly no better introduction can be found for acquainting the enthusiastic plucked string listener with this remarkable instrument than the present collection. Sasha Polinoff is a fluent performer, and the clear, widely spread stereo sound has just the right amount of bite to offset the spacious atmosphere suggestive of a dark, candle-lit cabaret.

ABOUT MUSIC

(from page 12)

and they informed Eduard van Beinum of their intention to remove the seats and place the orchestra in the center of the hall. Over the conductor's bitter protests, new tests were made. After hearing the playbacks, van Beinum said: "Gentlemen, do what you like. It's all right with me."

Like the late conductor of the Concertgebouw Orchestra, most artists have learned to keep hands off the sound. But some, like Leopold Stokowski, take an active interest in the recording process. Stokowski has frequently taken over the jobs of recording engineer and producer, deploying the orchestra for better stereo separation, watching VU meters specially set up for him atop the playback speakers,

and supervising the tape-to-disc transfer. Cellist Janos Starker, in the early days of his recording career, operated on both sides of the control-booth panel, playing Bach and Beethoven and also running the session with the help of an engineer, because the recording firm had no producer on its payroll. After the sessions, he edited the tapes himself—a case of a recording Orson Welles.

Under normal conditions, producers and engineers will continue to have their differences, but on one point they are in total agreement: nothing is as bad as the artist with electronic pretensions—Starker and Stokowski excepted, of course.

PULSE MODULATED AMP

(from page 40)

Translating this last circuit to use the high-voltage, high-current silicon types, which have excellent speed characteristics with appropriate drive circuits, (but are admittedly more expensive at the moment) promises to yield audio amplifiers capable of delivering kilowatts of audio power at phenomenally high efficiency and far lower cost than heretofore possible.

This represents a tremendous change in concept. Where a stadium installation at one time required racks full of amplifiers, and developed enough heat to supply a house in New York in mid-winter, it will now require a relatively compact, high-power unit, running at ambient temperature. Instead of taking at least 250 watts to operate a 50-watt unit, this mode of operation means that a kilowatt audio system, delivering 1 kilowatt of audio power, can operate on

a standby current well under 100 watts, and only draw very little over 1 kilowatt just for those moments when it's delivering a kilowatt of audio power.

The audio department has often been the "orphan" of an installation: Everybody likes to forget it when it works, although there's a big squawk anytime it doesn't! And the audio man is apt to find himself confined in a small space with his equipment running at an elevated temperature, the only advantage of which is that he can cook his meals on it! Now he'll be able to eat out, in comfort, and his system can really be hidden under the stand somewhere and forgotten.

Aside from the romanticizing, this new mode of operation does seem to have opened up a whole new realm for high-power audio amplification. **Æ**

LANGUAGE LABORATORY

(from page 21)

with his own recording for comparison. The student has control of his playback level to compensate for any hearing deficiencies and provide for comfortable listening. He may continue practicing by erasing his own voice on the lower track without disturbing the master lesson program until he reaches the required proficiency level. This is perhaps the most important advantage of the language laboratory. Beside facilitating constant repetition at his own learning rate, it enables the student to work individually during the entire lesson period and provides for individual assistance from the instructor and self-correction by the pupil. Another important feature of a language laboratory is that all students may practice aloud simultaneously and yet individually; in a class of 25 students in the traditional language laboratory, 24 are idle while one is practicing.

Control and Supervision Facilities

Through the signal lights on the master console, the instructor is aware at all times of what each student is doing without actually having to monitor continuously. There are three lights on each student-control strip—a red light indicates that a student is recording from the console onto his own master track, a yellow light indicates that he is recording his own voice on the student track; and a white light indicates that the student wishes to consult with the instructor.

In addition to the signal lamps each of the student-control strips contains a nine-position switch which enables the instructor to feed the desired program material to each student booth. Positions one to six provide six program lines (four tape recorders, record player, TV sound, radio, motion picture or slide projector sound). Positions GRI-GR2 are two group conversation lines through which two or more students may communicate and work with

each other. Position MS disconnects the student from the program lines, allowing him to work with his own master tape.

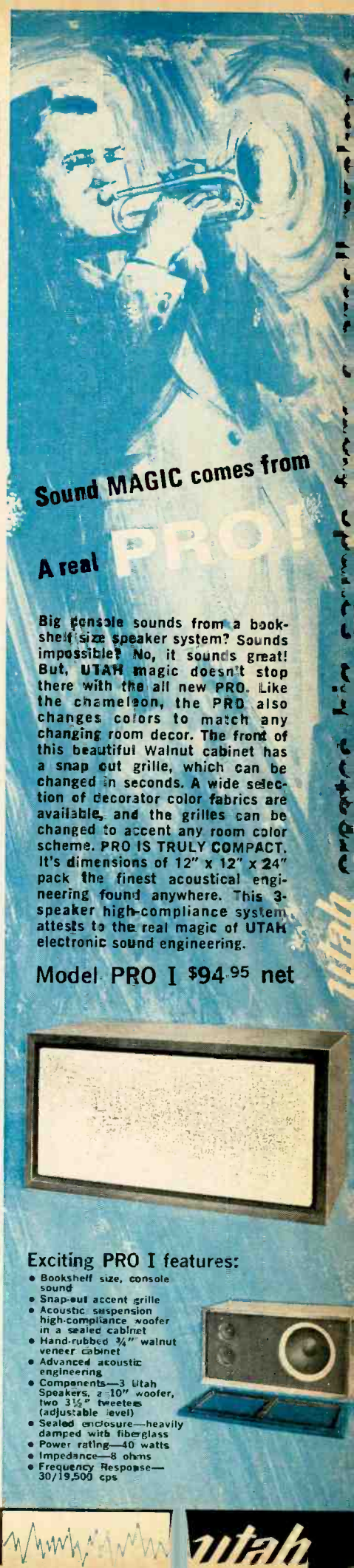
The student control strips also contain a key switch with positions for monitor/free-intercom. In the intercom position the program line from the master console to the individual student is disconnected. The monitor position allows the teacher to monitor the student without his being aware of it as mentioned earlier. This strip also contains a start/stop switch for the student's recorder, and a student phone output. The program being fed to the student's headphones may be monitored and recorded through individual jacks at the master desk. Connections between the instructor's tape recorder inputs and the individual monitor jacks are made on the panel to permit recording students' activities.

In addition to the individual student-control strips, the instructor has a master control panel which permits him to communicate directly with any individual student on with either of the group communication circuits, or to communicate directly with all of the students simultaneously in the "all call" position. He can also monitor and control the level on the program lines well as the volume level of his own voice.

System Attracts Others Users

The impact of the so called language laboratory on education is considerably greater than is generally believed and much more than its name would imply. Many schools and universities with progressive teachers have discovered that the system originally acquired was inadequate shortly after installation.

Instructors other than those teaching languages were requesting permission for its use. English teachers found it ideal for their students in teaching correct pro-




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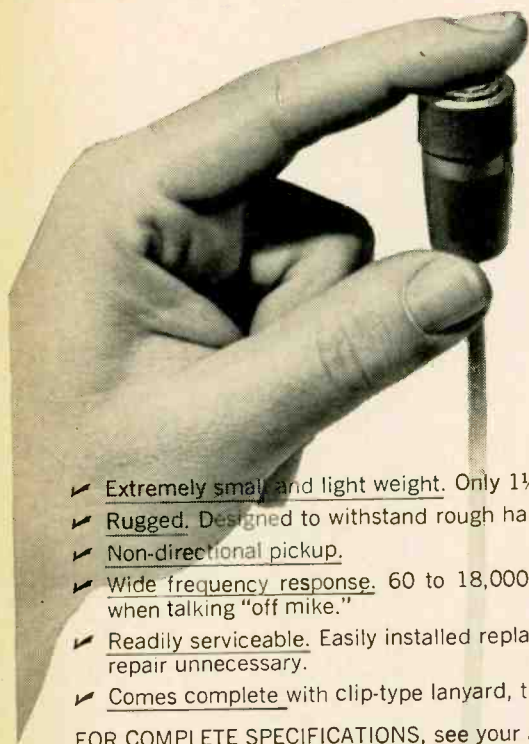


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nunciation. Drama classes benefited since they used it for diction. Music instructors found it ideal.

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TAPE TYPES

(from page 23)

need little reintroduction. Plastic is, of course, cellulose acetate; Mylar is the DuPont trade name for polyester film. We have some thoughts on the relative merits of these that may differ from what is usually considered.

Mylar is stronger than plastic. This is true. But Mylar, if pushed beyond endurance, stretches into a useless string. Plastic merely breaks, and can be respliced.

Mylar is a staple material. It does not absorb or lose water to the atmosphere. So it has a degree of *permanence* not ascribed to plastic. Plastic can lose water; further, it can lose that water faster from the reel edges than from the center so it cups and makes poor head contact.

This is theory. And in practice these tapes will conform to their type. However, for all practical purposes, allowing for careful storage of acetates, Mylar offers no real long-term storage advantages. *Why?*

There are many factors that limit the archival value of magnetic film. Stock deterioration is *not* the primary one. The very advantage of Mylar can be turned against it in long storage. Mylar is exceedingly smooth. It presents unique problems of emulsion adhesion. Time can cause the separation of oxide and base. And this is more a problem with Mylar than with plastic. The Library of Congress, in a recent report on "Preservation and Storage of Sound Recordings" concludes its study of tape materials by stating that 1.5-mil Mylar seems to be the best for long-term storage but that some doubt exists about base-to-coating adhesion.

This confusion of choice (Mylar is higher priced than plastic) is further confounded by the recent introduction of two new materials. The first of these is tensilized cellulose triacetate.

As can be guessed from the generic name, this material is closely related to our old standby. Only Eastman Kodak offers this material. Their trade name is Durol. What does it offer over regular plastic?

Durol's great virtues seem to be two-fold. First, significantly greater break resistance over standard plastics (though not as good as Mylar). Second, exceptional stretch resistance—

half that of plastic, as much as a twentieth that of Mylar. This is important for it means that a broken tape may mean no wow distortion or loss. Durot tapes cost little more than standard plastics but it must be remembered that their keeping qualities are similar to the plastics.

PVC—polyvinyl chloride—is a new-old name in tape stocks. Only BASF and Burgess offer PVC-based tapes. We were not able to receive complete technical data on this stock in time for this report. However, PVC exhibits a strength that is similar to plastic; it is resistant to aging in the same way as Mylar and is extremely supple, thus providing excellent head contact. However, stability and oxide-adhesion questions remain unanswered fully.

We have touched on this question of oxide-to-base adhesion. That, in part, is the job of the binder. This is one component about which we have been able to find out absolutely nothing. Binders are carefully guarded proprietary secrets. Needless to say, all manufacturers claim perfection for their binders but we suspect that there may well be long-term differences between them.

Several manufacturers are offering

triple-play tapes; that is, 3600 feet on a seven-inch reel. At least two—Reeves and Ferrodynamics—are coating their super-thins with high-output tape. The result, they claim, is no loss of output due to the use of thinner coatings. We have no figures on the print-through.

The aforementioned Ferrodynamics also adds to all of their tapes, at no additional cost, a strip of head cleaner tape plus metallic tabs fore and aft each reel. Irish offers a very wide range of regular and economy tapes. Finally, Sony-Superscope is the only one we know of offering a 3¼ inch reel that will fit the standard wide-pin professional machines. For owners of battery portables and big studio-type machines, this can fill a real need.

These then are the new types of tape to have appeared recently. Again, it needs to be said that the so-called standard tapes of all these companies, Audio Devices, BASF, Burgess, Ferrodynamics, Irish, Kodak, Reeves, Scotch and Sony-Superscope are vast improvements over that which has only recently been available. Remember, finally, to do as the professionals do. Find the tape that best suits your needs. Set the machine bias to suit that product—and stick with it. Æ

SOUND AND SIGHT

(from page 46)

In passing, the small permanent magnets in the cord (C) induce currents of electricity in their enveloping helix analogous to the currents in the field of a magneto-electric machine or a dynamo with permanent magnets in its armature. A more exact analogy would, however, be the currents in the helix of a solenoid if its ordinary action were reversed, and its core made a permanent magnet. These waves of current will correspond in length and relative intensity with the original wave currents, and will therefore reproduce the vibrations of the original sound in the diaphragm of the telephone at any time in the future. If such induced currents are not strong enough to produce sufficiently loud sounds it may be possible to insert at (X), *Figure 5*, some intensifying apparatus, such as a battery, but which has not yet been thought out.

"Like the two mechanical methods first mentioned, this electrical method has never been worked out to completion. The writer went far enough with it to build a temporary apparatus and to develop a successful machine for spinning metallic dust into a cotton cord, but was obliged to lay aside the whole thing before arriving at any *acoustic* results. His experiments showed that it was difficult, with ordinary tools, to harden steel filings on account of excessive oxidation. Experiments with hardened steel wire, broken in a special ma-

chine into very short pieces, showed that they must not be too short—say not less than three or four times their diameter—or they could not be saturated with magnetism to any appreciable degree. Possibly this is because the poles (or points of maximum polarity) of a magnet lie at some distance from the ends of the bar, and consequently neutralize each other when the bar is too short. If this theory is correct it would prevent making magnets of steel dust, the grains of which are supposed to be about as broad as they are long.

"To digress a little, it may be remarked that such a theory does not seem to agree with the fact of a magnetic polarity in approximately spherical or cubical bodies, like the earth, or a chunk of loadstone. Possibly, however, they would be much stronger magnets if elongated; and the tiny pieces of wire above referred to, may possess as much strength in proportion, though it is scarcely perceptible on account of their smallness.

"The writer confesses a good deal of ignorance upon the subject, but he was somewhat surprised to find an equal amount in several well known electricians whom he consulted; and also to find that none of the books he had at hand gave any definite data regarding the best proportions for permanent magnets or their actual strength (when saturated) in pulling power. Surely, there is in this depart-

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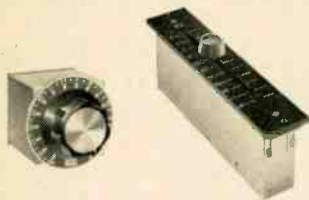


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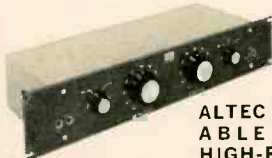
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ment of electrical science a good sized (magnetic) field for a number of lines of force—mental ones—to work in, in the way of careful experimenting.

"To return to our magnetized cord as a "phonogram," it is possible that an insuperable objection to it would be found in the great diameter and length which would be required to hold magnets of sufficient strength and quantity. This, however, can be determined by experiment only. Of course, if this cord approached a clothes line rather than a piece of sewing silk in its general proportions, it would be utterly useless as a practical recording medium. Regarding the general convenience of a record in a cord or ribbon-like form compared with one indented upon a cylinder or a flat circular tablet, there are probably advantages on both sides. One disadvantage of the cord is that if some small portion of the record near the middle has to be repeated there is a good deal of unwinding to do to get at it. The same objection, if it be one, applies to the first-mentioned methods, as well as the magnetic cord. In practice, however, it might prove that this unwinding was a small matter, if a rapidly-working automatic winder were used.

"Another general principle which may perhaps be adopted for a phonograph is that of *variable conductivity*. Possibly a cord or ribbon may be made of a poor conductor (perhaps a flexible substance impregnated with carbon), and may then be made better and worse in certain spots by the action of the "transmitting" instrument, either by making spots of the cord denser or thinner, in some way, at the inward stroke of the diaphragm. This recording action would probably be entirely mechanical. The reproducing, on the contrary, would be wholly electrical, and would consist of passing a current through a conductor which was broken by a space filled by the cross-section of the moving record. This current would pass through a receiving telephone and would, obviously, be thrown into the proper undulations of strength by the varying conductivity of the cord, as it passed along by the motion of its reels.

"The writer has not worked out the details of this latter scheme as completely as in the others mentioned—even upon paper. He has not the time, to say nothing of a properly equipped laboratory, to carry the ideas suggested to their logical conclusion of success or failure, and, therefore, makes them public, hoping that some of the numerous experiments now working in this field may find in them a germ of good from which something useful may grow. Should this be the case, he will doubtless get due credit for his share in the matter; but if, on the other hand, these suggestions prove worthless, they will still have served a purpose, on the principle that a demonstration of what *can't* be done is often a pertinent hint as to what *can* be."

Little did Oberlin Smith realize at the time of writing that far from being possibly worthless as he indicated, his concept of magnetic recording would eventually obsolete every form of recording and reproducing sound and sight to be developed in the next seventy years, including Thomas A. Edison's still to be invented kineto-phonograph.

AUDIO ETC.

(from page 14)

evitable (in my experience); you get maybe two revolutions and then the tone arm decides enough is enough and takes off into space. It jumps a good half inch, then samples a slice of another groove before hopping once more, a full inch or so, or maybe going into a fast inward glide (quick-turn on the anti-skate feature . . .) with an accompanying banshee screech. Not very illuminating from the audible viewpoint, I say.

Or the arm simply goes into a gentle bumping motion, up and down, playing random samples out of the same groove over and over again. Even more likely is the Gruv-Gard effect (copyright), produced by the sides of the cartridge, or the arm itself: the stylus never even gets to touch the playing surface at all, thanks to unwonted (and unwanted) vertical sphericity in the recording. Warping is the proper term, and it is rife.

The end of this story is going to be short. The plastic flexible disc-page is here to stay, I guess, even so. It won't die. Hope springs eternal. Those splendid possibilities still beckon. But the problems, mere mundane practicalities, persist too—after some 20 years since I first ran into them. Some of the present discs work pretty well. A lot more don't. And even under the Very Fanciest Auspices, too. You'd be surprised.

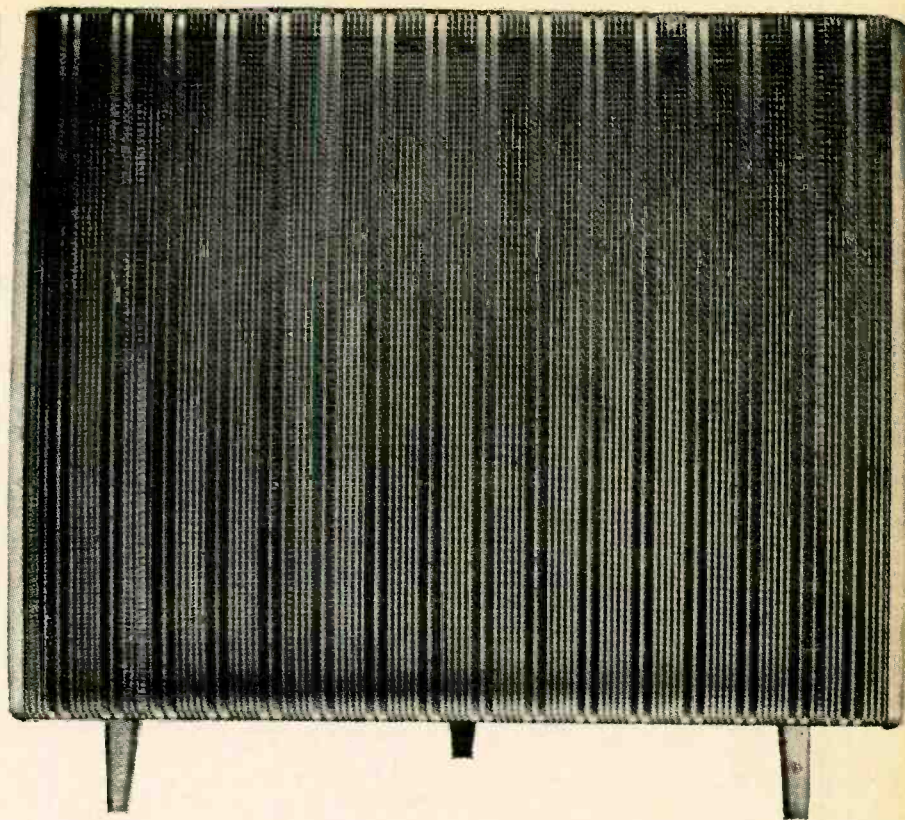
I have, for example, two of these in front of me right now, promoted by two of our most redoubtable magazines. Believe it or not—National Geographic and Reader's Digest. (You see what I mean by an idea persisting . . .) One of them plays. The other doesn't. About par for the course.

The Geographic's disc, a 33 mono, is the one that works. It really plays, even though it is pressed on a square "page" which has been pulled out of the binding at one edge—it is, in fact page 198 of the August issue of the magazine. The Funeral of Sir Winston Churchill. . . with Excerpts from His Speeches, narrated by David Brinkley. Side 1 and Side 2, all rights reserved by the Nat. Geographic Society and Decca Record Co Ltd. (Britain), manufactured by Eva-Tone.

The reason it plays is simple enough. It's all-plastic, heavy enough to lie flat, and it's recorded on *both sides* and therefore unwarped. The material is shiny opaque black, nicely springy and floppy as well as flexible, the label is printed conventionally onto the plastic (rather than on a base beneath a clear coating). The sound quality isn't much, I'll admit. I expect it could be better. But what matters is that the record *really* plays—all the way through, on both sides. A conservative-type job, but successful. (Isn't that the National Geographic all over?)

SECTION OF A CYLINDER

The Reader's Digest, alas, shows up the continuing technical disaster-proneness which seems to plague these enterprises. It's a round disc, another mono 33, one-sided, and its says "YOUR FREE AUDI-



moving mass

In virtually all loudspeakers the electrical energy is first converted into mechanical energy and then into acoustic energy. It is the stored mechanical energy in the mass of the cone that is the chief reason why loudspeakers usually sound like loudspeakers.

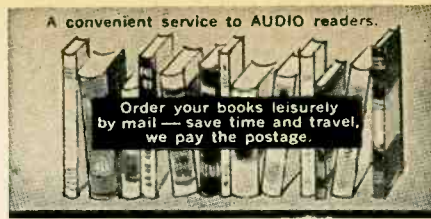
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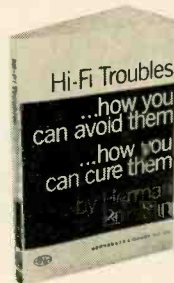
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TION RECORD FROM 'THE GREAT BAND ERA' with a message from Vaughn Monroe," followed by a warning: "PLEASE REMEMBER that this inexpensive Free Audition record is not intended to be 'High Fidelity'

Well, I wouldn't know whether it is or isn't. I never got the message. Because this record is pressed on plastic-coated paper and the plastic face has shrunk in the pressing process so that the single playing side is now a vertical concave section of a cylinder, the edges rising about 3 inches upwards from plane. No amount of flattening, under piles of books, or via stretch-over the edge of a table (the way you do with photo prints that curl) has had any noticeable result.

Fortunately, no manufacturer is given, so I don't have to mention his name.

Now why in the world didn't the Reader's Digest give us two sides of samplings, not one—and coat both sides of the blank with plastic facing? Not only twice as much sample material, but an equalized shrinking and—I'd suppose—consequent playability on the home machine! That is if the clearly visible dents and wrinkles and dimples I can now see on the recorded side would allow the stylus to sit in the groove long enough to make at least momentary sense. As a matter of fact, I doubt that they would.

So there's the present State of the Art.

SOLID-STATE VW

It was some time last year that I first began to hear about this thing called transistorized ignition. At first I thought it was something to do with a noise suppressor for the car radio, until our Big Boss turned to describe the gadget he had just installed on his large red motorcar, the brand that begins and ends with a C. Seems it did some rather nice things for that big C-----c. So ye Boss proceeded to write it up in our EQUIPMENT PROFILE, on the general theory that transistors and audio are more or less synonymous. Please refer to the February, 1965, issue.

Well one day not so far back the same Big Boss got to telling me more about the thing, which by this time was one of his Latest Enthusiasms.

Natch, in my dumbish way I had thought that for a C-----c with eight cylinders maybe you had eight big transistors, one for each "channel," so to speak. Remember, I don't get to know about things like this unless somebody comes along and tells me in simplified English. (Even the experts have to learn their expert stuff *somewhere*.) So I discovered, to my surprise, that it wasn't so; that one transistor-ignition model worked on any old car, and for any old number of cylinders. (After all, you only have one battery, and one coil . . .) Just a matter of where the thing is plugged into the circuit. It comes before the distribution—I mean the distributor. So, you see, you can have 126 cylinders in your car and it'll still work. If the 126 cylinders work.

Well, the upshot of all this enthusiasm was as you can guess. Why not me too? And the very next thing I knew, I had a solid-state ignition coming my way, just like the Boss's. It's the Spark-Injector Transistorized Ignition System, made by

Network Research and Mfg. Corp.* (Odd name, especially since the trade mark is a piece of sine wave on a graph.) The practical idea behind this was simple. Having tried the fanciest of cars, now how about the lowliest? How about thinking small? In fact, how about a transistorized VW? For that lowly semi-automobile, 1965 model, is my proud possession.

What, if anything, could be done for the beetle via solid-state circuitry? Some question! Because the very first thing you read about is that transistor ignition is most effective in the high speed range, above 65 or so. That's where it really works, delivering fat, clean sparks to the plugs where the ordinary system begins to lose its square-wave shaping and run into all sorts of hangovers and transients, to the detriment of lu-fi performance.

The 1965 beetle, you understand, will go 73 by company guarantee. So that gave me a nominal 8 miles per hour to play with. Below 65, for all I could expect, I wouldn't really be able to tell the diff.

On the other hand, the solid-state virtues are supposed to include a few other pleasing items. Like, say, an increase in gas mileage, and especially, a *non-decrease*, after tune-up, the mileage remaining as good as ever even up to 10,000 miles without points-and-plugs checking. With the usual mechanical ignition, the mileage tends to fall off seriously after 2 or 3 thousand miles, or less. (When was *your* last inspection?)

All of this and more, I gathered, was thanks to the basic fact of the new system, whereby the transistors take on the switching of the heavy current, leaving the mechanical switches in the distributor with an easy job to do, a light load and no pitting.

These attributes sounded to me like fine things for a VW as well as a C-----c. So, one day last summer, my assistant of the moment went out to my parking lot with the little thing in one hand and a few minutes later I drove merrily off on an errand, as if nothing had happened. All installed and working. A solid-state VW.

As a matter of fact, I had momentarily forgotten the change, in the press of other business. But I soon remembered. For suddenly, I had a brand new VW. Perky, lively, smooth-running and (relatively) potent. I was entranced. No missing the change—the car, indeed, acted a lot better than new; for VW's tend to be feeble indeed for the first few thousand miles of their lives, only coming into full power (as of my experience) at around 7000 on the odometer. It happened, too, that my car was well over the 3000-mile stretch of inattention that comes between inspections, and I had an appointment the very next day for the needed tune-up. The new ignition system instantly restored the engine precisely to its newly-tuned state, as compared with the insensibly deteriorated performance normal after several thousand miles. Astonishing.

To tell the truth, I had been a bit nervous; for I can't afford to try out gadgets on a car that spends so much time on the deadly parkways in and around New York, where a failure of any sort on the road is

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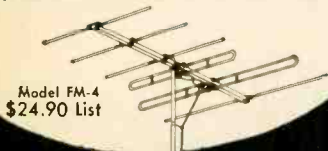
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a disaster. But when I found that to restore normal ignition, by-passing the the transistor unit, I merely would have to unscrew two connections and join them on a third binding post; I figured I'd risk it. After ten minutes on the road, that afternoon, I stopped worrying—and I haven't worried for 3000 miles since. Perfection. Not a trace of trouble nor any adverse effect of any sort. Haven't even looked at the thing since.

Now here's where I must go into generalities. The Big Boss, being an engineer, did an all-out test on his unit and reported same. I've started to any number of times. But I keep forgetting to put down the data. And one thing I simply cannot bring myself to do, absolutely necessary for a real comparison of transistorized vs. standard ignition, is to disconnect my solid state and return, for awhile, to the

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SELL: Weathers Professional PS-11 arm, cartridge, and 2-speed turntable (walnut). Excellent condition. \$135 prepaid. James Kregg, 5003 Bertram, Chicago, Illinois.

FOR SALE: Background music receivers, McMartin TN77 (new), \$125. Calbest MC707 (new), \$100. Bogen RM-3, \$75. Browning XR-100, \$50. P. O. Box 5723, Cleveland, Ohio.

EXCELLENT MONO EQUIPMENT: Fisher FM80 tuner, \$50. Dynaco preamp, \$20. Sullivan, 10 Standish Road, Milton, Mass. 02187.

SELL: Crown 822, Ampex PR-10 & 601, Fleetwood 800, Electro-Voice Georgian & Aristocrat, Citation A, I & II, Sony SSA-777, Pratt, 1201 Ellis, Cedar Rapids, Iowa 52405.

WANTED: Bzok B-400 speaker system. Please state price, vintage, condition in first letter. David Ellis, 2016 O Street, N. W., Washington, D. C. 20036.

FOR SALE: McIntosh C22, \$150. MC75, \$130; Thorens TD-124, Ortofon RMG-212, SPU-GT, \$130. Late models, excellent condition. Klipschorn enclosure, lacquered maple JBL mid-range high-frequency compression driver (7" 30 pounds), exponential horn, Electro-Voice 15W 15" woofer, JBL 500-Hz crossover. Superlative sound. Must sacrifice because of move to cramped quarters. Original Klipschorn. \$950, now \$250. Consider lower price for entire group. Barry Doyle, 8 Valley View Drive, Greenville, Rhode Island 02828.

normal system. I'm sorry. I've had it in mind for weeks. But I always put it off. I like solid state too much. I don't want ever to drive on standard ignition again.

I can give you a good idea, though, of the solid state sensations.

1. The car runs much more smoothly, is indefinably more lively, even at lower speeds where, in theory, the solid state has relatively little effect. It seems to have much more power (relatively speaking); it is eternally nimble, young at heart, ready-to-go. Do I sound like a copy writer? Well, that's the effect.

2. The nimbleness is permanent. That's what is really good! It does not gradually depart, as is normal between tune-ups. No doubt this is because of super-clean points and permanently clean spark plugs.

3. At higher speeds, on the turnpike, the increase in pulling power is very definite. On grades where, with the narrow VW margin of power, I used to slow down from 60 to 55 or even 50 I now maintain 60 or even increase the speed on the grade. After all, the range between 55 and 65 is vital on superhighway legal-speed driving.

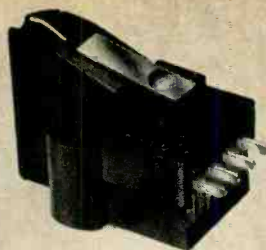
4. Gas mileage? Well—I didn't keep figures beforehand, but, as you know, the VW people tell you to expect 32 miles per gallon. Since being transistorized, I've racked up anywhere from 33 to 38 in normal driving, including slow rush-hour traffic jams in the city and a good proportion of fast superhigh-way hilly driving, plus more hills on standard old-fashioned roads in New York State and Connecticut. My lowest figure for 300 miles was, with an extra passenger and baggage, on a day of superhighway driving in a blinding series of cloudbursts—at 35 mph. Thanks to ploughing for hours on end through a steady couple of inches of sloshing water, I got a mere 32.8 for that trip. We never did get where we were going.

5. I haven't looked at the points and plugs since the changeover—but, judging from continued performance and according to the prognosis of the theory, I will find them clean as a whistle and just like new when the time finally comes. They should go on and on.

Finally, I noted that this unit uses the regular coil which comes with your car—otherwise I would not have been willing to try it. Don't like running extra-high voltages into my plugs, above and beyond the call of duty. It seems that most solid-state ignitions (this company says) resort to special coils. They can damage plugs as well as performance. And they may cause poor starting in cold weather. Definitely, with ten-below and no garage, I think I'll avoid that.

So, with my own coil—VW's—still in place, I expect no starting trouble nor any plug troubles. The beetle is the best-starting car on the market anyhow and I'd hate to change it. No fear, this time.

The Spark Injector ain't hay; it'll cost you \$50 or so. I'd say it's well worth it for anyone who listens to his car's sounds of combat and knows when things aren't all they should be. (Some of us just drive. Until the beast drops dead.) It might even pay for itself, in 50,000 miles or so. That's nothing for a beetle. (Plug.)



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You'll find these same features — and more — on our higher-priced E-V three-way speakers. The difference here is in degree, not in basic design. Our more expensive units have larger magnets and even tighter tolerances for smoother, wider range and higher efficiency. They are well worth the higher investment.

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