

**AUDIO
EDUCATION**

Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • JULY 1974 75c ®

47425 

QUADRAPHONIC PROGRESS REPORT



U0803760 0476 30725005P0101212 * *
DON L HUNTER
2608 CENTRAL BLVD
EUGENE OR 97403

t of each is up to us.

professional 10½-inch tape reels. Its unique combination of bias and equalization switching controls give 12 different settings to optimize the performance of any tape on the market.

The RT-1050's 3-motor transport system is activated electronically by full logic, solid state circuitry, triggered by feather touch pushbutton controls. Its transport is completely jam- and spill-proof, permitting you to switch from Fast Forward to Fast Rewind, bypassing the Stop button.

The RT-1050 was specifically

designed for easy operation with a wide combination of professional features like extended linearity VU meters with adjustable sensitivity, mic/line mixing, pushbutton speed selection and reel tension adjustment buttons. There's also an exclusively designed pause control and independent control of left and right recording tracks.

The same 2-track recording system studios use for better signal-to-noise ratios and higher dynamic range is incorporated into the RT-1050. Yet it can be easily converted to 4-track use with an

optional plug-in head assembly. Everything considered it's the most versatile open-reel deck you can buy. Professionals prefer it for its studio-quality performance. Everyone appreciates its completely simple operation.

Pioneer open-reel and cassette decks are built with the same outstanding quality, precision and performance of all Pioneer stereo components. That's why, whichever you choose, you know it's completely professional and indisputably the finest value ever in a studio-quality tape deck.



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Giving you the best

High fidelity is important to us at Pioneer. It's all we do and it's all we care about. We are excited that cassette tape decks have reached a level of performance that meet the highest standards. We are excited because we know that it means more enjoyment for you from your high fidelity system. We also know that you can now get more versatility and more value out of your high fidelity system than ever before.

The great advances in cassette technology have had impact on the reel-to-reel tape deck concept as well. We believe that the era of the small, inexpensive 7-inch reel tape deck is past. Neither its convenience nor its performance make it a good value compared to the new cassette technology. And it is now possible for Pioneer to offer you a professional studio-quality 10½-inch reel deck at prices that compare favorably with what you might expect from old fashioned 7-inch reel units. In our judgment the old ideas must move aside for the new ideas. And Pioneer has some very intelligent new ideas in tape for you.

The convenience of cassette. The performance of open-reel.

The stereo cassette deck has become a "must" in complete high fidelity systems. Because of its convenience, price and performance, it has virtually replaced the once popular 7-inch open-reel deck. As Julian D. Hirsch, prominent audio reviewer put it, "The best cassette machines compare favorably with a good open-reel recorder in listening quality." Pioneer proves it with four top-performing models.



Stacks compatibly with other components.

Our new CT-7171, with built-in Dolby, is a deck with a difference. It's designed with all controls up front so you can stack other components on or under it. Even the illuminated cassette compartment is front loading, for easy access and visibility.

Performance features stack up, too. Bias and equalization switches provide optimum recording and playback for every type of cassette tape made. You'll produce distortion-free recordings consistently with two oversized, illuminated VU meters plus an instant-acting peak level indicator light. And for those unpredictable program source peaks, there's a selectable Level L limiter circuit. It's similar to the type used in professional recording studios to prevent "clipping" distortion.

Finding a desired program point in a recorded cassette is simple with our new CT-7171. A memory rewind switch,

working together with the 3-digit tape counter, plus an exclusive Skip button, lets you monitor audibly at accelerated speed to make precision cueing a breeze.

Automatic tape-end stop, dual concentric level controls, separate mic/line inputs, pause control, in addition to many other features, make the CT-7171 the recording studio that fits on a shelf.

Whether you choose the sophistication of the CT-7171 or Pioneer's CT-5151, CT-4141A or CT-3131A, which share many of its features, you're assured optimum performance and maximum value. One tradition that never changes at Pioneer.

Open-reel. A professional recording studio in your home.

Professionalism comes with all three studio-quality open-reel models. The RT-1020L (7½, 3¾ ips) is unequalled in 4-track units. With three motors and three heads, it has virtually every professional feature you'd want. Yet it's extremely simple to use. In addition to stereo record/playback, it also highlights 4-channel playback. The complete extent of its capabilities becomes apparent only after you've worked with it. Then you'll recognize the magnitude of Pioneer's accomplishment.

Our FT-1050 is a 2-track, 2-speed (15, 7½ ips) 3-head deck which, like all our open-reel models, can handle



12 Bias & Equalization settings optimize performance.



**Whether you use
a cassette or
open reel deck
is up to you.**



Pick The Open-Reel Deck Features You Need

Model	RT-1050	RT-1020H	RT-1020L
Maximum Reel Size	10½"	10½"	10½"
Speeds	15 & 7½ ips	15 & 7½ ips	7½ & 3¾ ips
Number of Tracks	2 (4 optional)	4	4
Wow & Flutter (at high speed)	0.06%	0.06%	0.10%
Frequency Response (±3dB)	30Hz-22kHz	30Hz-22kHz	40Hz-20kHz
Tape Bias Selection	3 position	3 position	3 position
S/N Ratio	57dB	55dB	55dB
Equalizer Selection	4-Position	2-Position	2-Position
Mic/Line Mixing	yes	yes	yes
LED Peak Indicator	yes	no	no
Memory Recording	yes	yes	yes
VU Meter Scale Selection	yes	no	no
4-Channel Playback	no	yes	yes
Motors	3	3	3
Price	\$699.95	\$649.95	\$649.95

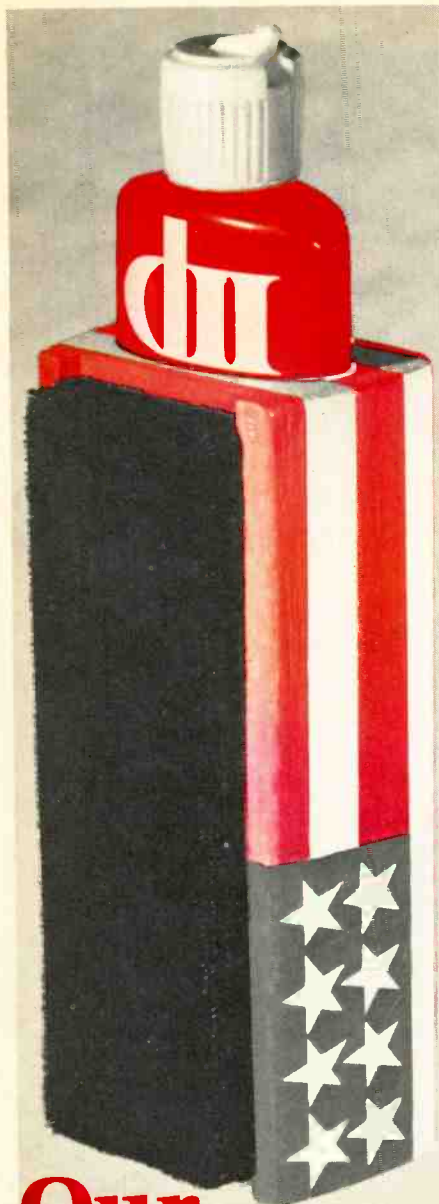
Pick the Cassette Features You Need

Model	CT-7171	CT-5151	CT-4141A	CT-3131A*
Dolby Noise Reduction	yes	yes	yes	no
Tape Selection Bias & Equal.	Bias & Equal.	Bias & Equal.	Bias & Equal.	Equalization
Auto. Tape Stop	yes	yes	yes	yes
Memory Rewind	yes	yes	no	no
Pause Control	yes	yes	yes	yes
Freq. Response*	30-16,000 Hz	30-16,000 Hz	30-15,000 Hz	30-15,000 Hz (*Chrome Tape)
Peak Indicator	yes	yes	no	no
Level limiter	yes	yes	no	no
Skip cueing	yes	yes	yes	no
Signal/Noise (Dolby)	58 dB	58 dB	58 dB	—
S/N (Less Dolby)	48 dB	48 dB	48 dB	47 dB
Tape Heads	Ferrite	Ferrite	Permalloy	Permalloy
Motor Type	DC Servo	DC Servo	DC Servo	DC Servo
Wow & Flutter (WRMS)	0.10%	0.12%	0.13%	0.13%
Price	\$369.95	\$269.95	\$239.95	\$179.95

*not shown



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Audio

Vol. 58, No. 7

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July, 1974

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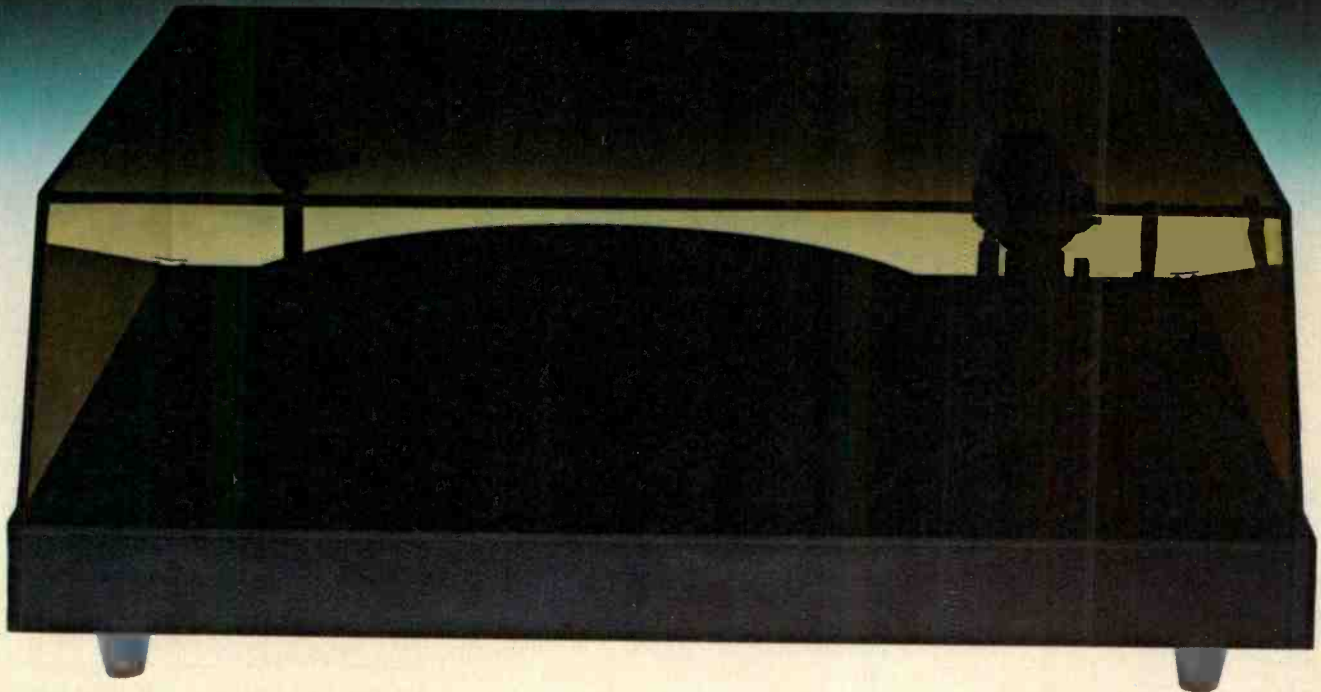
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About the cover: Four-channel sound has made many advances in the last couple of years with chips, discs, complete quadraphonic systems and a variety of accessories. Our cover symbolizes this progress.

Audioclinic

Joseph Giovanelli

Maximum Volume Control Setting Versus Power Output

Q. I own a four-channel synthesizer which controls both the amplifiers of my system. If each amplifier is set at full volume and if all volume is controlled via the synthesizer, do the amplifiers heat up and produce their average amount of distortion as if they were playing at full volume constantly? Or is the distortion and "wear and tear" on the amplifiers a function of the volume determined by the setting of the control on the synthesizer?
—Richard Bearoff, Carlisle, Pennsylvania

A. The fact that you set the volume controls on your power amplifiers to their maximum settings has nothing to do with their producing maximum power. The power delivered by any amplifier is determined by the amount of actual signal present at the input of the amplifier. This input signal is determined by the amount of signal produced by the preamplifier. What I am saying is that if the volume controls of the power amplifiers are turned up fully and if there is no signal presented to their inputs, the amplifier will not generate any significant output power. The only signal it will produce is its own internal noise, present in all electronic equipment. This noise is generally so low as not to be heard in the loudspeakers. Fully advancing the volume means that if the synthesizer produces one volt of signal, this voltage will be fed unattenuated into the input of the power amplifier. If it happens that one volt is needed to drive the power amplifier to full output, under the conditions I have described, the amplifier will deliver its maximum output power. When the volume control of the synthesizer is reduced so that it is now supplying 0.1 volt, however, the power amplifier will produce considerably less power output than its maximum possible output, even though its volume control is set to its maximum clockwise position.

If the volume control on the power amplifier is tuned down, the amount of voltage supplied by the synthesizer is attenuated before it can affect the power amplifier. Again, if we have a power amplifier which is capable of maximum rated power output at a signal level of one volt, and if the synthesizer is producing this one volt, the amplifier will now not produce full output power because its volume control

has been set lower than maximum. Therefore, the power amplifier is receiving less than the full signal from the synthesizer.

While what I have said is true, there may be other considerations which would keep you from setting your power amplifiers' volume controls to their maximum clockwise positions. If the synthesizer produces noise (as all electronic gear does) and if your power amplifiers have fairly high gain, this noise might appear as a hiss in the loudspeakers all the time, regardless of the setting of the controls of the synthesizer. The noise can be reduced by decreasing the volume control settings of the power amplifiers to a point where the hiss just disappears.

If the two power amplifiers are of different manufacture, their characteristics may be different enough so that, with their volume controls wide open, each would produce a different amount of output power, given the same input signal voltage. The result would be channel imbalance. You would have to correct for this by adjusting the volume controls of the "stronger" power amplifier.

Degrading of Electrolytic Capacitors

Q. Is it true that electrolytic capacitors wear out gradually if left in a non-operating condition? Such could easily be the case with consumer-type electronic audio gear which may not be operated for extended periods of time. How insidious for an amplifier to wear out just sitting there—say, perhaps in storage, for a considerable length of time!—Steven Heinisch, Prior Lake, Minnesota

A. When an electrolytic capacitor is not used, most of the time its capacitance does not change much. Its voltage breakdown point, however, will gradually fall. This fact can cause trouble when a piece of equipment has not been operated for long periods. In some instances, the capacitance may also decrease.

If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped self-addressed envelope.

Introducing our new speakers. They stubbornly maintain their neutrality.

We call them *the Neutrals*. And that's how we designed them—to be neutral, as free of coloration as possible. Because Technics is convinced neutrality is the key to great speaker performance.

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Technics speakers achieve their unusually high degree of neutrality without using gimmicks. Instead, they use drivers of proven design. Like phenolic-ring tweeters, dome-center cone supertweeters, cone-type midranges, and air-suspension woofers. Expertly matched with specially

tailored crossover networks. And then precisely positioned in fully sealed enclosures.

Model	T-200	T-300	T-400	T-500
Freq. Resp.: free field	44-18kHz ± 3dB -10dB at 35Hz	40-20kHz ± 3dB -10dB at 50Hz	38-20kHz ± 3dB -10dB at 28Hz	35-20kHz ± 3dB -10dB at 25Hz
Dispersion: on axis-1m.	120° at 10,000 Hz	160° at 10,000 Hz	180° at 10,000 Hz	180° at 10,000 Hz
Power:				
minimum	10 watts	10 watts	10 watts	10 watts
max. music	100 watts	100 watts	100 watts	100 watts
max. 400Hz	40w-5 min.	50w-5 min.	90w-5 min.	100w-5 min.
Sensitivity: 3,000 cu. ft.	10w = 90dB SPL	10w = 90dB SPL	10w = 92dB SPL	10w = 92dB SPL
Drivers:				
woofer	10"	10"	12"	2-10"
midrange		3"	5"	5"
tweeter	1 3/4"	2"	3 1/2"	2-1 3/4"
supertweeter			2-2"	2-2"
Controls: normal f-3dB	tweeter	tweeter midrange	tweeter midrange	tweeter midrange
Enclosure:				
oiled walnut	H-21 3/4" W-12" D-10 1/2"	H-24 3/4" W-13 3/4" D-12 1/2"	H-27" W-15" D-13 1/4"	H-29" W-18 3/4" D-14 1/2"

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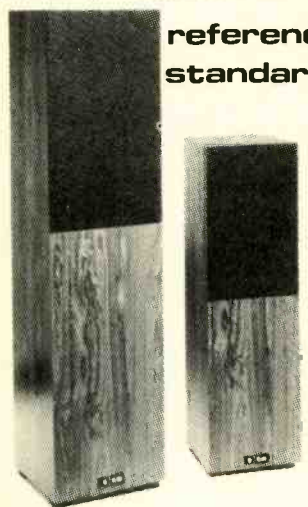
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Tape Guide

Herman Burstein

Connecting Heads

Q. Would you tell me the best way to connect two record heads to one recording channel? Should they be connected in series or parallel, and is an isolation network necessary? Please inform me if there would be problems such as insufficient record or bias current.—John K. Behrens, Eagle Pass, Texas

A. I would advise against connecting your record heads either in parallel or series because of problems of bias and signal current. It seems that the logical thing to do is to split the audio signal and feed it through isolating resistors to each recording head. The proper value of the isolating resistor would depend on the impedance of the record head. Perhaps you can determine this experimentally or with the aid of the tape machine manufacturer. You will have to compensate for signal loss due to the isolating resistors, and this in turn will require readjustment of the record level indicator, unless the audio signal is split at a point prior to the indicator. Finally, you will have to make provision for feeding sufficient bias current to the extra record head.

Three Motors

Q. I would like to obtain information on the advantages and disadvantages of three motors in a 3-head tape deck over a single motor in a 3-head deck. Is the much higher price of a 3-motor tape deck really worth it?—I. R. Ligon, Toronto, Ontario, Canada

A. From the point of view of performance, a 3-motor tape recorder offers little if any advantage over a high quality 1-motor unit. In fact, if the machine is to be portable, the 3-motor unit is at a disadvantage, being heavier. On the other hand, a 3-motor recorder does tend to be more rugged and better able to withstand the full-daily kind of use that a commercial recorder is exposed to. Usually the 3-motor unit has faster, and perhaps smoother, rapid wind. Also, it tends to be a less complex affair in mechanical respects, therefore less subject to breakdown. All-in-all, though, for home use, a well-made 1-motor recorder appears to be quite adequate for high fidelity. Some of the most highly regarded home machines have but one motor.

1/2 Mil Tape

Q. I have been taping operas from the Saturday afternoon broadcasts onto an Ampex 2100 tape deck, using Irish 1/2 mil polyester tape. I have noticed that, contrary to the manufacturer's claim, after a year the recording deteriorates and develops what I call "warbles" in the treble range. The effect is sometimes startling. I have taken the matter up with the distributor, but with no satisfaction. I should add that in general the tapes play back many times without apparent deterioration; the problem occurs only after a year, and does not discriminate between often or seldom used tapes. I plan to switch to either 3/4 or 1 mil polyester tapes in the hope that this may help eliminate the undesired sounds. It will be quite a job, as I have over 30 operas nicely taped and edited. Any suggestions you can offer to help me build up a permanent library will be most appreciated.—John A. Stees, Mainland, Pennsylvania

A. It seems that 1/2 mil tape of any brand is a good thing to stay away from. The NAB (National Association of Broadcasters) standards state that 1/2 mil tape is "not recommended." Therefore I suggest that as quickly as possible, before deterioration sets in, you transfer your valued recordings which are still in good shape onto 1 mil or 1 1/2 mil tape of good quality.

Note

Mr. Ivan Berger (of *Popular Mechanics*, New York, N.Y.) points out a "goof" in my answer to Mr. Jose F. Reyes in the March issue. He states that since the Sony TC-100A and Crown CSC 9350M are both cassette recorders, "they're perfectly compatible. Stereo cassette recorders have both tracks of each stereo pair side by side, covering the same area. So both stereo heads will automatically read the mono track, and a mono head will automatically read both stereo ones." Correct, of course! **H.B.**

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

We give you the softest soft to the loudest loud. Choose any model. You won't get 'clipped'.

Today's best recordings can reproduce music's full dynamic range, from the softest soft to the loudest loud. Most of today's popular low and moderate efficiency speaker systems can't. But BIC VENTURI™ speakers do.

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BIC VENTURI speakers are efficient! They need as little as one fifth the amplifier power of most air suspension systems for the same sound output. So, you can listen louder without pushing your amplifier to the point where it starts clipping the tops and bottoms of musical peaks.

Today's popular, low-efficiency speakers require about a 50-watt per channel amplifier to deliver lifelike sound levels. Even our Formula 2 will deliver that same sound level with only 25 watts of amplifier power; the Formula 4 with 20 watts and our Formula 6 with only 9 watts! With BIC VENTURI, your amplifier can loaf along with plenty of reserve "headroom" to reproduce musical peaks cleanly, effortlessly. It's as if your present amplifier suddenly became two to five times as powerful. BIC VENTURI can handle lots of power, too. A typical, low-efficiency system is rated for a maximum safe power input of about 50 watts. Feed it more power and you're likely to push it into distortion, or even self-destruction!

With a BIC VENTURI you can turn up the power, without distortion or speaker damage. Even our compact Formula 2 can safely handle 75 watts per channel. With that much power feeding it, it will deliver 210% more sound output than a low-efficiency system will at its

power limit. Drive our super efficient Formula 6 at its maximum, and it will deliver nearly 1300% more sound power!

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With soft music (or when you turn down the volume) you want to hear it soft.

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But BIC VENTURI's are. The sound goes smoothly softer, without any sudden fadeout, retaining all the subtle nuances that add to the character of the music.

But, even though BIC VENTURI speakers remain linear, there is a point where your ears do not. At lower sound levels, your ears lose their bass and treble sensitivity. So, our DYNAMIC TONAL BALANCE COMPENSATION™ circuit (pat. pending) takes over. As the volume goes down it adjusts frequency response, automatically to compensate for the ear's deficiencies. The result: aurally "flat" response, always!

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Behind The Scenes

Bert Whyte



The Wollensak 8075

AT THE 1973 Consumer Electronics Show in Chicago, the 3M Company demonstrated a prototype 8-track cartridge recorder featuring Dolby B noise reduction and new circuitry to utilize a special high performance tape formulation. This unit is now in regular production and is available as the Wollensak Model 8075. I have been using one of these recorders for some months now, and it is obvious that it represents a significant step forward in 8-track cartridge technology.

Since its introduction in 1965, the 8-track cartridge has been the predominant medium for car stereo. In the past several years, a steadily increasing number of people have been installing cartridge playback units in their homes, thus getting "double duty" from their commercially recorded cartridges. While this made economic sense to these people, they soon found that the playback of cartridges in the home revealed sonic flaws in this medium which were not apparent in the much noisier environment of their cars. The principal problem was, of course, the poor signal-to-noise ratio with its obtrusive tape hiss, along with restricted high frequency response and some distortion. The quieter ambience of the home also made any wow and flutter problems more obvious.

The 8-track cartridge was designed as a playback medium, but as is common with all magnetic tape formats, people soon wanted the ability to record their own programs. Thus the 8-track cartridge recorder came into being and since the cartridge is an endless loop configuration, with four 2-track stereo sequences, on the early

models there were timing problems. To be frank, those original cartridge recorders were so difficult to use, and the results so mediocre, that "rolling your own" cartridges simply wasn't worth the trouble. Nonetheless, some companies persevered on the idea of a cartridge recorder, principally Telex and Wollensak. While improvements in these units were slow in coming, I think it is safe to say that they have reached their culmination in this Wollensak 8075, and have finally made cartridge recording a practical proposition.

The Wollensak 8075 is an attractive-looking unit, with all controls easy to handle and in practical groupings. There are many refinements and little niceties to make life easier for the cartridge recordist, but let's look at the principal features. Foremost, of course, are the Dolby B noise reduction facilities. There is a three-position switch in the Dolby section. In the record/play position, a red signal light indicates the Dolby circuit is active in either mode. Dolby record and playback levels are factory preset. A check with my Dolby reference level cartridge revealed the playback to be "right on the money," with left and right meters indicating exactly 0 VU. The "off" position of the switch affords normal non-Dolby record and playback. The third position of the switch is for FM decode and record. Yes, the 8075 "gilds the lily" by enabling the decoding of Dolbyized FM broadcasts. On the rear of the unit are left and right channel Dolby FM calibration controls. When the FM station broadcasts its 400 Hz Dolby tone, the controls are adjusted to read 0 VU on the meters. When recording a Dolby

FM program, the switch is in the FM decode position. If the Dolby record/play position was used, you would be Dolbyizing a Dolby signal . . . and that is a "no-no." All Columbia cartridges are now Dolbyized, as are some selected Ampex cartridges and as played back through the 8075, those I auditioned were impressively quiet.

While the recorded Dolby music cartridges were of generally good quality, the most satisfying sound quality resulted from recording my own copies of Dolby "A" open reel tapes. On a more usual home recording activity, I was really impressed by the excellent sound of the Dolby cartridges I made of some high quality disc recordings. The Wollensak 8075 has a tape equalization switch for regular "high output/low noise" cartridges and a position marked "special" for the new 3M super high performance cartridges. No details of the "special" tape oxide are available, but presumably it is some variant of the new high density gamma ferric oxides now coming into vogue. In any case, with the machine set up for the specific bias and equalization of the tape, the performance is very high indeed. How about 30 Hz to 15 kHz, ± 3 dB for a cartridge? 3M has used a B and K $\frac{1}{3}$ -Octave Analyzer to show that the new high performance tape is better than 10 dB over regular tape at 16 kHz! This special 3M cartridge is in very limited supply at the moment. 3M did supply me with some however and, when used in conjunction with the Dolby noise reduction, the recordings are really outstanding. The sound in all cases was clean and wide range with little or no distortion. And of course . . . blessed thing in a cartridge . . . virtually no tape hiss. How quiet is the 8075 with Dolby? Better than 60 dB at 4000 Hz and above, better than 59 at 2400 Hz, better than 56 dB at 1200 Hz.

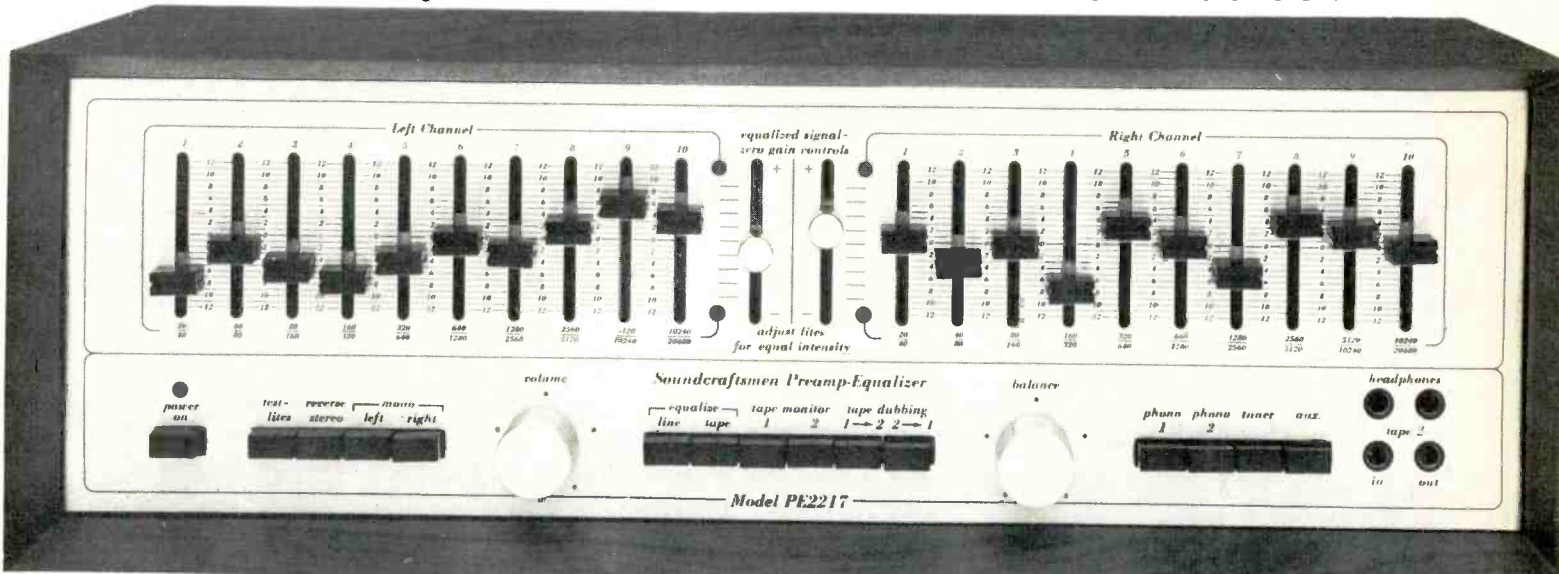
The Model 8075 has illuminated VU-type meters which read record and playback. The recording level controls are of the slide type. It is best not to trust the markings on the panel to set levels. Wollensak recommends using a mono signal, which is all right, but it is better to use a discrete frequency tone. For example, when recording phono discs, I used the CBS

(Continued on page 12)



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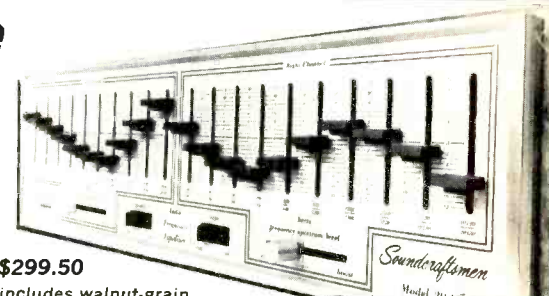
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Soundcraftsmen

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(Continued from page 8)

Labs STR100 test record, which has left and right 1000 Hz 0 VU @ 3.54 cm/sec. reference levels. I found that you cannot set the meters at 0 VU or overload will result from average level discs. With levels set at minus 3, S/N was optimum, distortion not apparent.

As mentioned before, timing and fitting of program material to the four stereo sequences has always been a tricky thing with cartridge recorders. While this problem has not been completely resolved in the Model 8075, sequencing has been greatly simplified. There are two switches for AUTO EJECT and REPEAT which work interdependently. Logic circuitry is incorporated here and, depending on the position of

the switches, there are various play and record options. For example, with REPEAT switch on position ONE, the machine will record the selected track and then eject. If the REPEAT switch is in the ALL position, the cartridge will be recorded tracks one through four in sequence and then eject. Of course there will be the switching click, and very minute loss of signal as the machine switches from sequence to sequence. In addition to the eject/repeat logic there is a digital counter registering in minutes and seconds. If you are a real stickler for timing accuracy and maximum utilization of sequence tape length, you can use a technique I used to sequence car-

tridge masters at RCA. I should add that this works only with typical pop recordings which are banded on each side of the phono record. Classical works require a much more complicated process with special equipment. In any case, assume a 60-minute cartridge, which ideally would mean four 15-minute sequences. Figure on 14 min. 50 second sequences as more realistic and manageable. Now add up the total time of the selections on the record. If the time is more than the total length of the cartridge, eliminate a selection whose time is enough to bring the total below the required time span. Now it will not be possible to record the selections in the same order as they were on the disc recording. Choose a group of selections which total in time as close as possible to the 14 min. 50 sec. sequence. Now record the disc onto open reel tape, preferably with Dolby noise reduction. Each selection on the disc is separated by a 5-second spiral, which naturally will be blank on the tape. By editing the tape to the groups of selections you have chosen and then deleting or adding blank tape between the selections, you can usually bring each sequence to the exact timing. After assembling the tape, it is then recorded onto the cartridge. An admitted pain, but in this way you won't cut into any of the music.

The Model 8075 also features a fast wind facility. I can see the value of this, but my personal feeling is that this upsets the conformation of the endless loop tape pack and can give rise to audible wow and flutter. Incidentally, the Model 8075 has a wow and flutter spec of 0.1% weighted rms, which is about par for most cartridge machines. Unfortunately, part of this spec is dependent on how good the cartridge itself is in terms of free tape flow. Far too often, the combination of the machine and the cartridge add up to audible wow.

The Wollensak Model 8075 has many other exemplary features that make for easy handling and good quality recording. This may raise the hackles of the companies which issue recorded music cartridges, but with the quality of this unit, it sure is nice to record your own programs, especially for use in a car. The Dolbyized cartridges played on non-Dolby equipment in a car sound fine, because if the hiss seems excessive, you can turn down the treble control, which gives you a form of noise reduction without losing highs. All in all, the Model 8075 is a fine example of the new breed of cartridge recorder. Æ



The B&K 1/3-Octave Analyzer display indicates the peak music at each 1/3 octave. Top photo shows display with Scotch brand High Output Low Noise tape. Bottom photo shows display with new Scotch brand Special High Performance tape, which was found to be better than 10 dB over regular tape at 16 kHz.



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Signals and Noises

IF A NOISE annoys an oyster, will it annoy *me*? What is noise—would the noise that Dolby eats up, and Burwen and dbx, be a sound an oyster might enjoy? If I seem mixed-up, it's because I have a pair of noise treaters on hand, one of them a batch of words, treating noise, and the other a consumer-type box, the same. And so different! How could I help but think of the oyster.

A play on words is one thing and a noise another. The audio man has a nice, pat definition in front of his nose when he sets out to treat what *he* calls noise. But move yourself a millimeter away and you are into philosphics and aesthetics, into music and non-music, and into a great deal of noisy hot water. Oyster stew. What is noise?

Ever tried out music on a dog or cat? No reaction, though a dog may raise a questioning ear to a speaking voice in the loudspeaker. The cat, like the oyster, just looks annoyed. Yet try a fire siren on your dog and get his reaction—nine out of ten docile house puppies turn instant wolf and let out gut-tearing wails of grief—or is it joy? Hard to tell. You should hear them in New York City, right out of the steppes of Russia or maybe the Alaskan North Slope, where they recorded that marvelous wolf-howling disc. Something atavistic in this sound. Back to primevality. *Noise*? Not for a wolf. Not for a dog, nor for me.

There's wolf in every human being. First time I played that wolf howl in my living room, all by myself. I rar'd back and let go with my own wolf howl, right in sync. It felt good. It belonged in me and out of me, the call of the wild, the clan, kindred souls communicating! Enough to stand the hair on end. I think maybe this is the original of the art of singing, which is a major part of music. Controlled wolf howl? Probably. Just as language is controlled bark, whine and growl.

I am a real wolf, I guess. Old hound dog near me in Connecticut; on a still night he sends out his CQ challenge, WOOF, wowowowowow, and waits for an answer. Sometimes I answer him, and I can hear the pleasure in his next, which is perceptibly higher in pitch. A fellow soul! Good doggie.

I think the most useful definition of noise in this area, as in much else,

even in audio, is non-communication. Noise, practically speaking, is meaningless sound. Meaningless to whom? Can't get out of it that easily, you see. If I can communicate with a dog, can you communicate with Stravinsky? One man's noise is another's communication. What kind of noise, then, do we selectively reduce in audio equipment designed for the purpose? The audio circuitry leaves the wolf howl untouched. Also Stravinsky. That is *signal*, not noise. Communication, you see, is directly at the nub, in the very meaning of the word signal, clearly related to *signify*. It means something. If we agree on any aspect of noise, it is that we do have common modes of intercommunication in sound and it is these which provide us with signal.

Noise has been defined and redefined and it is amusing to see how self-serving all such definitions are, in the name of objectivity. Words are that way—they fill a need. They define things after the fact. First the fruit and then the apple. What is a tree? *That's* a tree, right over there, though its prehistoric forebears had no name at all and didn't mind in the slightest. How do you define a hill as contrasted to a valley? Nature couldn't care less, and the only boundaries between the two are man-made and man-thought. Nature *is*, man defines.

And so in audio, noise is the meaningless, therefore the *unwanted*, stuff, unwanted for whatever reason—as opposed to the wanted, the significant signal. Ours not to reason why. (Ours but to do and die!) That's good engineering. Further, noise, generally, is electronic "sound" that leaks in or generates itself uninvited additively. Or destructively. Yet the signal can be noise. We generate it in shades of pink, white and gray, in fine contradiction. Nobody yet, to my knowledge, has hooked up a Dolby A noise reduction unit to a white-noise generator to see which could outdo the other. The reason is clear enough if you understand the "wanted" in our field is interchangeable with "original," both being signal rather than noise. But as you'll see, even here we walk on eggs.

I have here those pages of noise treatment, from a correspondent who has come at me from so many angles I haven't always realized he was one and the same, Morris Knight. Look back in March, p. 88, and you will

find my capsule review of **New York Brass Quintet Plays Knight**, on the Now label. I used the word noise. Mr. Knight isn't sure I made my meaning clear, though he does think my (75-word) review was "thoughtful and well written" which, considering I said his music contained "vast stretches of chicken-like cluckings and scratchings," was rather decent of him, you'll admit. I liked it. "Such a range of brass noises you'd never guess," I said.

Well, I knew what I meant, though not according to any audio definition. This was brass music with (a) *unpitched* sounds—grunts, clucks, burps. In music, noise often means unpitched sound. And (b) *non-standard*, i.e., new and novel sounds not in the normal brass communication, over and beyond the expected musical language—hence, noise. Hmmm. Yes, I'll stand by it. Maybe "brass sounds" would have been more neutral; but also less descriptive. You see what is involved in writing capsules. Words work overtime.

Mr. Knight sent me three pages of his own comment on noise, plus two in duplicator purple, noise definitions. "People do not like noise. By definition it is unwanted sound." Cyril M. Harris, Ph.D., *Handbook of Noise Control*, 1957. So noise is undesirable sound? Too sieve-like, that definition. "Noise, in a sense, is the totality of all sounds within the range of hearing to which attention is not directed." My italics. Joseph L. Hunter, *Acoustics*, 1957. O-ho—so that's why I always say that background music for my ear is so much noise. A new factor, attention vs. inattention. If you don't attend, you don't communicate. Tell that to Dolby! So you see what I mean. All this is very subjective.

How about distortion? Distortion is noise, if you will, when it is added to or alters the signal or the signal perception. (Those two are different.) My first reaction, years back, at the time of the sudden appearance of the pocket "transistor" on our streets, parks, on the beach, was that suddenly, here was a wanted distortion, tolerated, invited, yet monstrous in terms of audio measurement. Small power, large overload. (Less in recent years as improvements have come along and power is greater.) People who carried these radios invariably turned them up far beyond the overload point into the agonized-scream range. Did they wince? Of course

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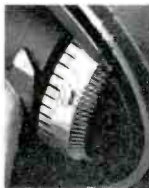
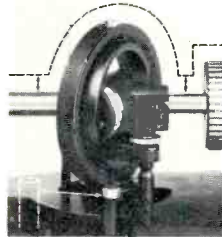
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not! This was desirable sound, if mainly for status. (But isn't plenty of hi fi that?) So look out—noise can be signal; so can distortion. The fuzz generator. One begins to wonder whether the "original" is getting to be no more than raw material, like the "original" of a multi-track pop recording.

And there's John Cage. A ballet, with deliberately overdriven loudspeakers squalling a hideously distorted live piano pickup. I groaned, but I got the point. Or his music for thirteen (?) radios, randomly and simultaneously tuned on stage, another thought-provoker and another kind of noise—or signal. *Randomness*. Is it communication? He makes it so, and he is right. Nobody is ever bored by Cage. Though, like the oyster, we are often annoyed.

Now Cage could be called esoteric or avant-garde but you can't call a transistor radio esoteric. And so I've long thought that its squeal is the finest walking illustration I know of the meaning of music, art and entertainment, and the best paradox around, too. Morris Knight goes me one better.

"The sound of surf and wind at an ocean beach can only objectively be measured as noise (it very much consists of non-period pulses, therefore non-pitched) (*See?*), yet populations as far as recorded history discloses have particularly sought this sound (noise?); furthermore, it has often been described as a curative." Can one imagine having this "noise" cut off at a beach? As a matter of fact, a radio playing "music" at the beach is often a very great in-

trusion . . . it becomes unwanted "sound."

Good! And what about a crowded beach where a dozen (or thirteen) radios compete for air space to the point of—What? Meaninglessness? Noise? All Cage did was to take that idea into the concert hall and ask you—what about it? This sound, too, exists. It *is*. You name it. And so we have enough of a paradoxical jumble here to last a month. As for me, on the beach, I want the ocean sound and I hate the radios, singly or in multiple, clear or distorted. I go there to absorb sun and listen to white noise. White signal? Maybe it's just as well that engineers like those at Dolby, Burwen and dbx stay strictly inside their audio technology—which is where I will confine myself from this point on.

Sitting on my table, underneath Morris Knight, is the "signal preserver" that started all this fuss, the dbx 154, all function and no aesthetics. Except in the looks. A small box, 9 x 10 and weighing nothing much; yet inside there are four discrete channels of highly sophisticated dbx signal preserving. Each is controlled by three simple push buttons, no more, REC, BYP and PLAY. That's all. Code-in, decode-out or bypass. The dbx 154 is "top of the line" in a new configuration of dbx equipment designed to complement the quality "home" or semi-pro recording equipment still burgeoning all over. There are other models for different needs but all share one really unique feature. These noise reducers are

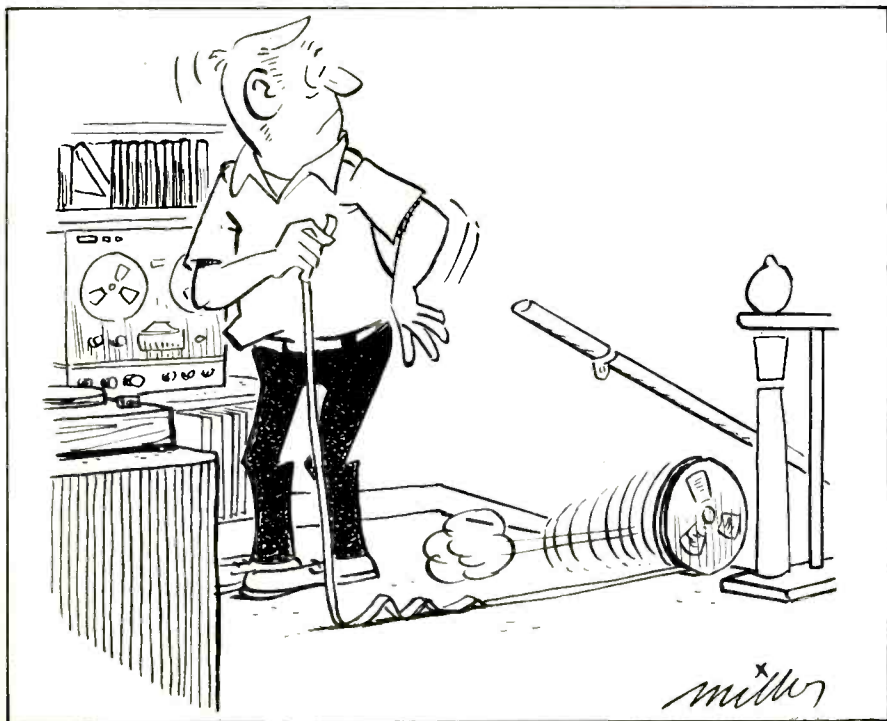
compatible with all existing dbx professional equipment. Same characteristics.

Now that is something. A free interchange, in terms of dbx noise (?) processing, between all sorts of four-track home-style equipment, light-duty, semi-pro, superduper—and the ultimate, the all-out heavy stuff in the pro studio. (Heavy in performance reliability, not weight.) It spreads a glorious recording potential, right across the board, and should extend the usefulness of the four-track quarter-inch tape, stereo or quadraphonic, into new areas.

If I am right, you see, increasing numbers of virtually pro recordists are already making use of the compact four-track quarter-inch tape for what amounts to professional recording, as standards for the medium continue to rise both in the tape itself and in equipment performance. But there are barriers left. Noise, the kind of noise we are talking about, is going down and down, S/N getting better, even without special treatment. Even so—with four narrow tracks on one narrow tape, and cassettes notwithstanding, the perfectionist tends to feel that some noise reduction circuitry would be a good thing, to remove any little micro-residue that just might somehow creep in. After all, look at all the half-inch and inch- and two-inch tapes in the "real" pro field. If they need it . . . ? With a bit of noise control, we could really call ourselves pro in most respects, at a tenth the cost. What we can afford.

Dolby? The obvious first thought. The Dolby success is twofold; first its clever world standardization, right from the beginning and, second, the fact that Dolby *does not touch the signal at all* except at its lowest levels. That's safety and sonic insurance and it has built up immense confidence. For your 10-plus dB of S/N improvement in Dolby A, you get a whale of a bargain in sound and total signal purity. Dolby B does equivalently well in its area. But you must make a choice if you intend to process your four-track recording in some near-pro fashion. The two Dolby circuits are not compatible. You record in Dolby B and you decode in the same—or you go all-out and buy the A, which ain't hay, I assure you. Not really intended for our intermediate area.


As most of us know, dbx goes a lot further than Dolby in noise reduction, up to 30 dB. But at a definite, tiny, yet considered risk. Dbx treats the whole signal with compression and expansion; the signal does *not* remain untouched. It get miraculously well re-



stored, though, especially considering the untidy history of past attempts at this approach. Just amazing. But dbx would be the first to say it is *possible* that a very acute ear, in some particular kind of signal, might conceivably notice a minute A-B discrepancy between signal IN and signal OUT. Depends on the sound. And of course, the ear. It's that sort of risk. Minus A-B, you are *very* unlikely to notice anything at all. Try for yourself. I've listened. I haven't heard anything wrong. Signal goes in. Signal comes back out, minus noise. Period. A small, calculated risk in exchange for a whale of an S/N advantage, and the dbx control method, the signal squared and then an antilog "average" taken as the level indicator (did I get it right?), seems to work astonishingly well.

And now—compatibility between "consumer" dbx and dbx professional. I couldn't wait to try. I've been muttering *testingtesting* into a channel or two of the dbx for some time but now I have a much better project in mind, a challenge as always. Coming up. Last year, my Canby Singers recorded with the tiny, battery-powered Nagra IVS in stereo for the second time, and with a new fillip, cheap electret mics from Electro-Voice. We threw out the expensive ones in their favor and we were absolutely delighted. So our third session this year will go this way: (1) Four electret mics, bottomed price; (2) my TEAC 2340 four-track quarter-inch quadrasonic recorder, still on hand; and (3) the little dbx 154, to encode the four-track session. How's that? Not even an oyster could object.

If this works, it'll be straight back to the processing studio and, hopefully, on to a disc, just like for real. Could be! You should try too. I see a great future for this dbx kind of consumer/pro compatibility and I look forward to taking a risk on it myself. Wish me luck.

P.S. One item at a time. Burwen goes further. Where dbx compresses signal around 2:1, Burwen goes up to 3:1, they tell me, for an incredible advantage—total silence in the background. I heard it—remember the kettledrum demo? Scared me out of my wits. But there is an inevitable additional risk of signal alteration. Try Burwen, and see. I *like* the way these noise people talk to you, not only about themselves but informatively about the other outfits. They are honest and they give you real information, a choice of different parameters to suit differing needs. Wish everybody in hi fi would talk this way. Good for our business. 



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Illustrated: Model AT14S with Shibata stylus, \$75.00,
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Check No. 4 on Reader Service Card

Editor's Review

APPARENTLY many readers of *AUDIO* are nostalgia buffs, judging from the response to Arthur Shifrin's article in our April issue. Quite a few have written to Mr. Shifrin, in care of the magazine, while many others commented favorably in letters or on the Reader Service Card. Such feedback, either positive or negative, is always welcome because it helps us gauge the amount of reader interest in various subjects, and ultimately gives you a magazine you'll find more interesting.

Be that as it may, the nostalgia buffs took it on the chin this spring, as one of the main producers of music away from home announced that it was getting out of the business. The Wurlitzer Co. said that it was discontinuing production of jukeboxes, of which it has made some 750,000 since it began in 1934. The firm says that the business is no longer profitable because there aren't enough places to put jukeboxes anymore and cites urban renewal and most particularly the demise of the neighborhood tavern. Wurlitzer estimates that about 45,000 jukeboxes were sold last year by the four major firms in the business, which the firm says is down from about 60,000 produced five years ago. Wurlitzer's three rivals disagree that a trend is in the making.

The first jukeboxes appeared in the 1930s and contained only 10 records, as compared with the 200 common today. Each play cost a nickel, and there was no selection; the patron could only hear whatever disc was next in line.

Russell Mawdsley, president of the Music Operators of America (MOA), the industry association, feels that jukeboxes have a good future. Basic to this, Mawdsley feels, is the restyling of the machines to help them fit in with the decor of today's chic restaurants and cocktail lounges.

Knowing what customers want to hear is also important to making money with jukeboxes. The man who operates the unit locally relies heavily on such industry publications as *Billboard* or *Cashbox* which list tunes frequently played by area of the country and type of location in which the jukebox is installed, as well as music type. The "top ten" dominates such lists, but country and western has about 15 per cent of this market and is gaining.

Guides to Recordings

The Schwann Record and Tape Guide folks have released a 20-page Basic Record Library of Jazz, a selective list of especially important jazz recordings made

from 1920 through 1973. All of the discs listed are still current and available through retail outlets. The list is arranged by decades, with a brief historical introduction, and supplementary artists' listings are extensively cross-referenced. Also included is a list of selected reference books and magazines about jazz recordings and performers. The Basic Record Library of Jazz was edited by Richard Seidel, former curator of the Institute of Jazz Studies at Rutgers Univ., and is available at record shops for 50¢ or from W. Schwann, Inc., 137A Newbury St., Boston, Mass. 02116 at 75¢ for individual copies.

JNP Audio Tapes, a division of Jeffrey Norton Publishers, has released a new 64-page catalog listing over 1,000 spoken-word tapes which they have available, with most priced at \$11.75. Basis of the series is Sound Seminars, formerly owned by McGraw-Hill, which includes the YMHA-WA Poetry Center Series of live recordings of contemporary poets, writers and critics. Another major source of titles is the Pacifica Foundation, which owns a network of four listener-supported FM radio stations. Subjects included range from Abnormal Behavior to Zen, while speakers include S.I. Hayakawa, Margaret Mead, Winston Churchill, Norman Mailer, Paul Goodman, Alan Watts, and a host of others. The catalog is available free of charge on request from Jeffrey Norton Publishers, Inc. 145A East 49th St., New York, N.Y. 10017.

Armstrong Awards

Eight FM radio stations will share \$4,000.00 in prize money for winning programs in the 10th Annual Armstrong Awards competition for excellence and originality in FM broadcasting. First place awards of \$500 and a bronze plaque in the commercial stations division went to WPST, Trenton, N.J., for "The Unfair, Impractical Equal Time Law and Fairness Doctrine," in the community service category; WRVR, New York City, for "Rockefeller's Drug Law," news; WTIC-FM, Hartford, Conn., for "The Listening Room" series, music, and WFMT, Chicago, for "A Legacy of War," education.

Winners in the non-commercial station division, who received similar awards, were: KPFA, Berkeley, Calif., for "The Little People, or Think Big," community service; WOSU-FM, Ohio State Univ., for "Municipal Court Series," news; WITF-FM, Hershey, Pa., for "The Opera: Der Ring Des Nibelungen," music, and CBL-FM, Toronto, for "Aldous Huxley and Beyond," education.

E.P.



Ms. Gladys Hopkowitz, Recording Engineer
Mastertone Recording Studio, Inc., New York

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This is the first American designed and manufactured stylus developed for discrete four-channel records. It was especially engineered for the Stanton 780/4DQ cartridge which is already the first choice of professional record reviewers, anxious to evaluate the new discrete 4-channel discs coming on the market.

The performance of the stylus (and cartridge) fulfills all the extensive demands and sophisticated requirements necessary for playback and review of all the material recorded on discrete discs. And while performing brilliantly, it is actually very kind to records in terms of wear. Stanton's own engineers, whose professional products are the standards of the industry, tested and proved its characteristics, and report that it functions with total reliability in every measurable aspect.

This new cartridge, the 780/4DQ is available at your franchised Stanton dealer.



For further information, write: Stanton Magnetics, Inc. Terminal Drive, Plainview, N.Y. 11803.

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QUADRAPHONIC

PROGRESS REPORT

George W. Tillett

OUR LAST SURVEY of the quadraphonic scene was back in July, 1973, and not a great deal has happened since then. There are still three main contenders—CBS and Sansui on the matrix side and RCA/JVC with their CD-4 system. E-V has virtually dropped out of the race, having transferred their patents to CBS, who has also picked up the Scheiber patents. Although the majority of receiver makers have opted for SQ (there are now more than 100 licensees), the tendency is to make provision for both—or all systems—which seems a sensible thing to do!

As far as records are concerned, the score is 360 SQ (includes releases from Columbia, Connoisseur, Vanguard, Project 3, et al. and Sansui QS 160 (ABC, Ovation, Black Jazz, Quad Spectrum, Dunhill, BASF, et al). JVC has

released a good number in Japan, but the combined total of JVC and RCA discs available here is less than 30, although many more are promised for release just about the time this article hits the editor's desk. (A JVC-circulated list published subsequent to the writing of this article shows 188 CD-4 discs released in this country from all sources. *Ed.*)

Many FM stations have been broadcasting matrix records (sometimes without mentioning it; two broadcast engineers told me the matrix discs sounded better than the regular two-channel version), but the situation with CD-4 is still unresolved. The Electronic Industries Association formed a committee to study the problems involved in broadcasting discrete records, and they are evaluating 10 different systems from Quadracast,

Zenith, RCA, GE, and others. One of the best, in my opinion, is the Quadracast system, also known as Dorren after its inventor. It has been tested over San Francisco's K-101 and a Toronto station as well. Like the other proposals, the Dorren system could be described as an extension or variation of the present multiplex stereo system. Figure 1 shows the baseband distribution of the stereo signal. The main channel, on the left, contains both left and right audio modulation, $L + R$, and the upper and lower sidebands (38 to 53 kHz and 38 to 23 kHz) carry the difference information, $L - R$. There is a pilot signal at 19 kHz which is used by the tuner to generate the missing 38 kHz carrier and so resolve the $L + R$ and $L - R$ signals by addition and subtraction to yield the left and right channel signals. The SCA

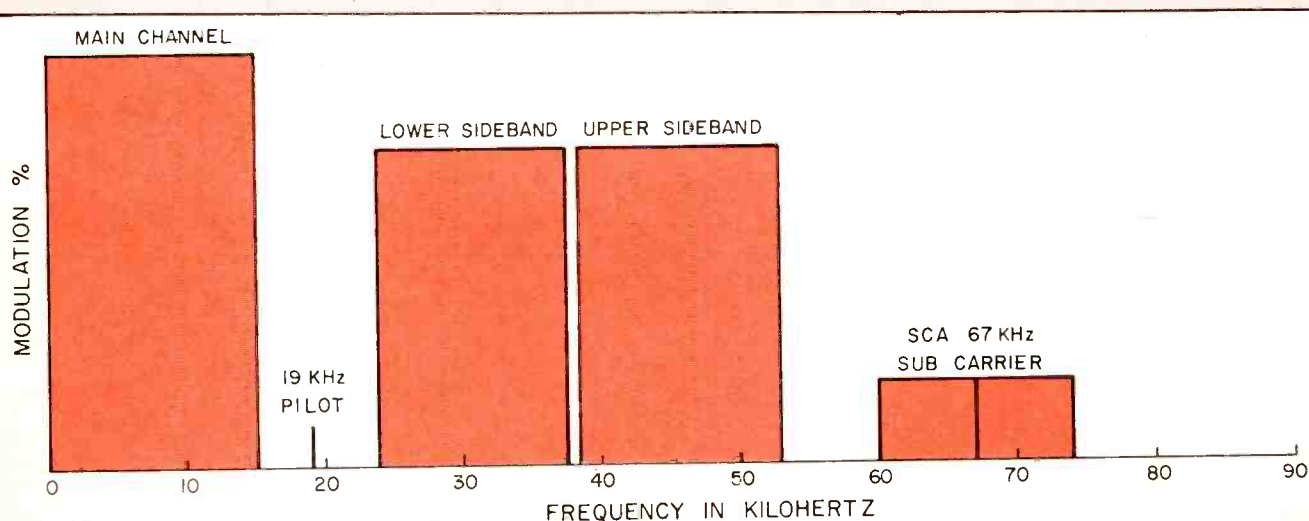


Fig. 1—Present stereo frequency distribution.

subcarrier, on the far right in the figure, is centered on 67 kHz, and this is used to provide special services and background music to subscribers who use an appropriate receiver or adaptor. The presence of this SCA signal is a source of exasperation to proponents of four-channel broadcasting because the FCC insists that there must be provision for it.

We will now see how the Dorren system tackles the problem. Figure 2 shows the basic arrangement. The main channel is in the same place but it now carries the sum of all four signals (L_f , L_r , R_f , and R_r). The 19-kHz pilot is retained, as is the suppressed 38-kHz subcarrier—but there are now two sets of upper and lower sidebands in quadrature. In other words, the second set leads the first by 90 degrees phase. It is then possible for a suitable detection circuit in the receiver to resolve them. The first pair of sidebands contains the following signals ($L_f + L_r - R_f - R_r$) and the second pair contributes

($L_f - L_r - R_f + R_r$). So far so good. (You probably wondered whether that algebra you learned in school would ever be of use!) Now, at 76 kHz there is another subcarrier with upper and lower sidebands and they carry additional difference information ($L_f - L_r + R_f - R_r$), and so the net result is four equations that end up as four separate signals. The 76-kHz carrier (4 times the 19 kHz pilot) is suppressed. As you can see, that SCA subcarrier now finds a home at 95 kHz—where it can be locked to the 19-kHz pilot ($5 \times 19 = 95$). Some critics have said that the Dorren scheme would contravene FCC regulations as there is information above 75 kHz—in other words, out-of-channel radiation. In fact, this is not so as the FCC rules stipulate merely that sidebands between 120 kHz and 240 kHz from carrier frequency must be attenuated by 25 dB or more. However, the extended bandwidth will certainly pose problems for some receivers, especially the less expensive kind.

Chips

Both JVC and CBS have designed and introduced IC “chips” for their decoders (strictly speaking, the JVC unit is a demodulator). The CD-4 device is made by Signetics and is a 16-pin, dual-in-line unit. Two are required with a few discrete components for a complete demodulator, and the printed board size is only four by three inches. ANRS noise reduction is incorporated, and the signal-to-noise is quoted at 48 dB. Phono RIAA equalization is also built-in, and the gain is around 50 dB at 1 kHz.

The SQ chips were jointly designed by CBS and Motorola, and three types are available so the designer has a choice of non-logic or three kinds of logic systems. Figure 4 shows separation of the basic matrix using a single chip. Left-to-right separation is high but front to back is relatively low and so this circuit will only be used with inexpensive equipment. Figure 5 shows how the separation is increased when a

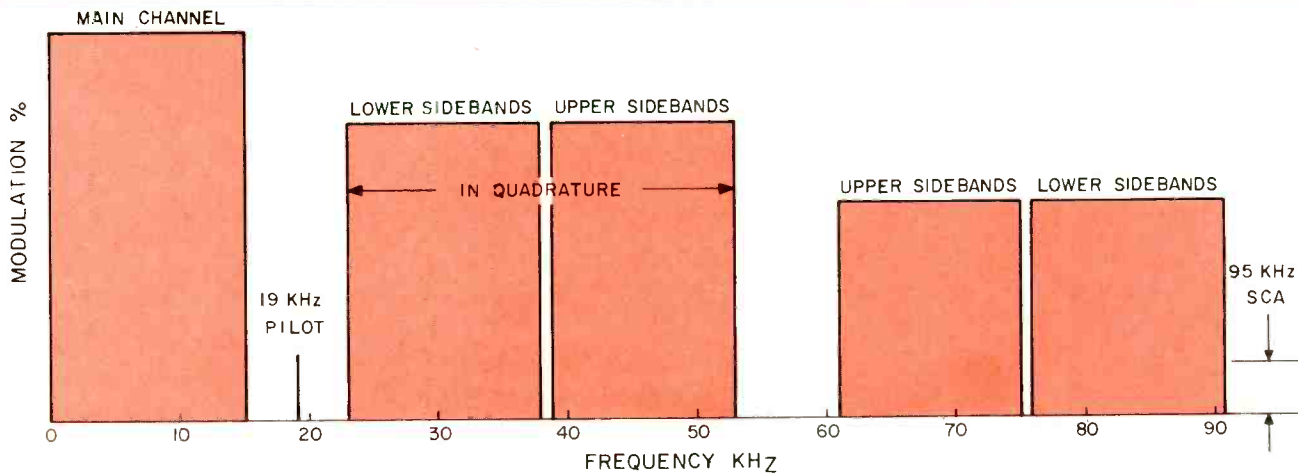


Fig. 2—Quadracast frequency distribution.



Fig. 3—Two of these ICs, plus a few small components, can replace JVC's 4DD-5 unit above.

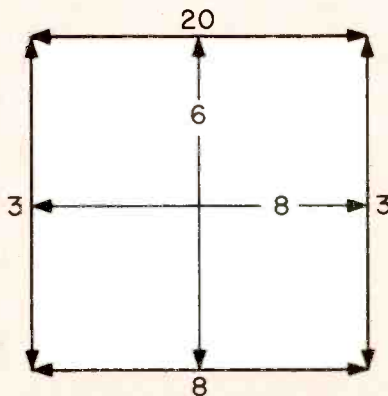


Fig. 4—Separation in dB achieved by non-logic SQ matrix.

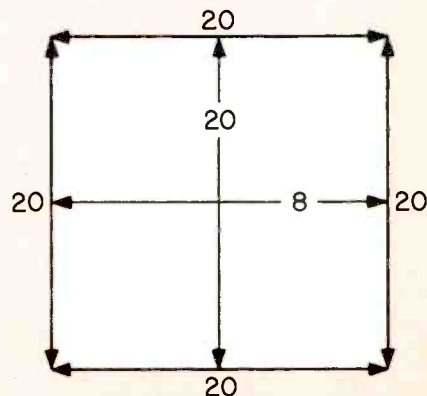


Fig. 5—Separation in dB achieved by full-logic SQ matrix with blending.

Future Sound Shock, Enoch Light.
Project 3 PR-5077QD, SQ, QS,
or CD-4.

Enoch Light was one of the first to realize the potentialities of quadrasonic sound. This record is a fine one for demonstrations and includes *One Note Samba, Baubles, Bangles, and Beads,* and *The Girl From Ipanema*, played by "the world's finest wind and percussive musicians."

The Second Coming, Rudolph Johnson.

Black Jazz BJOD-11, QS.

Features *The Water Bearer* and *Time & Space*, as well as the title piece. Kent Brinkley on bass, Doug Sides on drums, Kirk Lightsey piano, and Johnson on tenor sax.

Two Concertos for Organ and Orchestra, Rheinberger. E. Power Biggs and the Columbia Symphony conducted by Maurice Peress.

CBS MQ-32297, SQ.

The New York Times said it was "perfectly gorgeous" and, for one, I agree with the good, grey Times. Rheinberger is not as well known as he should be in America. Born in 1839, he was appointed organist at the Chapel of St. Florian, in Vaduz, Liechtenstein, when he was only seven years old.

World's Greatest Jazz Band, Yank Lawson & Bob Haggart.

Project 3 PR-5033, SQ and QS.

Needs no introduction to lovers of Dixieland! Selections include *Sunny, Panama,* and *Limehouse Blues.*

Four-Channel Dynamite, Enoch Light.

Project 3 PR-5068-QD, QS or SQ.

Described as "new arrangements and recording concepts of world famous hit songs," this disc includes *Cecelia, Penny Lane,* and *Chicago.*

Persuasive Percussion. Command CQD-40000, QS.

This appears to be a four-channel version of the old stereo disc featuring Terry Snyder and his All Stars. Among the selections are *I'm In The Mood For Love, I Love Paris,* and *I Surrender, Dear.*

Big Band Hits of the Thirties, Enoch Light & the Light Brigade.

Project 3 PR-5049, CD-4.

Among the bands saluted are Glenn

Miller, Tommy Dorsey, Woody Herman, and Harry James. Enoch puts you right in the middle—a good demonstration record, though.

Experience, Dick Shory

Ovation QD/2, QS.

This is really a demonstration record or a sampler and it contains extracts from a number of quadrasonic records, including Bonny Kolac's *Hold Onto Me, Days of Wine and Roses* by Mancini, and *Rich Mountain Tower*. Also featured is a cut entitled *Men In Motion* which describes the evolution of motion from walking to space flight—a sort of audio montage.

Early American Vocal Music, The Western Wind.

Nonesuch HQ-1276, CD-4.

The subtitle is "New England Anthems and Southern Folk Hymns." A nice, spacious spread of sound.

Bach Organ Favorites, Vol. 5, E. Power Biggs.

CBS MQ-31424, SQ.

The organ is the Flentrop instrument in Harvard's Busch-Reisinger Museum and the works played include the *Fantasy and Fugue* in G Minor and the *Prelude and Fugue* in B minor.

String Quartet No. 2 (Lily), Leon Kirchner and the Lenox String Quartet.

CBS M-32740, SQ.

One of the Modern American Music Series. *Lily* is a part of a theatrical piece commissioned by the New York State Opera and it can be played as a chamber music composition. In the stage version, lighting effects are used to heighten the drama. However, the recording has some interesting location effects (the original uses tape recorders off stage). The string quartet is more conventional but not for those accustomed to Haydn, Mozart, et al.

Mancini Salutes Sousa

RCA Quadradisc APD1-0013, CD-4

The Mancini orchestra was augmented by "the cream of Hollywood's musicians" for this recording and they certainly play with élan. All or most all of the popular tunes are there—*Semper Fidelis, The Thunderer,* and *El Capitan*. During the playing of *Stars and Stripes Forever*, jet planes are heard flying past—adding to the parade ground atmosphere.

complex logic circuit is used and front-to-back separation is now 20 dB, i.e. left-front to left-rear or right-front to right-rear. This configuration is called full logic with blending. It might seem strange to use "blending" when the name of the quadrasonic game is separation, but it's really quite logical (sorry!). The blending in this instance combines a portion of the left-front signal with the right-front signal and vice versa for a center-front soloist. The same is done for a center-rear soloist in the rear channels. Since a center-front signal appears out-of-phase at the two rear-channel outputs of the decoder, blending causes this signal to subtract or decrease at the rear. The result is an increase in center-front to center-back separation—at the cost of a slightly lower left-to-right separation. If the designer wishes, the blend function can be made variable as determined by the program material. In the absence of either a center-front or center-rear sound, the blend circuit is inoperative so there is full left-to-right separation. A sound appearing either at center-front or center-rear will activate the blend circuit causing the front-to-rear separation to increase. An FET is used as a "dynamic resistance" and obviously the associated time constants must be chosen with care to avoid "pumping" action. If the designer wishes, he can use the blend circuit on the front channels only as there is rarely any significant information at the center-rear, although Walter Carlos (*Switched on Bach*) would not agree!

In the early days of quadrasonic sound—only two years ago really—we had a number of critics who said, "It was a gimmick hatched up by the record companies" (although the sales figures showed that they were all doing very nicely anyway), that it "did not improve the quality of reproduction—that stereo was not perfected" (neither was mono) "so why go to the extra expense," and so on. Well, many of these voices are now silent and even the most conservative, the most respected music critics concede the advantages of quadrasonic sound. This stage has not been reached in Europe (with the possible exception of West Germany). In England, all the music publications regularly review quadrasonic discs and the large EMI Company voted for SQ a long time ago, but other companies like Philips, Decca and DGG are still uncommitted.

A few months ago, Dr. Steinhausen, former vice president of DGG, had this to say: "Up to now, we have tried, with great success, not to bring the



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Say farewell to the grand old DC300, and welcome to THE PROBLEM SOLVER, the amp that is going to make your job easier and your customers happier. The original model DC300 was a great amp — the first super-power low distortion amp in the world, when Crown introduced it five years ago. Meanwhile, top sound systems designers have used it successfully in hundreds of demanding situations, and made some excellent recommendations for improvements. The response of the Crown design team was *not* an updated DC300, but a totally *new* and different amplifier, the DC300A. It is the *only* high power low distortion amp specifically *designed* for commercial sound applications. (CAUTION: *There are some large consumer-type amps attempting to sell in the commercial sound field without providing adequate continuous power for all load impedances.*)

Power You Can Count On

The New DC300A has *double* the number of output transistors, effectively twice the muscle of the old DC300 at the same price. Each channel has eight 150-watt devices for 1200 watts of transistor dissipation per channel. The DC300A is rated at 150 watts per channel continuous into 8 ohms or 300 w/ch continuous into 4 ohms (both channels driven) and 500 watts continuous into 2.5 ohms (single channel driven).

Two Amplifiers in One

As a dual-channel amplifier with separate level controls and circuitry for each channel, the DC300A is almost *two* amplifiers in one. This gives you additional flexibility in controlling your speaker load, as when driving separate front and back speaker systems in a large auditorium, or when bi-amping a system. For 600 watts continuous output at 8 ohms, the DC300A converts to a mono amp with two plug-in parts. This makes it possible to drive a 70-volt line directly without a matching transformer.

Superior Output Protection

The DC300A output protection circuitry is a radically new design which completely eliminates DC fuses and mode switches and further reduces service problems to the negligible level. It is superior in every way to the old VI-limiting circuit pioneered by Crown and now used by most other high power amplifiers, since it introduces *no* flyback pulses, spikes or thumps into the output signal, whether operating as a single- or dual-channel amp.

Gone too is the need to baby the amp by carefully juggling load configurations. The Problem Solver can drive *any* speaker load — resistive or even totally reactive — with *no* protection spikes! Parallel speakers with no deterioration of sound quality, since changing the load impedance only affects the maximum power available, not the ability of the amp to keep on producing clean sound.

Lowest Distortion and Noise

Also new is the DC300A's IC front end, which sets new world's records for low distortion and noise. At the 8-ohm rated output, IM and harmonic distortion is less than 0.05% full spectrum; hum and noise is 110db below. Servicing — if ever necessary — is a snap, since removing the front panel accesses the entire circuitry.

Although it is a completely redesigned model, the DC300A has inherited some characteristics from its predecessor:

PRICE - still under \$700. As two amps in one, it will probably give you or your customers a welcome cost/break when you design your next multiple-amp system.

WARRANTY - three years, covering all costs of parts, labor and round-trip shipping.

COOLING - excellent heat dissipation provided by massive cooling fins and the entire chassis itself.

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PEOPLE - the same innovative design team and careful craftsmen who made the DC300 such a sound success. And the same knowledgeable customer-service men ready to discuss your special application and send you detailed technical data. Phone 219 + 294-5571 or write Crown International, Box 1000, Elkhart, Indiana 46514.



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concert hall itself into the limited confines of one's own four walls, but rather the *music* of the concert hall. To convey the impression of the concert hall is a physical problem which can be solved only adequately even with four channels; but to convey the music of the concert hall is an artistic task which is technically capable of being carried out fully with two channels. The attractiveness of the effect which an unobtrusive mixture of ambience from the rear can achieve is not disputed, but many consider it out of all proportion to the expense involved . . . again if this ambience is exaggerated, it can very quickly lead to a distortion of the sound picture and to paralysis of the artistic mind.

"The transparency of definition of the sound picture, which is often limited in the concert hall and is normally enhanced in stereo recordings, is based on the fact that ideal clarity of sound exists only in close proximity to the sound source. Normally, in a concert hall this area of proximity has no seats. As a result, the recording microphones are set up in positions where no member of the audience could sit. The sound picture which emerges initially is usually clear and dry and its hard contours need to be

carefully softened. This is done by the corresponding careful addition of ambience—that is, through the addition in indirect constituents of the sound picture. An important aspect of the art of the sound engineer lies in achieving the best mixture of direct and indirect sound. If the indirect constituents are exaggerated, the result can produce a 'swimming pool' acoustic and an increasingly mono type of sound picture. In good recordings, the concert hall is therefore manipulated as if it existed just for one listener seated in an ideal position, and the art of recording begins where the concert hall leaves off.

"The second possible application of quadraphony is to create up to four different sound sources, each issuing different, though artistically related information. This is not in itself new: musical literature contains a few well-known examples, and one wonders why there are not more. It could be because the composer rightly fears prohibitive performance difficulties—and here a multi-channel reproducing medium could help. However, it could also be that most composers have not so far looked to technical complexity for the expression of their artistic thoughts and have mainly regarded

dispersal of sound as no more than a gimmick . . . We shall have to wait to see whether artists can find and develop a new art form here; whether technology has discovered new territory or is driving an empty artistic truck to a dead end."

Those were Dr. Steinhausen's thoughts in November, 1972 as published in *The Gramophone*. At that time, I believe some of his misgivings were justified but since then we have had ample evidence of the artistic merits of quadraphony as opposed to the gimmickry. The Bernstein *Mass*, E. Power Biggs and the organ of St. George's Church, Ormandy and the Philadelphians, the Leipzig Gewandhaus and the Beethoven series, Somary with the English Chamber Orchestra, Boulez and the New York Philharmonic—all testify to the musical values of the medium. But Dr. Steinhausen is right when he criticizes composers for not making the best use of the multi-channel recording techniques. There are Henry Gant, Walter Carlos, Subotnick, Walter Crumb, and a few others who do well, but we ought to have more operas, more drama, and large-scale orchestral works composed for this exciting new medium. In London, the BBC has been recording in



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MP-3000 combines the rare attributes of sound and styling. Clean, undistorted sound comes from this 4-speaker, 3-way speaker system. The oiled and hand-rubbed walnut veneer cabinets, and unique grille of sculptured foam are both acoustically and geometrically beautiful. The system contains a 15" high compliance woofer with a 2" voice coil, as well as two horn-loaded-dome-tweeters. It's a distinguished combination of well-defined, distortion-free sound reproduction. Size: 27" x 20½" x 14" deep, excluding base. Shipping weight: 70#.

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quadrphony for some months and I am told that the tapes made of the *Promenade* concerts in the Albert Hall are fabulous. So is a performance of *Oedipus Rex*, which is called an experimental quadraphonic drama.

Ambionics

Ambionics has been widely publicized in the British audio magazines as "superior to both stereo and quadraphonic sound." It is sponsored by the National Research Development Corporation, Professor Fellgate and others at Reading University, and an electronics company—IMF (not connected with the U.S. company with the same name). Full details are not available, probably due to patent difficulties, but it appears to be a matrix system linked to the use of four microphones in a double-coax or tetrahedral array. This would have merit for the recording of music with a concert hall reference but it was stated that certain effects could be obtained by the use of what are called "outrigger" microphones. The system was being demonstrated at the recent Sonex Audio Show in London, where it was listed as the major attraction.

I must say straight away that the results were most disappointing. The room was fairly large, holding about 300 people, and not only was there a sense of confusion similar to that caused by out-of-phase effects but there was hardly any location. Voices sounded totally unreal, some appearing to emanate from 30-foot mouths! I spoke to a number of people who confirmed these impressions; in fact, I found no one who was in any way impressed. To be fair, the organizers did point out that they were not happy about the sound either and that much better results could be obtained from smaller, more domestic size rooms elsewhere in the hotel. Unfortunately, I was unable to attend this demonstration.

Looking back to the first public demonstration of quadraphonic (matrix) sound at the RCA studios in New York held under the auspices of the AES, I well remember that this was hardly an unqualified success either. But on the other hand, the organizers were a little more diffident about it—there was none of the ballyhoo associated with ambionics. Therefore, I will suspend judgment. Incidentally, the Sonex demonstration must be one of the first large-scale affairs to use a cassette recorder and overall sound quality was excellent. The particular recorder was a Nakamichi, which costs a small fortune in England.

You have to come to a decision between your ear and wallet when you buy a microphone. Take the AKG D-224E for example. It's one of the most advanced mikes made. Technically it's a "two-way" cardioid dynamic microphone. There's one mike element for highs. Another for lows. You get incredibly smooth, even recordings. And a lot of other features that will satisfy the most demanding ear. But it might shake up your wallet. It costs about two hundred dollars.

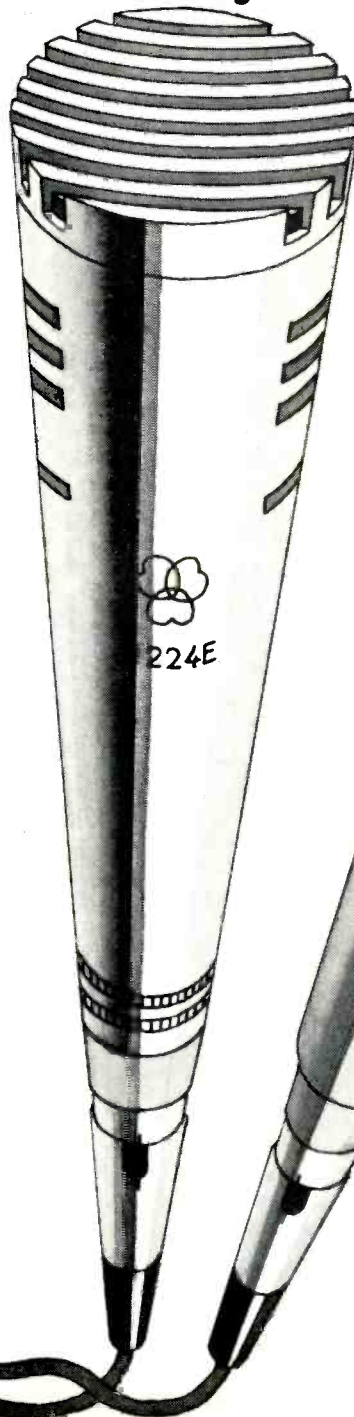
If you don't earn your living as a recording engineer, the AKG D-200 is for you. It's a "two-way" mike, also. And it's working recording wonders for thousands of part-time professionals in studios and on location, too. The AKG D-200 makes almost every ear happy. Wallets, too, at \$79.00.

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EDUCATION IN AUDIO

Paul Moverman

MONTH AFTER MONTH people write to the editors of various trade magazines such as *AUDIO*, and ask, "How do I become an audio engineer?" Before attempting to answer that question, I feel that a common misconception should be cleared up. The common image of the audio engineer is that of someone who sits behind a 16-track console and helps make hit records. Actually, the audio engineering field includes more than just the recording of gold records.

It is certainly true that the recording engineer or mixer whose name appears on the cover of an album is a bona fide

audio engineer, but let's take a few moments to explore other areas where an audio engineer may be employed.

Many of the major record labels, such as Columbia and RCA, maintain staff engineers in such major recording centers as New York, Los Angeles, and Nashville. These engineers are usually members of a union (such as I.B.E.W. or N.A.B.E.T.) and normally will be employed solely by one label. However, the majority of recording engineers are employed by independent studios such as A&R in New York or Sound 80 in Minneapolis. These engineers work mainly out of their own in-

dividual studio, but many do free-lance work for either record companies, producers, or other studios. Also to be included in this "free lance" category is the tape mixer, the person who will mix the 24- or 16-track tape down to either stereo, four-channel, or mono.

The second type of audio engineer that we will discuss is the mastering engineer or disc cutter. The mastering engineer is the man who will conduct the tape to disc transfer of the music that has already been mixed down. The disc cutter has to make certain that the disc will sound exactly like the tape that was mixed in the studio. Although many lathe manufacturers are now marketing automated disc cutting systems, an engineer must be present to ensure quality control and proper equalization. Many times, a disc mastering engineer has to be more creative than the mixer in ensuring that the song is cut the way the producer heard it, without sacrificing any highs or lows to enable it to be cut.

Another category of audio engineer is the motion picture sound man. Many film production houses maintain a staff of audio engineers to supervise the recording of filmtracks, sound effects, etc., and then to mix them down into a single audio soundtrack. The soundtrack will then be transferred to either a magnetic or optical track that will be heard in movie theaters around the world.

Closely related to the motion picture sound engineer is the audio engineer employed by many radio and television stations and networks across the country. These television audio engineers are responsible not only for the sound on such programs as "In Concert," but also for the live audio that is heard daily on such programs as "The Edge of Night" and all the major network news broadcasts. Also, do not forget to include the engineers that have re-



Scott Rivard of Sound 80 Studios in Minneapolis specializes in the design and construction of sophisticated sound reproduction systems.

corded the New York Philharmonic Young People's series for so many years. It should also be noted that engineers such as Richard L. Kaye of Boston have been responsible for instituting stereo and quadrasonic broadcasts of the Boston Symphony Orchestra for several years now. On the other end of the musical spectrum are the well known rock broadcasts (and quadracasts) of the King Biscuit Flower Hour, a syndicated concert series.

When discussing audio engineering, one must be sure to include the acoustic architects, noise control engineers, and sound reinforcement engineers. Many people fail to realize that each and every one of these people is required in order to produce a concert where someone in the rear of the hall will be able to hear the performance as well as the person sitting in the front row. Television stations, concert halls, and even airports would be totally lost without the services of these audio engineers. Just imagine an evening news broadcast where you couldn't understand what the newscaster was saying due to the amount of echo in the studio! All of the above mentioned people are audio engineers, although they may have specialized in a particular area of the field. Let's take a look now at how you can become an audio engineer!

The first step you can take towards becoming an audio engineer is to try to decide the particular area you want to "major" in. You may find that you will want to go into several areas rather than just one. One good way to get a feel for which area(s) you might be interested in is to go to a local meeting of the Audio Engineering Society. The A.E.S. is a corporation whose purpose is that of "... uniting persons performing professional services in the audio engineering field and its allied arts, of collecting, collating and disseminating knowledge in the field of audio engineering . . ."* and as such offers the best source of information in the audio engineering field. The society has sections located in Boston, New York City, Atlanta, Chicago, Los Angeles, San Francisco, Washington, D.C., and also in Canada, Great Britain, Japan, and Central Europe. Most of these sections offer monthly meetings that are open to anyone interested in audio. The Society also publishes a journal which in itself is a great source of knowledge. By attending these meetings you can get a chance to meet and talk with many of the persons who have

made audio what it is today. By listening to these people talk on a wide range of subjects you might discover a certain area that is of special interest to you.

Once you have decided what aspect of audio engineering you want to become involved in, there are two possible routes that you may take to achieve your goal. One is to try to find a job through the political method. In other words, without much knowledge, you could conceivably get a job in a studio, etc., just by knowing somebody that knows someone. The only difficulty with this method is that after a short time, if you're not extremely alert, you'll find yourself in a jam and will have to go looking for help. Also, you could find yourself waiting for a job using this method for months. An example of this is a close friend of mine who has been waiting since last April for a relative who knows somebody to get a job for him.

The other route most likely will prove to be more fruitful in the long run. Although neither route could be said to be any faster, this second method is certainly the smarter of the two. Let's take a look at the traditional way of becoming an audio engineer.

Educational Programs

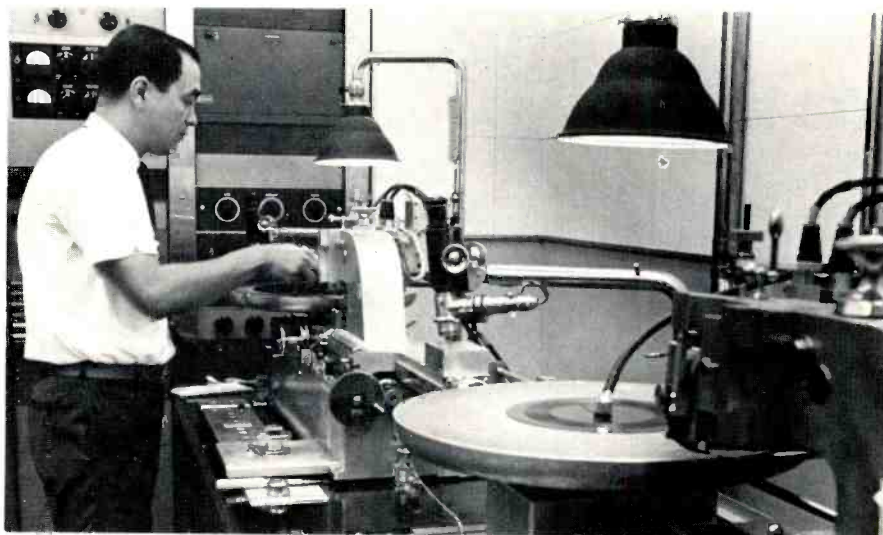
The first step is to select some sort of technical school and enroll following their supervised program. Upon completion of this program (the length of which could vary from 8 weeks to four years) you will want to get down to work and find a job. Before discussing job hunting through the audio engineering field, let's take a look at what

type of educational programs are now available and take a look at some of the problems facing audio engineering instructors.

One major problem facing the audio engineering educators is the problem of the evergrowing number of "quickie" courses that may or may not promise employment upon graduation. You might remember the disc jockey craze of the late sixties when dozens of schools sprang up, all selling you on the fact that there were more jobs available than there were applicants. Before going any further, it's a good idea to note that whatever school you may graduate from, it is going to be very difficult to get that first job.

The schools that offer courses in audio engineering generally fall into two categories, the private institutes, and the universities and colleges. Schools such as Albert B. Grundy's Institute of Audio Research and Don Davis' Syn-Aud-Con are excellent examples of private institutes that offer courses in different aspects of audio engineering. Many students that have taken courses at these institutes have continued their education at some of the nation's leading universities, receiving credit for courses taken. While the majority of these private institutes offer only one course, several such as the Institute of Audio Research are now offering courses in areas such as Studio Technology, Disc Mastering, and Systems Design. These programs normally run for two to three months, unlike the university level programs that run for a minimum of one college semester.

During the past several years, more and more colleges and universities have added courses in audio engineering to



Capitol Records' disc mastering center in Hollywood.

* Audio Engineering Society, Inc., by-laws, revised June, 8, 1973. Journal of the AES Vol. 21, p. 425.

their curricula. The list of schools ranges from Brown University to the University of Surrey in Great Britain. A moderate list of colleges and universities offering courses in audio engineering is appended to this article.

While many schools of higher education now offer programs in audio, there are many schools which have not made such courses available even in view of the fact that they own sophisticated audio equipment. Examples of this situation may be noted at the Evergreen State College in Washington and the University of Illinois at Urbana. At Evergreen there is an array of professional audio equipment ranging from a Quad-Eight console to an Ampex MM-1000 (16-track) tape recorder, and to top it off, an intense student interest in a formalized audio program has been continual. However, the "powers that be" at this school have not seen fit to hire an instructor and institute an audio engineering program. If this isn't enough, take a look at the University of Illinois, where in addition to sophisticated audio gear, the University has on the campus, the beautiful Krannert Center for the Performing Arts. This complex of four magnificent theaters would be ideal for a program in audio engineer-

ing as world reknowned artists perform there almost on a daily basis. Perhaps in the near future people will become less "afraid" of audio as it develops into a more popular area of study.

Most of the schools that offer courses in audio engineering have a very detailed theoretical curriculum with little emphasis on the actual operation of the hardware. As I have found out, the operation of a tape machine is far easier than the understanding of what is happening when you align the machine. However, as I shall proceed to point out, the actual operation of equipment in a real studio operation is a vital part of your education.

The Ideal Education

Several months ago, I undertook a survey of several leading audio engineers both in the United States and abroad. Each engineer was asked what the "ideal" education would be for a young person who wanted to get into the audio engineering field, and also, what particular area of study should be stressed the most in an audio engineering education.

The subject area that seems to lead the pack is Music Theory and practical music experience. It should be noted that the group of engineers responding

was not made up strictly of recording studio personnel, but included representatives of such areas as acoustics, noise control, education, and transducer design. Most of the engineers responding felt that the primary area of importance was that of understanding and having a "feel" for music. In second place was electroacoustics, followed closely by disc cutting and psychoacoustics. It would seem only natural that an engineer would have to have a thorough understanding of not only the equipment, but also the medium with which he is working. A study of disc cutting would certainly help the mix down engineer understand the limitations of the art and enable him to guide his final mix appropriately. The three final areas of study that appeared were, in order of importance, Music Law, Electrical Engineering, and Analog/Digital Computer Techniques. Although the a/d computer techniques appeared to be of the least importance in relation to the other subject areas, one might note that the importance of this field will increase sharply over the next several years as more and more digital audio equipment appears on the market. During the last few years alone, we have seen the introduction of digital audio delay lines and automated mix-down systems, both spawned by the computer age.

Indications of the advent of a new, highly specialized, recording operation are becoming evident throughout the world. Dr. Ray Dolby of Dolby Laboratories noted during a recent telephone conversation, "... due to the growing need for efficiency in the handling of the complex and varied booking schedules of studios today ... there seems to have been a division of responsibility in major recording projects. You may now have a recording engineer, producer, musical director, maintenance engineer and tape machine operator all working together on a single project. Because of the tremendous growth of the recorded music industry, the making of records is now a team effort, not a solo performance by a versatile and highly trained engineer/musician. The need now is for more specialization." Perhaps due to the new need for specialization the old "Tonmeister" concept is becoming outdated.

As noted earlier, almost 95% of those engineers responding to the survey felt that, in addition to the classroom training, a valuable part of the educational program would be spent in a workshop situation, or on the job training under the direct supervision of a qualified engineer. However, at the present time, this is almost impos-

Recommended texts for audio engineering students:

- | | |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Bernstein, Julian L., <i>Audio Systems</i> , John Wiley & Sons, 1966, 409 pages. | Villchur, Edgar, <i>Reproduction of Sound</i> , Dover Publications, 1965, 92 pages. |
| Brown, Robert M. with Paul Lawrence, <i>How to Read Electronic Circuit Diagrams</i> , Tab Books, 1970, 189 pages. | Publishers' Addresses |
| Crowhurst, Norman, <i>Audio Systems Handbook</i> , Tab Books, 1970, 189 pages. | Dover Publications, Inc. |
| Dillow, Arthur P., <i>Alternating Current Fundamentals</i> , Howard W. Sams & Co., 1966, 416 pages. | 180 Varick Street |
| Lowman, Charles E., <i>Magnetic Recording</i> , McGraw-Hill Book Company, 1972, 288 pages. | New York, New York 10014 |
| Lowery, H., <i>A Guide to Musical Acoustics</i> , Dover Publications, 1966, 94 pages. | McGraw-Hill Book Company |
| Navy, Department of U.S., <i>Basic Electricity</i> , Dover Publications, 1970, 490 pages. | 1221 Avenue of the Americas |
| Navy, Department of U.S., <i>Basic Electronics</i> , Dover Publications, 1969, 538 pages. | New York, New York 10020 |
| Olson, Dr. Harry F., <i>Music, Physics, & Engineering</i> , Dover Publications, 1967, 460 pages. | Penguin Books, Inc. |
| Olson, Dr. Harry F., <i>Modern Sound Reproduction</i> , Van Nostrand Reinhold Co., 1972, 335 pages. | 7110 Ambassador Road |
| Taylor, Rupert, <i>Noise</i> , Penguin Books, Inc., 1970, 268 pages. | Baltimore, Maryland 21207 |
| | Howard W. Sams & Co., Inc. |
| | 4300 West 62nd Street |
| | Indianapolis, Indiana 46268 |
| | Tab Books, Inc. |
| | Monterey & Pinola Avenues |
| | Blue Ridge Summit, Penn. 17214 |
| | Van Nostrand Rheinhold Company |
| | 450 West 33rd Street |
| | New York, New York 10001 |
| | John Wiley & Sons, Inc. |
| | 605 Third Avenue |
| | New York, New York 10016 |

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sible to accomplish. Dave Kent-Watson, Director of Indigo Sound Studios, Ltd., notes: "Basic theory should be dealt with, after which practical experience is the only way to a complete education. (However) as studios are reticent about taking on inexperienced staff, I feel that the professional organizations should sponsor entry to a studio for training."

The first school to sponsor entry into the professional recording field was the University of Surrey (England). The School of Music at Surrey set up

a program that led to a B. Mus. (Tonmeister) degree. The tonmeister concept is a rather old theory instituted by the Germans many years ago in order to educate audio engineers. The basic idea is that the student be thoroughly educated in both physics and music. At Surrey, during the third year of studies, the student works at a commercial recording studio as a regular paid employee. The student is required to file both oral and written reports on his training upon his return to the University. Quite contrary to

the general employment situation, there were more vacancies last year than there were students.

Here in the United States meanwhile, several schools now offer audio courses that include regular visits to major recording studios but do not offer the student the opportunity to work in the industry for several months as part of his education.

How to Get a Job

After completing a program of study in audio engineering, you will be faced with the problem of how to get a job. There are several employment agencies claiming to specialize in the audio engineering field. But as you will discover, they aren't really interested in the newcomer who will go to work for somewhere around \$5500 per year as a trainee, but rather in the professional engineer whose salary will pay off with a big commission. Don't let a put down at the employment agency stop you! The best way to find a job in this business is to get dressed at 8:00 am and go knocking door to door until you meet the right person at the right place at the right time. You might preface your pavement pounding by mailing a resumé to the studios that you will be visiting. New York City is definitely the wrong place to try to break into the audio engineering business. Granted, there are dozens of studios on the island of Manhattan, but the last time I checked, there was one studio that had a waiting list of some 125 people just waiting to work without pay as messengers or janitors, just to be able to get inside a recording studio. The most important thing about your first job is that you should try to get into a studio where there is someone who is qualified to take you under his wing and teach you the studio business. Working in a studio without proper supervision will lead nowhere fast.

After seeing how hard it is to get into the audio engineering field, you might ask, what is being done to better the situation? Several years ago, the National Academy of Recording Arts & Sciences formed the NARAS Institute in Nashville. The Institute, under the direction of Mr. Henry Romersa, has been responsible for the coordination of commercial music educational programs throughout the country. The Institute has also instigated the formation of several new courses in this area. Last fall at the Audio Engineering Society's 46th Convention in New York City a session was devoted to audio education. Those attending, in excess of 150, were not only audio engineering



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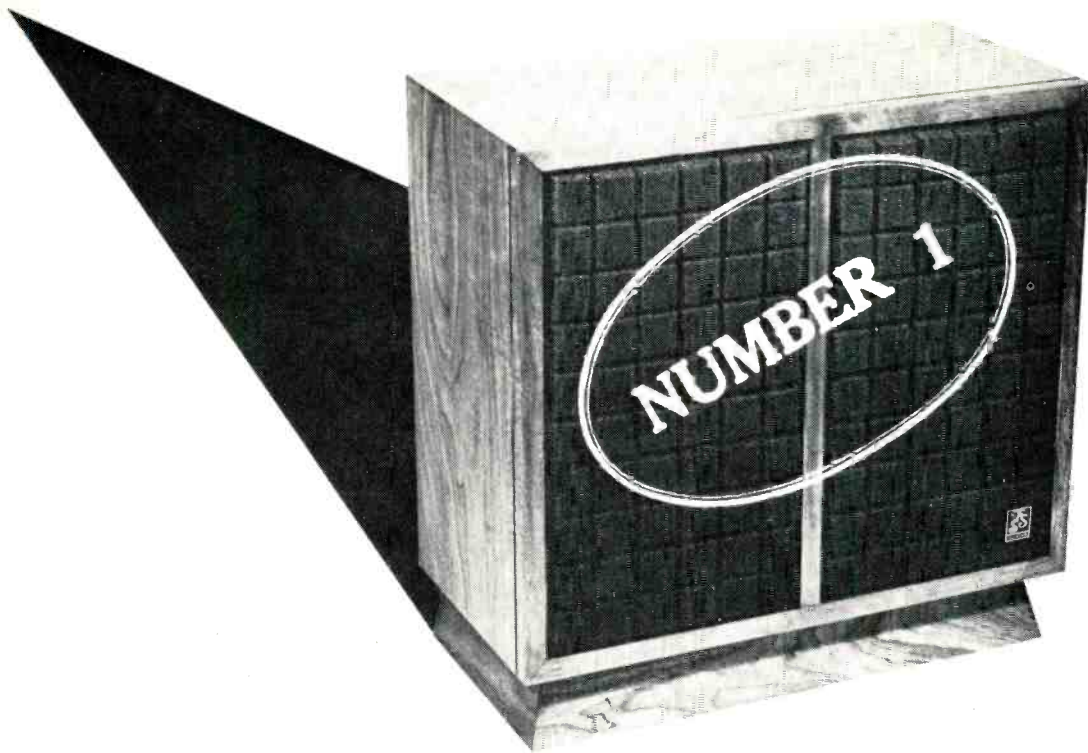
Protection—Patented electronic energy limiters. **Power**—Greater than 350 watts/channel R.M.S., both channels operating into 8 ohms, 1 to 20 kHz. **Hum and noise**—Better than 100 dB, below 350 watts. **Harmonic and I.M. distortion**—Less than .25%, typically .01%. **Price**—\$799. Cabinet—\$37. **Warranty**—3 years, parts and labor, normal use.

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students, but educators, and well known representatives of major recording studios and product manufacturers.

It is happening slowly, but there is a growing interest in the future of audio engineering education.

Following is a partial list of the schools that are currently offering courses in audio engineering. Additional information may be obtained by contacting either the NARAS Institute in Nashville, the Audio Engineering Society in New York, or the author in care of this publication.

The Brown Institute
3123 East Lake Street
Minneapolis, MN 55406

Brown University
Engineering Department
Providence, RI 02903

Cincinnati, University of
Cincinnati, OH 45221

Eastman School of Music
26 Gibbs Street
Rochester, NY 14604

Fanshawe College
1460 Oxford Street East
London, Ontario N5W 5H1, Canada

Georgia Institute of Technology
Atlanta, GA 30332

Gilfoy Sound Studios
300 Gilbert Avenue
Bloomington, IN 47401

Illinois Central College
Box 2400
East Peoria, IL 61611

Institute of Audio Research
64 University Place
New York, NY 10003

Minnesota, University of
105 Morrill Hall
Minneapolis, MN 55455

Missouri, University of
Columbia, MO 65201

NARAS Institute
Box 12469
Nashville, TN 37212

New York University
School of Continuing Education
New York, NY

Recording Institute of America
15 Columbus Circle
New York, NY 10023

Seattle West Recording Corp.
319 North 85th Street
Seattle, WA 98103

Southern California, University of
University Park
Los Angeles, CA 90007

Surrey, University of
Guildford, Surrey, England

Tennessee State Technical Institute
Memphis, TN

Brigham Young University
Provo, UT 84601

The following schools offer courses in acoustics and/or noise control:

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, MA 02138

Bruel & Kjaer Instruments, Inc.
5111 West 164th Street
Cleveland, OH 44142

Synergetic Audio Concepts
Box 1134
Tustin, CA 92680

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The slim but potent 320MT modules handle 200Hz-up, and are compact enough to fit wherever stereo or quad effects are optimum.

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effective frequency range:	125Hz-22KHz	25-250Hz
max. sound levels:	128db @ 4'	128db @ 4'
crossover frequency:	1500Hz; 4000Hz	200Hz
dispersion:	100°h., 45°v.	360°
speaker elements:	spl. 12" mid-bass HF-91 reflective mid-high horn (2) dhorm tweeters	(2) spl. 12" woofers
impedance:	8 ohms	8 ohms
dimensions:	6"x18"x14½"	25"x25"x20"



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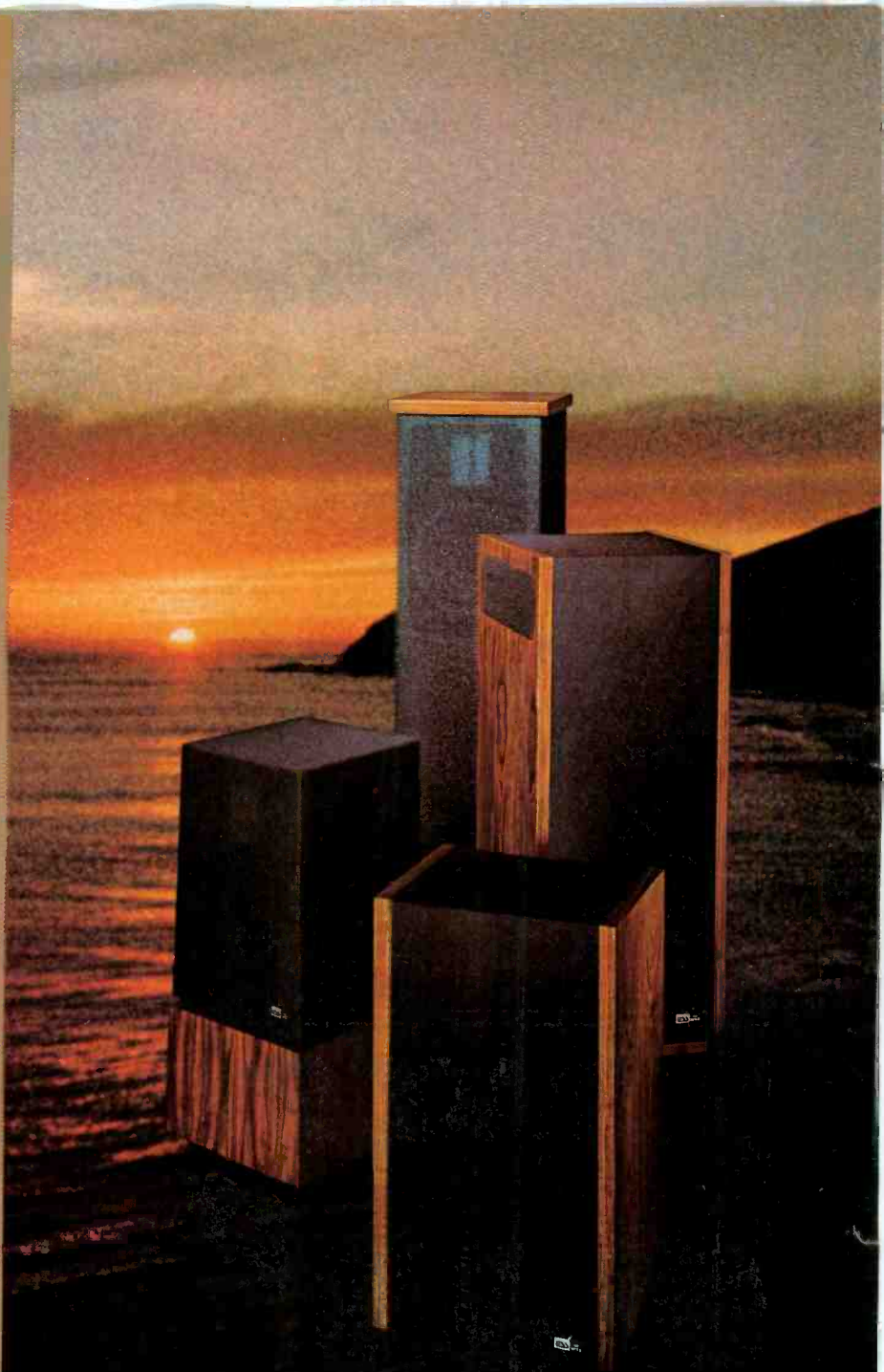
Presently the high fidelity industry evaluates performance of speakers with a response curve that measures the relative *loudness* of various frequencies. But our ears are not very sensitive to loudness. Most people, for example, do not realize that a mere 3 dB increase actually represents a *doubling of power* because it is heard as just perceptibly louder. On the other hand, our ears are *very* sensitive to the frequency *content* of sounds. With this faculty we can immediately recognize a friend's voice even over a crude telephone. The extraordinary sensitivity of the ear in this area can be realized by imagining yourself at a concert with the orchestra playing double forte. Amidst this avalanche of sound, a single trumpet hits a wrong note and you are immediately aware of this inaccuracy although the trumpet represents only an infinitesimal fraction of the sound power being produced.

Since our ears are so sensitive to the frequency content of sounds, even the minutest amount of frequency distortion will make us aware we are listening to a reproduction. "Listener fatigue" occurs as we unconsciously fight to ignore these distorted inaccuracies which are produced by conventional loudspeakers because, like all solids, their solid diaphragms "store" energy. "Stored" energy is what happens to piano strings when they are struck. They take in energy at the hammer's impact and "store" it, releasing it slowly as a sustained tone. It is this resonance that allows us to recognize a vibrating solid as a block of wood, a bell, a cymbal, or a gong. The solid diaphragms of conventional speakers have such a resonance too. This "storage" resonance is designed to be as short as possible, but because the voice coil is always pushing and pulling it is constantly being re-excited.

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Microphones—Vital Link in the Recording Chain

Part 2

David Lane Josephson

MOST READERS of this article will no doubt be trying to achieve a stereo pickup in their recordings. This is one of the toughest problems in making good tapes—getting the “stereo effect”—because, especially in live recording, stereo is not “two monaurals.” Rather it must be a complex aural experience leading to the listeners’ illusion that they are actually where the recording took place. The jump from mono to stereo is much more difficult than the jump from stereo to quadraphonic, since four-channel, in this context, is an extension of the stereo effect.

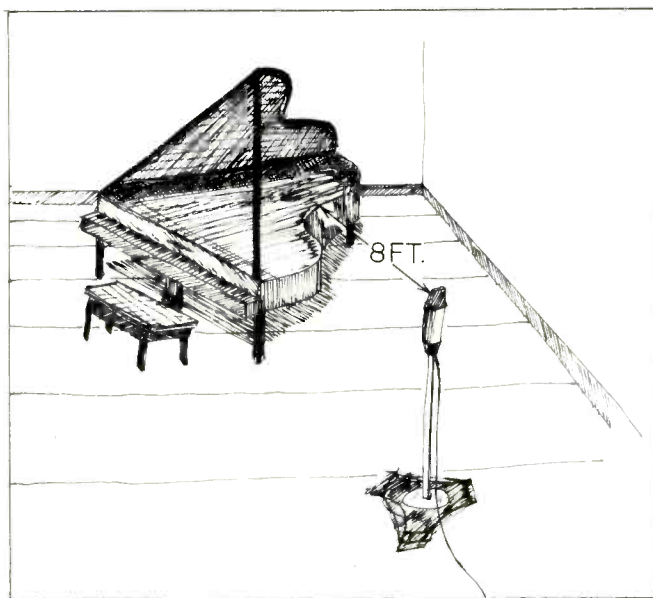


Fig. 1—Single mic pickup of piano. Single mic shown may be replaced with two for stereo; they should be placed one on either side of the mono mic position and about 18 in. from where the mono mic would be. Distance between piano rim and mic(s) may be varied from six to 12 feet to achieve a balance between direct and reflected sound.

Recording engineers have arrived at two basic means to obtain the stereo effect. One is an imitation of the way human ears perceive this depth-and-position sensation, known as *binaural*; the other uses a great number of microphones, each placed quite close to one particular sound source and then mixed to create a synthetic stereo illusion, known as *multi-tracking*. Since the amateur recordist usually doesn't have the huge number of high quality mics and mixing gear required for multi-tracking, this guide to microphone placement will stress variations on the binaural technique, using at most two microphones per recording channel.

Pickup of a single voice is probably the easiest microphone placement problem a recordist will run into, but it is by no means simple. Any good quality microphone may be used. A velocity mic will provide an extra fullness, another intangible characteristic that isn't reflected in a microphone's specifications. Most recordists mike much too close to the speaker—this may give a bassy “studio sound” that some appreciate, but it is not an accurate pickup. Some mics, such as the Neumann U87 and Electro-Voice RE15, incorporate bass rolloff switches that reduce the response below 150 Hz or so by as much as 10 dB, to compensate for the bass accentuation that occurs when any microphone, especially a unidirectional one, is used close to the sound source. Sometimes, in voices lacking depth and assurance (most amateur announcers), this proximity effect will be beneficial.

Omnidirectional dynamic mics, such as the Shure SM-60 or Electro-Voice 635A, are often used for voice pickups since they are relatively insensitive to wind and breath noise, and because of their lack of proximity effect, usually sound smooth and natural. Additional noise reduction—to the almost complete exclusion of all wind, breath and handling noise—may be had with the *isolated* mics similar to the SM-60 and 635A, the Shure SM-61 and EV RE-50. With this type of mic, the announcer or singer may be placed as close as six inches from the mic without any severe proximity effect or breath noise. Unidirectional mics, unless equipped with bass rolloff and very effective windscreens, must be used no closer than 12 inches—preferably two feet—from the speaker. Bidirectional velocity mics must be placed no less than two feet from the announcer, for accurate pickup.

Placing the microphone(s) directly on the table or lectern,

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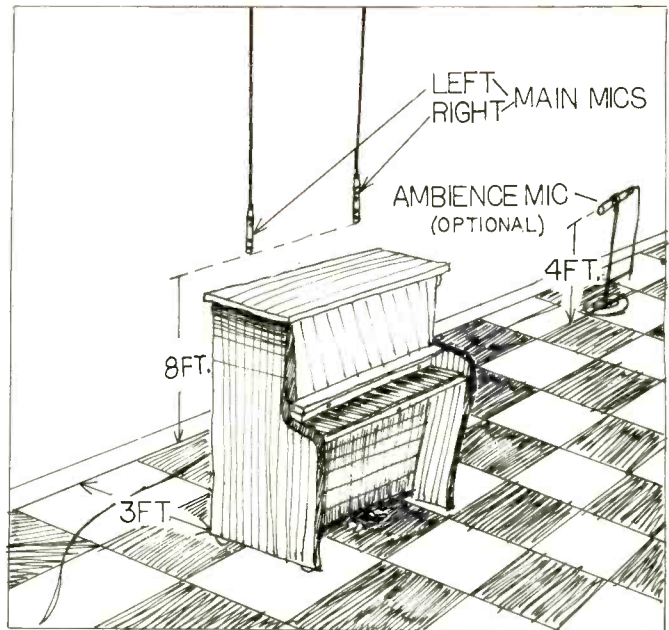


Fig. 2—Stereo pickup for upright piano. The main mics are placed about four feet apart, equally spaced from the two ends of the piano and an equal distance (about 18 in.) from the piano back and the wall. The ambience mic may be recorded on a separate track and mixed into left and/or right later, or may be mixed into left and right during recording. Some mixers have a panpot or "blend" channel and this is how it is used.

rather than on a stand, will reduce reflections that can add a tinny quality to the recording. Covering the table with felt or any similar sound-absorbing material will also reduce this form of aural multipath distortion.

Miking Pianos

Piano pickups are another very simple type of setup. Grand pianos should be placed in the one position they were designed to be used in—with the lid at full stick. Some engineers advocate leaving the lid closed, or opening it to half-stick, or even removing the lid entirely. But the piano was designed to be used at full stick, and the most accurate and natural-sounding pickup almost always results when it is recorded this way. In mono, a single microphone, preferably capacitor or velocity, should be placed about six feet off the floor, on a line parallel to the keyboard but centered in the middle of the sounding board, eight feet out from the rim of the piano. If the bass is too prominent, the mic may be moved toward the front (keyboard) of the piano, still maintaining the eight foot distance from the rim. Conversely, if the treble is prominent and the sound is harsh or bright, the mic may be moved toward the rear of the piano. The distance from the mic to the rim should be decreased only if the room is too reverberant, and then only to a minimum of four feet. Unidirectional mics are usually used to eliminate extraneous noises. A stereo effect may be created using two microphones, placed about three feet apart (each about 18 inches from the center line). Height and distance from the rim of the piano should not be changed. Two pianos may be miked with one omnidirectional or bidirectional mic as shown. Two unidirectional mics are used for stereo.

Upright pianos present a sort of diamond-in-brass problem. They were not designed for use except in places where grand pianos could never fit. The compromises made to reduce the size usually render them less fit for music recording—but it

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Fig. 3—Acoustic guitar pickup using a bidirectional velocity mic, in this case the RCA SK-66. Most velocity mics have a bass rolloff of some sort, either fixed or variable, that can be used to counteract the proximity effect to be expected when the mic is used this close.

can be done. Most of the sound is produced from the back of the piano and reflected from the wall. The piano should be spaced about two feet from the wall, and the mic placed above the piano. The lid (if you can call it that) may be raised for a little more brilliance. The distance between mic and piano should be between four and eight feet but experimentation is called for. Player pianos may be miked the same way, except that the mic may have to be raised further to eliminate mechanical noises. A zero-reflectance pickup with the mic on the ceiling might work well for this sort of pickup.

Electric organ pickups have been described as "duck soup." Simply place one mic directly in front of the unit's speaker, about four feet out. Since these units are entirely electronic, the microphone may as well be dispensed with, except for pickup of room acoustics and/or vocals. Most electric and electronic organs have tape recorder outputs that tap directly into the amplifier. Pipe organs present an entirely different miking requirement. Good capacitor mics are almost a necessity for pipe organ pickups, although good velocity and omnidirectional dynamics have been used. The main criteria is that the frequency response must be as flat as possible down to 30 Hz and up to at least 16 kHz. In this type of pickup, since the acoustics of the room have probably been designed for organ, the natural ambience is important. This calls for mic

placement further away than would be expected. Church organ pickups generally may have a great deal more reverberation than might be desired in an electric organ pickup. Walking around the church during a rehearsal will help find the best spot for a single-mic pickup for the organ, which should be employed if at all possible. An accent mic should be used for the choir. This may be a unidirectional capacitor or dynamic unit.

Guitars and Strings

Guitar pickups are another subject of acute controversy among professional recording engineers. Generally the preferred technique is to use a good unidirectional capacitor mic one to two feet out from the sound hole of the instrument and directly out from it. A good omnidirectional dynamic may also be used. The main problem with guitar pickup is the great bass accentuation when the mic is any closer than two feet. This is, of course, especially troublesome when a unidirectional mic is used, and if a bass rolloff switch is available on this type of mic, it should be switched in. Any acoustic guitar, lute, mandolin, ukelele or banjo may be miked this way. With banjos, only capacitor mics should be used because of the necessity of preserving the "twang" and sharp attack time that characterizes this instrument.

Electric guitars may be miked in one of two ways. Either the output from the unit itself may be fed into the recorder, or a single good dynamic or capacitor mic may be placed in front of the amplifier speaker. If any sort of effects (fuzz, reverb, tremolo, etc.) are used, the latter method must be employed. Since fuzz tone depends on good square wave response, capacitor mics should be used if this effect is predominant. Electric basses may be miked the same way, although any decent dynamic or velocity mic may be used. Contact mics should be avoided like the plague, both for electric and acoustic guitars. In most cases, these are simple crystal units, with response dropping sharply below about 200 Hz. The standard electric guitar pickups depend only on changes in a permanent magnetic field caused by movement of the steel strings, and this usually provides an accurate pickup.

Classical stringed instruments such as violin, cello and bass should always be miked with capacitor mics if they can possibly be obtained. Accuracy in pickup of bowed stringed instruments depends mainly on the untarnished rendition of the complex harmonics of the basic note. Violin harmonics extend past 18 kHz, and it is important to use mics that will respond linearly to this high frequency. Omnidirectional capacitor mics are ideal for this type of pickup. Only two need be used in achieving a very realistic and accurate stereo effect.

(To be continued)

Addenda

The Revox Corp., American distributor for the Beyer line of microphones, complained about the contention in the December, 1973, *AUDIO* that velocity microphones were heavy and susceptible to damage due to strong wind or breath noises. The firm's representative stated that Beyer mics, pressure gradient ribbons though they may be and not velocity units, were "tarred with the same brush." Revox very kindly loaned this writer three samples of the Beyer pressure gradient ribbon mics for testing.

First, let us be clear that *not all* mics that use a ribbon element are velocity microphones. In order to be a true velocity mic, the ribbon must be open to the air front and back for its whole length. These mics are usually very heavy and always very susceptible to strong coughs and wind. They are also certain to be damaged by high-level impulse noise, such as a close-range shot from a timer's

gun at a sporting event. The steep rise and fall of the pressure from this sort of noise simply snaps the ribbon.

On the other hand, pressure gradient ribbon mics, such as the entire Beyer line of ribbon mics, the RCA BK-58 and 77-DK (in unidirectional position), the Shure SM-33, can be made much lighter (they require less magnet) and much smaller, some as small as small dynamic units. Since more than half of the ribbon is *not* exposed to the air in the rear but rather ducted to an acoustical labyrinth which is sealed to outside air, the pressure gradient ribbon mics are much less sensitive to damage caused by breath noise or wind. The mics tested, the Beyer M-160, M-260 and M-500, and the Shure SM-33, all seemed to be impervious to damage from these causes, when subjected to extremely loud feedback and repeated breath and wind noise over a five-day period by an electric guitar class at the Middletown, Calif., High School. In short, the pressure gradient ribbon mics aren't nearly as fragile as their velocity ancestors.

Ed.

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Tandberg Model TR-1055 FM/AM Stereo Receiver



MANUFACTURER'S SPECIFICATIONS

FM TUNER SECTION: IHF Sensitivity: 2.0 μ V (1.6 μ V typical). S/N: mono, 68 dB; stereo, 66 dB. THD: Mono, 0.2%; Stereo, 0.3%. Selectivity: 80 dB. Capture Ratio: 0.9 dB. Frequency Response: 20Hz to 15,000 Hz (-3 dB). Separation: 40 dB.

AM TUNER SECTION: IHF Sensitivity: 600 μ V/Meter (internal antenna); 60 μ V (external antenna). Selectivity: 45 dB. IF Rejection: 52 dB. Image Rejection: 39 dB. THD: 1.0%.

AMPLIFIER SECTION: Power Output: 55 watts/channel, 8 ohm loads, both channels driven, any frequency from 20 Hz to 20 kHz. THD: 0.2%. IM: 0.2%. Power Bandwidth: 4 Hz to 40 kHz. Damping Factor: (1 kHz): 55; (20 to 20,000Hz): 50. Frequency Response: 7 to 70,000 Hz, -1.5 dB. Input Sensitivity: Phono, adjustable from 2 mV to 8 mV; Tape 1 and 2, adjustable from 150 to 600 mV. Phono Overload: 100 mV. Preamp Output Level: 2.0 V. Main-amp Input Level: 220 mV.

GENERAL SPECIFICATIONS: Dimensions: 17 in. W x 4 1/4 in. H x 12 in. D. Weight: 23 lbs. Price: \$579.90 (cabinet included).

The Tandberg Model TR-1055 is more than just a worthy addition to that company's line of receivers which began with the TR-1020 reviewed here more than a year ago. It is a superb product in every sense of the word and is NOT just a higher-powered version of the earlier entry. The sole criticism you will find in this entire review has to do with the listed specifications presented by this reputable manufacturer from Norway—and that is a two-fold criticism. First, the company failed to give us enough specifications, omitting such important numbers from their instruction booklet as AM suppression, Spurious Response Rejection, Image Rejection and IF Rejection. Since all of these parameters turned out to be excellent, Tandberg could have done themselves a lot of good by being more complete in their tabulation of performance specifications. Second, those specifications that are listed are almost without exception too conservative for the highly competitive U.S.

market where manufacturers tend to squeeze every last watt and microvolt (and then some) out of their products!

Seriously, though, the TR-1055 is a handsome receiver—inside and out, and resembles the earlier TR-1020 in panel layout and execution. Clean aluminum extruded bars break up the long expanse of panel into easy-to-use and read sections, with a well illuminated AM and FM dial scale, a signal strength and center-of-channel meter and a large tuning knob occupying the upper section. Below the meter area are a series of illuminated words which light up to tell you mode of operation and presence or absence of such extra circuits as filters and loudness control in the audio chain. The center “bar” is legibly and boldly marked with the names and functions of the push-buttons and rotary controls located directly below. These include a power on/off switch, muting switch, stereo/mono FM switch, five program selection buttons (FM, AM, Phono, Tape 1 and Tape 2), tape monitor button and volume, balance, bass, treble and speaker selector in the form of easy to grip rotary knobs. This row also contains the usual phone jack and a “Tape 3” jack which, besides enabling you to connect a tape recorder directly via the front panel is special in another way. The lower bar of aluminum which looks for all the world like an immovable part of the front panel is in reality a hinged flap which, when pulled down reveals such secondary controls as a mono/stereo selector, a mono-L(ef) selector, mono R(ight) selector, rumble filter switch, loudness control switch, a pair of high-frequency filters and a unique pre-amp record button which allows you to use the aforementioned Tape 3 jack without bypassing tone, volume, balance and filter controls for altering the tonal response of the recording in process. We honestly can't think of a single control facility that Tandberg might have added to this panel—and yet, when that flap is swung back into place, the Tandberg TR-1055 looks uncluttered, clean and elegant. Incidentally, in case the flap is closed and you're not sure of how the Tape 3 jack is in the circuit (bypassing controls or not) a light in the dial area lets you know that at a glance too.

The rear panel of the TR-1055, pictured in Fig. 1, contains conventional phono tip input and tape output jacks, with each pair of jacks supplemented by a standard DIN socket. Speaker connections for two sets of stereo speakers also provide a dual option—regular screw terminals or polarized sockets. By

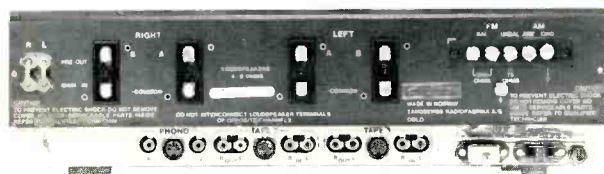


Fig. 1—Rear panel.

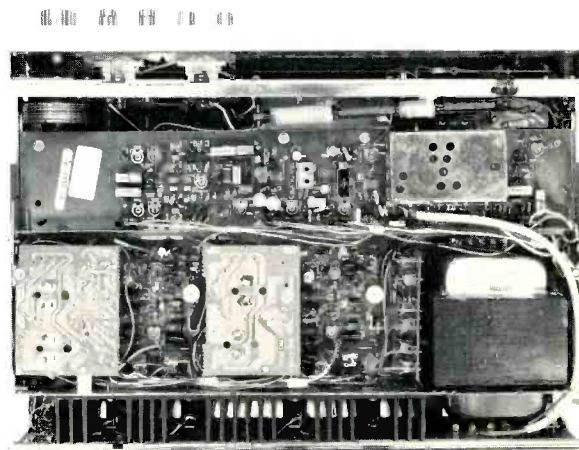


Fig. 2—View of the chassis.

connecting corresponding plugs to your speaker cables you are assured of correct phasing if speakers should have to be unplugged and reconnected for any reason. The rear panel also contains preamp-main-amp jumpers which permit you to separate the two sections and insert a variety of auxiliary products such as equalizers, reverb units and the like. Antenna terminals are provided for either 75-ohm or 300-ohm transmission lines and a pair of a.c. outlets (one switched, the other unswitched) and grounding terminals complete the back panel layout.

But there is more! If you lift up the chassis and look under it you will find three input level controls (one for phono, and two for the pair of "Tape" inputs). These permit you to equalize the levels of these program sources with respect to the built-in AM and FM facilities but, more important, they permit you to adjust overall levels so that the front panel loudness control circuit, when used, becomes a precision device for aural compensation at low listening levels, rather than the "extra bass boost circuit" which it has been degraded to in less ambitious designs. To repeat—Tandberg thought of everything this time!

Figure 2 shows the inside of the chassis, which is a model of orderliness and careful circuit layout. There are separate modules for the low-level preamp circuits, tape selector board, tone control circuits, power amplifier circuits, AM tuner circuit, FM-i.f. and MPX circuit and left and right power supply sections. An interesting innovation is Tandberg's use of two separate rectifier systems to power left and right channels. There are even small separate modules for circuit fuses and the various pilot lamps discussed earlier. The FM front end contains a pair of dual gate FET's plus two conventional r.f. transistors and tuning is accomplished electronically through the use of four back-to-back varactor diode pairs. The i.f. section contains, in addition to two stages of amplification tuned by permanently aligned solid state filters, a multi-purpose CA-3089 IC which amplifies, hard limits and quadrature-detects the composite audio signal. Although this IC requires only one tuning coil, Tandberg has elected to use a double-tuned, primary-secondary quadrature coil arrangement for greater linearity and lower distortion in the recovered audio. The heart of the MPX circuit is a single IC which operates in the phase-lock-loop mode and requires no coils or alignment. Nine additional transistors are used in this circuit and twin-T notch filters effectively reject carrier products from the output lines. Tone control circuits are of the feedback type, and two degrees of filtering slope rates are provided for the two hi-cut circuits. Each power amplifier section is fully direct-coupled from input to output, with a differential amplifier in the input stage for proper bias stability. Thermally activated switches as well as mechanical relays interrupt connection to the speakers in the event of overloads, shorts or other problems which might otherwise damage the set.

Tuner Section Measurements

IHF sensitivity of our sample measured $1.7 \mu\text{V}$ —more like the $1.6 \mu\text{V}$ "typical figure" stated by Tandberg than the "nominal" $2.0 \mu\text{V}$ listed. 50 dB of quieting was achieved with an input signal strength of just under $4.0 \mu\text{V}$, while ultimate quieting reached exactly 70 dB as opposed to the 68 dB claimed for mono FM. Mono and stereo quieting and THD curves are plotted in Fig. 3. In stereo, S/N reached 65 dB with no external high frequency filters connected between the outputs and our measuring equipment. This means that not only was the random noise level down by that amount, but that all sub-carrier products (19 kHz, 38 kHz, etc.) were also suppressed by at least that amount.

The ultimate THD measurements constitute a "first" in our laboratory. This is the first time we have measured *identical* values of THD for both mono and stereo performance—0.2%! Who said it couldn't be done? Tandberg claims only 0.3% for stereo—but our sample proved to be better than that. A couple of other firsts are represented in the graphs of Fig. 4, where mid-band separation for stereo FM reached an incredible 50 dB—the theoretical limit of our stereo generator. Separation remained well above 35 dB all the way down to 50 Hz, decreasing to about 30 dB at 10 kHz. THD in stereo at very low frequencies approached 1.0%, but at the higher frequencies, THD was the same for both mono and stereo, approaching 0.5% at about 10 kHz with no evidence of "beats" observed in either the meter readings or the 'scope display used to examine the distortion components.

Other measurements made of FM performance were a capture ratio of 0.9% (as claimed), selectivity of 85 dB (better than claimed) and spurious response rejection in excess of 90 dB. Automatic switching to stereo takes place with an input signal strength of $5 \mu\text{V}$, while the muting circuits are adjusted to allow reception of signals of $3 \mu\text{V}$ or higher.

The AM section, while not the most sensitive we have measured, proved to have excellent selectivity and relatively low distortion—0.8% for 30% modulation. AM tuning, unlike the FM arrangement, is done by means of a conventional variable capacitor and i.f. stages in this section are tuned by means of conventional interstage transformers. I.f. rejection measured 52 dB as claimed, while image rejection was a bit better than 40 dB. Calibration of both the AM and FM dial scales was extremely accurate from one end of the band to the other.

Amplifier Measurements

Harmonic and Intermodulation distortion characteristics of the amplifier section of the TR-1055 are shown in Fig. 5, the former with an input signal of 1 kHz applied to the Tape 1 inputs. Under these test conditions, with both channels driven

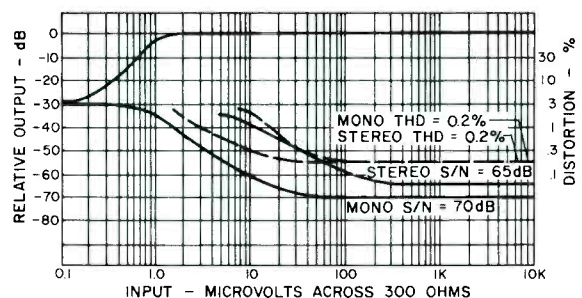


Fig. 3—FM quieting and distortion characteristics.

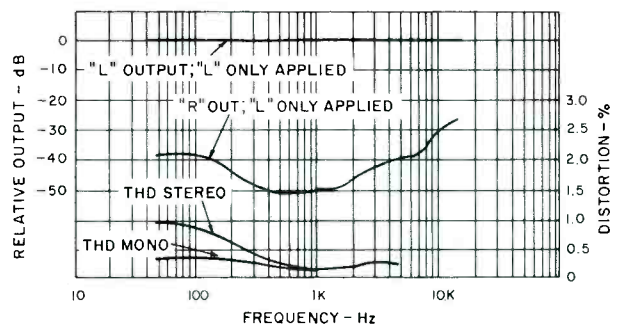


Fig. 4—Separation and distortion vs. frequency.

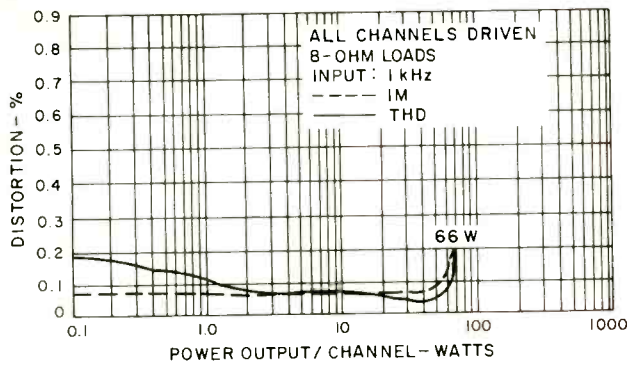


Fig. 5—Harmonic and intermodulation distortion characteristics.

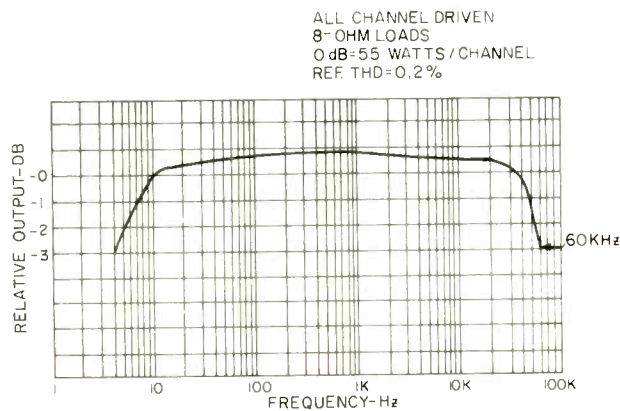


Fig. 6—Power bandwidth characteristics.

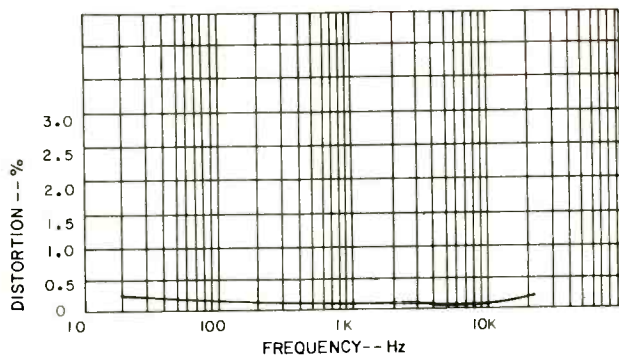


Fig. 7—Distortion vs. frequency, at full power output.

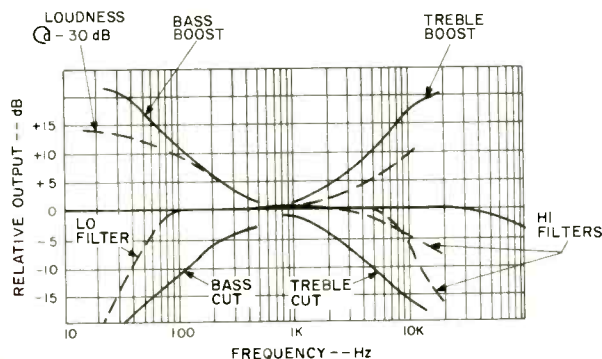


Fig. 8—Tone control range, filter and loudness characteristics.

and connected to 8-ohm loads, power output reached 66 watts for the rated THD of 0.2%. Tandberg makes no claims with respect to this measurement, preferring to quote power output over the entire frequency range from 20 Hz to 20 kHz at 55 watts.

Figure 6 is a plot of power bandwidth which extends from 4 Hz to 60 kHz (as opposed to the 40 kHz limit claimed by the manufacturer). Note that at 10 Hz, the curve crosses the 0 dB level, corresponding to 55 watts. At the high end of the audio range, the amplifier actually produces a bit more than 55 watts. At the rated power output, THD at 20 kHz measured 0.08% as shown in the continuous frequency vs. THD graph of Fig. 7. While we normally present frequency vs. THD curves for three different power levels (full power, half power and 1 watt levels), there was no point in showing the lower output curves in the case of this receiver, since even at full power output, THD was below 0.2% for all measured frequencies. At the one watt level, the curve would have actually crossed the "full power" curve because of residual hum. Residual hum measured via the Tape input terminals was -76 dB with reference to full output. Phono hum measured -66 dB with reference to a 2 mV input signal and with the input sensitivity adjusted for maximum sensitivity. Since most magnetic cartridges will produce more than 2 mV nominal output with typical record groove velocities of 3.14 cm/sec., this hum figure is quite impressive and must be interpreted in the light of actual cartridge outputs rather than with respect to the high sensitivity circuits of the phono preamplifier of the TR-1055. Overall frequency response was flat within 1.5 dB from 4 Hz to 70 kHz. At 100 kHz, audio response was down 2 dB. Phono overload occurred at anywhere from 35 mV to 100 mV, depending upon the setting of the input sensitivity control.

Tone control, loudness, and filter response characteristics of the Tandberg receiver are plotted in Fig. 8, and if you want to see how filters should be designed for greatest effectiveness, take a look at the steeper sloped hi-filter and the low-cut filter curves. Note that at 80 Hz and 8 kHz the filters have just barely begun to cut into the response, while at 30 Hz (a prominent "rumble" frequency) and at about 17 kHz, attenuation produced by these two filters is some 15 dB. The alternate hi-filter has a more gradual slope and is intended for use when moderate high frequency attenuation is desired. Alternatively, both high filters may be used in tandem, which results in a somewhat steeper attenuation of highs with a lower crossover frequency.

Listening Tests

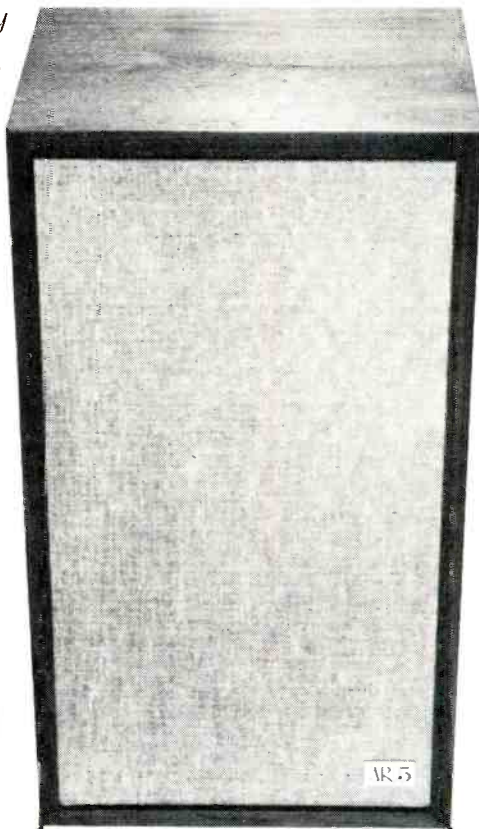
Before describing our reactions to the Tandberg TR-1055 under actual listening conditions, there is a useful, additional "surprise" on the front panel which we found. When you pull out on the speaker selector knob, the signal strength meter becomes a power output indicating meter. Since it is calibrated in arbitrary numerals from 0 to 20, Tandberg thoughtfully supplies a chart in the owner's manual which relates meter readings in this mode to actual power output, depending upon speaker impedance. A very handy addition for such a powerful set if you have any doubts about the power handling capacity of your associated speaker systems.

We were not surprised to find that FM performance, and particularly stereo FM, was superb. The very excellent capture ratio of this unit actually resulted in audibly better stereo FM—particularly from those stations where we ordinarily detect small amounts of multipath distortion even with "best" antenna orientation. Not a single "usable" signal was blocked by the introduction of the muting circuit, thanks to its very low but effective threshold setting of 3 μ V.

Listen to a professional who listened to the AR-5

6 *I was immediately struck by its superb mid-range to high end smoothness and broad dispersion... the AR-5's bass line is solid and supremely clean, very deep... had a room-filling size to it, this is of course, a function of the excellent high frequency dispersion characteristics... if you like your music loud, you will doubly appreciate the AR-5. It is downright cheerful about accepting large amounts of power.*

LARRY ZIDE
IN AMERICAN RECORD GUIDE



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As for the amplifier section, the availability of full power even down to 20 Hz made an audible difference as we tried to drive our low efficiency speaker systems to louder and louder listening levels. We must confess that they "gave up" before the amplifier section of the TR-1055 did—especially on low, low bass passages of music. This was confirmed by continued monitoring of the amplifier's output waveform while listening to different program material. There's enough reserve power here to really take advantage of dual location of pairs of speaker systems—even low efficiency types. We did find that

the treble emphasis afforded by the loudness control was a bit much for us, and so if you use the loudness control at low listening levels you may want to turn your treble control down to about "10 o'clock" to offset this slightly exaggerated treble emphasis. Chances are, though, that when you are working with this powerful unit, you're not going to spend much time listening to "background music"—it's just too fine an instrument for "casual" listening.

Leonard Feldman

Check No. 50 on Reader Service Card

Technics by Panasonic SL-1200 Direct-Drive Player System



MANUFACTURER'S SPECIFICATIONS:

Speeds: 33 $\frac{1}{3}$, 45. **Platter Diameter:** 13 in. **Material:** Aluminum. **Weight:** 3.86 lbs. **Motor:** 20-pole rotor, 15-pole stator, ultra-low-speed d.c. brushless motor. **Variable Pitch Control:** $\pm 5\%$. **Wow and Flutter:** Less than .03% weighted r.m.s. **Rumble:** Better than -65 dB (DIN A), -70 dB (DIN B). **Dimensions:** 17 $\frac{1}{16}$ in. W, 13 $\frac{3}{4}$ in. D, 7 $\frac{3}{32}$ in. H. **Weight:** 22.1 lbs. (with dust cover). **Price:** \$279.95.

TONEARM SECTION: Direct-reading stylus-force adjustment,

static-balanced type, universal head shell, anti-skating device. **Effective length:** 8 $\frac{2}{32}$ in. **Overhang:** $\frac{35}{64}$ in. **Stylus force:** 0.4 grams. **Arm Resonance:** 10 Hz. **Tracking Error Angle:** Within ± 2.0 deg.

This is a beautiful instrument. Anyone who has any interest in mechanical devices would derive considerable pleasure in inspecting it to say nothing about connecting it up to his stereo system or even to a CD-4 installation, since it is already provided with low-capacitance leads in readiness for discrete four-channel applications. The measured capacitance is 70 pF, which is exceptionally low.

The motor itself is an interesting device—no commutator, and a speed selectable by a switch to either 33 $\frac{1}{3}$ or 45 rpm so as to drive the turntable directly without the need for any speed-reducing drives which were almost universal a year ago—no belt, no idler, no mechanical movement to change speeds. The speed is controlled by an electronic circuit, and although adjustable over a range of $\pm 5\%$, it remains exactly where it is put with no dependence on line frequency or, within limits, on line voltage.

The cast chassis is relatively heavy, and is mounted on four "audio insulated" legs which combine springs and damping material for the insulation, and yet may be rotated to adjust levelling of the platter. The large platter—13-in.—extends beyond the record area to provide the stroboscope markings: four rows of die-cast "dots" for both 50- and 60-Hz line frequency for the two speeds. The mat is molded rubber, attractively ribbed, and of the full diameter of LP records. Cast in the chassis is an opening for the 45-rpm adapter disc. Cleverly made with two "levels," the adapter is lifted into a position where it may be grasped easily by pressing slightly on the back

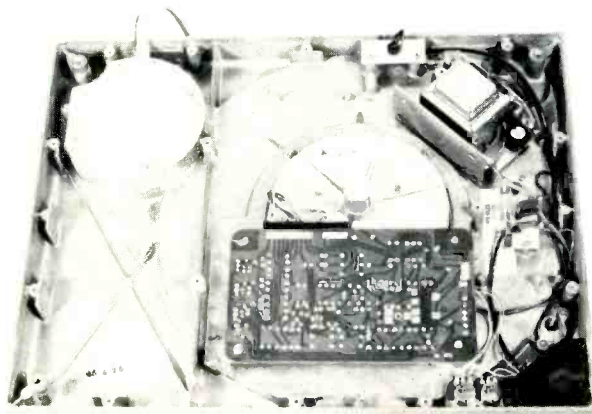


Fig. 1—Underside of chassis with protective molded plastic cover removed.

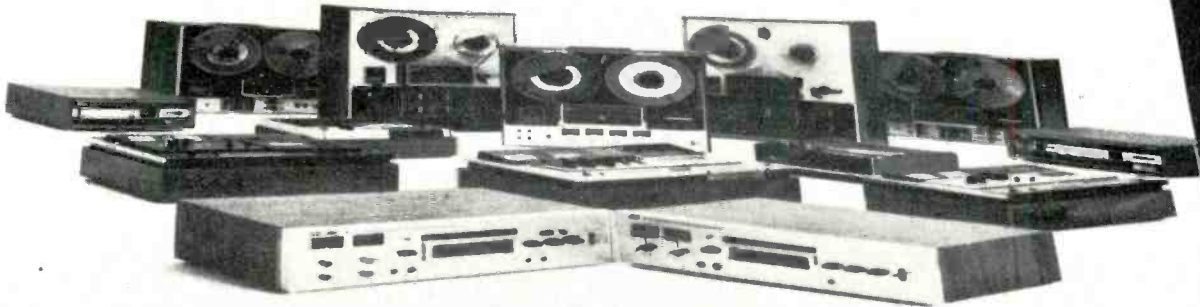


Fig. 2—Close-up of arm mounting showing balance and stylus-force adjusting knob, cue control, anti-skating control, and arm lock.

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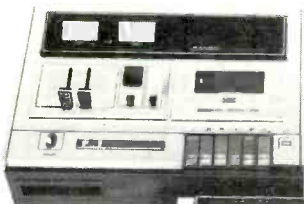


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half. Along the left side of the chassis toward the front is a housing for a neon lamp which illuminates the rows of dots comprising the stroboscope. At the front left corner is a three-position lever switch for power and speed selection, and to its right are two small knobs for vernier adjustment of speeds.

The tonearm is just as loaded with unique—or at least intelligently designed—features. It has all the usual functions and characteristics such as offset, angled horizontal pivot, viscous damped lift and lowering mechanism, locking cartridge head, and so on, but all in a precise form. The one feature that is unique, in our opinion, is the adjustment for balancing the arm. This is a true rack-and-pinion type of adjustment, which is not unusual; many turntables are so equipped. But, once the cartridge and arm are balanced, the balancing knob is then pulled outward and presto! the indicator is automatically at zero, and the desired stylus force is set with the indicator functioning correctly. The arm height is readily adjustable, as is the amount of lift after the correct normal position is set. Similarly, the amount of anti-skating compensation is set by adjusting a knob to the indicated stylus force position.

The dust cover of smoke-colored plastic is molded with slots which engage with the hinges mounted on the rear of the chassis, providing easy removal when desired, yet holding the cover in the upraised position firmly during record changing operations.

Electronic Speed Control

The motor, described as a brushless d.c. unit, actually operates on pulsating d.c. controlled by three power transistors, which are in turn controlled by the interaction of a locally generated signal of approximately 50 kHz with a toothed wheel which rotates with the platter. The signal is picked off by three coils which effectively generate a three-phase 50-kHz signal. These three signals are rectified and compared to a reference voltage from the regulated supply and in turn control the power transistors which govern the pulsating d.c. which actually drives the rotor and hence the platter. The advantages of this system are that there are no 60- or 120-Hz a.c. hum-producing

fields around the motor, and the correction signals fed to the driving power transistors operate so fast that there is practically no deviation from the predetermined speed. Wow and flutter figures are sufficient proof of this.

Measurements

As usual, the normal system of measurements were made with this unit to substantiate the specifications of the manufacturer. Using NAB specifications, wow and flutter measured 0.4 per cent. Measured separately, wow was 0.04% and flutter was 0.035%, all within specifications. Noise and rumble together measured -58 dB below a stylus velocity of 3.54 cm/sec at 1000 Hz. This measurement was made over the whole audio spectrum, but machine-run curves supplied with the machine showed noise and rumble levels ranging between -50 and -60 dB in the vicinity of 25 to 35 Hz, with no peak levels exceeding -65 dB over the spectrum above 45 Hz. Truly remarkable performance. While line frequency variation had no effect on speed, line voltage did. With the line voltage lowered to 85, speed dropped off materially. This is undoubtedly not a function of the motor itself, but of reduced operating voltages for the electronic portions of the mechanism which may cause a shift in frequency of the local oscillator, or insufficient potential to maintain complete regulation. However, in most instances the normal line voltage usually exceeds the nominal 117, often rising to 125 or more during off-peak-load periods. In our tests, speed/voltage consistency was within 0.2% from 90 to 125 volts.

In addition to the fine packaging of the SP-1200, now practically standard with any high-quality Japanese-built product, the unit is furnished with the ubiquitous polishing cloth, the necessary screws for mounting the cartridge, the 45 adapter, a small screwdriver, and a tube of special oil for the motor, which requires ten drops of this oil after 2000 hours of playing—which amounts to 5½ years if the device is used only one hour per day. The tube of oil should last at least as long as the turntable's owner.

C. G. McProud

Check No. 51 on Reader Service Card

Frankmann Integrated Stereo Speaker System



MANUFACTURER'S SPECIFICATIONS

Speakers: Woofer: Four 12-inch, each channel; Midrange: Four 8-inch direct radiator, each channel; Tweeter: Four diffraction horn, each channel. **Crossover Frequencies:** 200 Hz, 5 kHz. **Crossover Type:** 12 dB per octave. **Weight:** Woofer: 185 lbs.; Satellites: 30 lbs. each. **Size:** Woofer: 31

in. H x 49½ in. W x 24 in. D; Satellites: 43 in. H x 9 in. W x 6 in. D. **Price:** \$1300, utility cabinet; \$1600, stained wood cabinet.

Measuring 31 x 24 x 49½ inches and weighing 185 pounds, which would be considered a massive speaker by anyone's standards, the Frankmann stereo reproducing system is marketed by King Research. And these are the specifications of only the woofer section! The midrange and tweeter speakers are housed in 9 x 6 x 43-inch satellite enclosures meant to be suspended on either side of the woofer enclosure to constitute a stereo installation.

A total of 24 speakers are used in the Frankmann. The woofer section for each channel consists of four 12-inch drivers. These are positioned in a multiple configuration with an equal offset of 13 inches between centers and alternate speakers canted so as to cross-fire into the room.

The left channel and right channel woofers share a common enclosure which is sturdily crossbraced for structural rigidity. All woofers share this common volume of 16.1 cubic feet with the distinction between left and right stereo woofers made by their physical location with respect to center of the enclosure. While the woofers are housed in a completely closed fashion, there is substantial leakage of air through the woofers, which, together with a common acoustic communication with woofers of the opposite channel, mean that this was probably not designed as an acoustic suspension system and ranks more nearly with a passive radiator vented system than an infinite baffle system.

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The woofers cross over at 200 Hz to the satellite enclosures which house midrange and tweeter drivers. These are configured in a line-speaker arrangement with four 8-inch direct radiator midrange speakers alternated with four diffraction horn tweeters. The satellite enclosures are intended to be positioned on the same plane as the common bass enclosure and on either side at a height of 18 to 31 inches from the floor, according to King Research. Since these satellite units each weigh 30 pounds, this reviewer recommends a sturdy support for safety reasons.

Speaker connection is made by means of a screw terminal barrier strip on the rear of the enclosures. Each channel uses a pair of wires from the appropriate amplifier terminals to

the rear of the bass enclosure. A flexible wire pair supplied by King Research connects the satellite reproducer to its appropriate terminals also on the rear of the bass enclosure. The terminals are well marked and legible and no difficulty should be experienced in hookup or operation. Each half of the stereo pair is protected by fuses, access to which is available through holders in a recessed cavity on the rear of the bass unit.

The unit received by AUDIO was finished in flat black for custom installation. The only literature supplied to AUDIO by King Research appears to be more nearly associated with a patent disclosure than conventional technical information. This should be very confusing to a purchaser who had not previously had the experience of reading such prose.

No warranty or user oriented instructions accompanied the unit delivered to AUDIO.

Technical Measurements

Figure 1 shows the measured impedance as a function of frequency. Because the woofers communicate through the common enclosure, excitation of one channel causes an interaction with the undriven woofers of the other channel. Because of this, two impedance plots are shown—one with the undriven woofer section unterminated and the other with a low impedance termination.

The curve marked A is the unterminated companion woofer measurement and shows two distinct peaks at 27 Hz and 50 Hz in the bass region. This is characteristic of a vented system and in fact the unterminated woofers constitute the equivalent of a passive radiator, or "drone cone." One can anticipate from this that the low frequency response will not be that of a simple rigid closed box.

The curve marked B is made with a short circuit across the undriven woofers and clearly shows that the double resonance is due to passive radiator effects and not to moving boundary problems in an otherwise rigid enclosure. The B curve is more characteristic of behavior when driven by stereo amplifiers of high damping factor and this configuration was used for all other spectrum tests.

The relatively broad impedance peak at around 2.5 kHz and dip at 7 kHz do not occur at the stated higher frequency crossover of 5 kHz. For the majority of program material, the Frankmann can be considered to be an 8-ohm system as specified.

The one-meter anechoic amplitude frequency response for one-watt input is shown in Fig. 2. The Frankmann is an unusually sensitive system with an acoustic output per watt ranking close to the larger horn radiator systems. The response was measured one meter directly on the axis of symmetry of a satellite which had been placed directly above and in the plane of the woofer cones. Low frequency response is impressive with an acoustic output at 32 Hz well above the mid-range output available from many conventional direct radiator speaker systems when driven at the same power level.

The frequency response above 200 Hz, measured under anechoic conditions, is unfortunately very dependent upon the microphone position. This is due to the "broadside array" properties of periodically spaced multiple midrange and tweeter units. A displacement of the space position of the measuring microphone by less than an inch produces quite a different looking frequency response. This substantial space interference may be responsible for an unusual nonlinear property noted during these measurements. The frequency response is a function of drive level. Figure 3 is a measurement of the normalized response at one watt average and 10 milli-watts average drive. The detail behavior in the 3-4 kHz and 9-10 kHz range is different for the two drive levels as is the

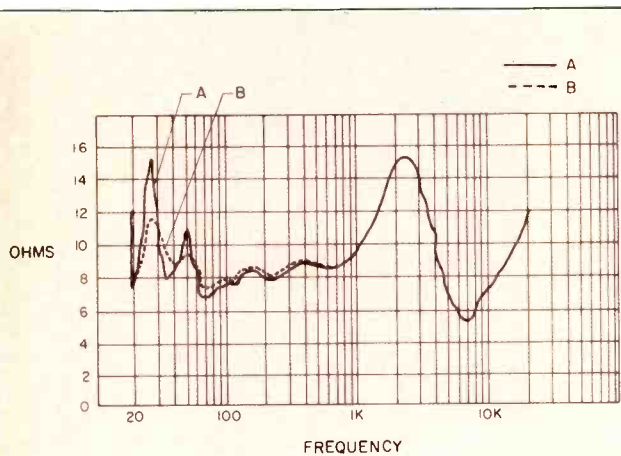


Fig. 1—Impedance (A) opposite channel woofer terminals open and (B) opposite channel woofer terminals shorted.

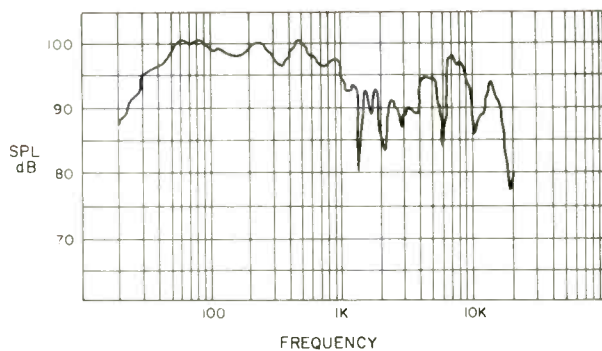


Fig. 2—One meter on-axis anechoic amplitude response with one-watt drive.

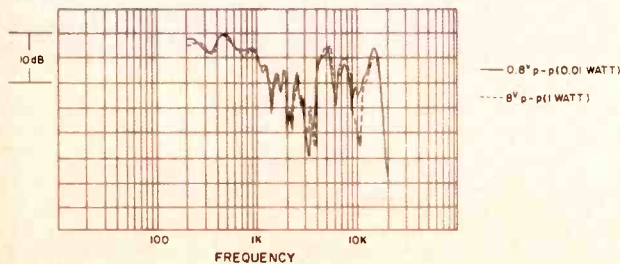


Fig. 3—One-meter anechoic response at two power levels.

fine detail elsewhere. This effect was completely reproducible as a function of power and was not due to driver damage since at no time was measurement made at power levels in excess of 10 watts average above 1 kHz.

Because the phase response was more dramatically modified by drive power level and completely changed characteristics dependent upon microphone position, no phase plot is included for the Frankmann. This reviewer did not feel that it would be possible to provide a representative phase measurement. The Frankmann is almost totally non minimum phase above 1 kHz.

The three-meter room response is shown in Fig. 4. To make this measurement, the bass enclosure was floor-mounted and placed against a flat wall. The satellites were also placed against the same flat wall as a user might prefer to mount them and in a manner indicated in literature supplied by King Research. The satellites were oriented with the long axis vertical and the lowermost part 31 inches above the floor. The satellites were placed slightly over one meter to the left and right of the center of the bass enclosure. Only the left channel stereo speakers were used for test and the right channels had the terminals shorted to simulate an amplifier source. The microphone was placed one meter above the floor and three meters distant from the front surface of the satellite left channel speaker.

The frequency spectrum of the first ten milliseconds of sound arrival are shown. The two measurements of on-axis and stereo listening are displaced 10 dB for clarity of presentation. Much of the midrange-robbing interference evidenced in the anechoic measurement is filled in by floor, ceiling, and bass enclosure sound scattering when listening in a room. The substantial drop in response at 220 Hz for the on-axis position is due to the fact that the acoustic position of the woofer is sufficiently far behind that of the satellite that its contribution does not arrive in time to be passed through the time gate of this 10 millisecond measurement. The implications of this three-meter measurement are that overall sound balance will be good between 300 to 10 kHz for most seating positions, but pinpoint stereo sound images should not be expected. Additionally, the timbre of percussive instruments with fundamentals in the octave around middle C will change with listening position. Instruments which have a more steady state characteristic, such as organ, will not be bothered by this effect and should be accurately reproduced to the satisfaction of many listeners.

The anechoic polar energy pattern for the satellite mounted in the preferred vertical position is shown in Fig. 5. There is, in fact, a preferred left and right satellite position due to an angular offset of the front mounting panel. This is not mentioned in the literature which King Research supplied; however, it would appear that the satellites may be mounted so that the drivers each more nearly face into the listener position or away from him. To prevent ambiguity, the polar azimuth plot of Fig. 5 was made with the frontal axis aligned with the axis of the speakers themselves, which means that if the enclosure were placed flat against a wall, the wall would be represented by a line passing through the center of this plot and going from about the 9:30 clock position to the 3:30 clock position.

Figure 6 shows the polar energy pattern for the vertical, or elevation, axis of the satellites when mounted in the preferred position. The effect of multiple drivers on a total energy basis is evident in this measurement. Substantial floor and ceiling reflection is to be expected from the satellites, according to this measurement.

Because the bass enclosure handles energy below 200 Hz while the satellites cover the musical range above that fre-

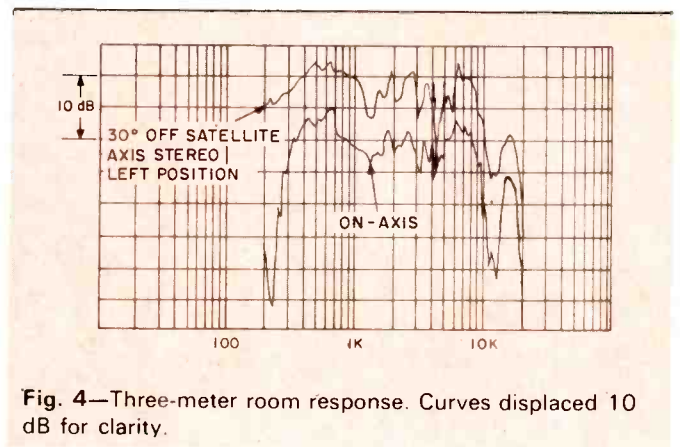


Fig. 4—Three-meter room response. Curves displaced 10 dB for clarity.

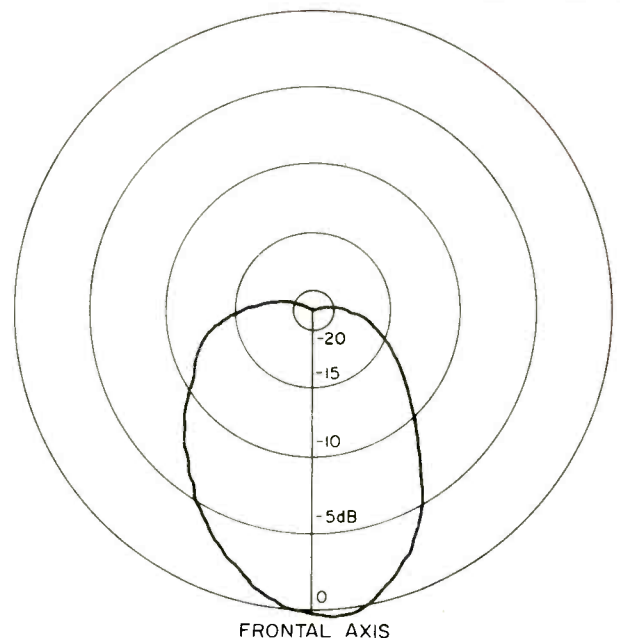


Fig. 5—Horizontal polar response.

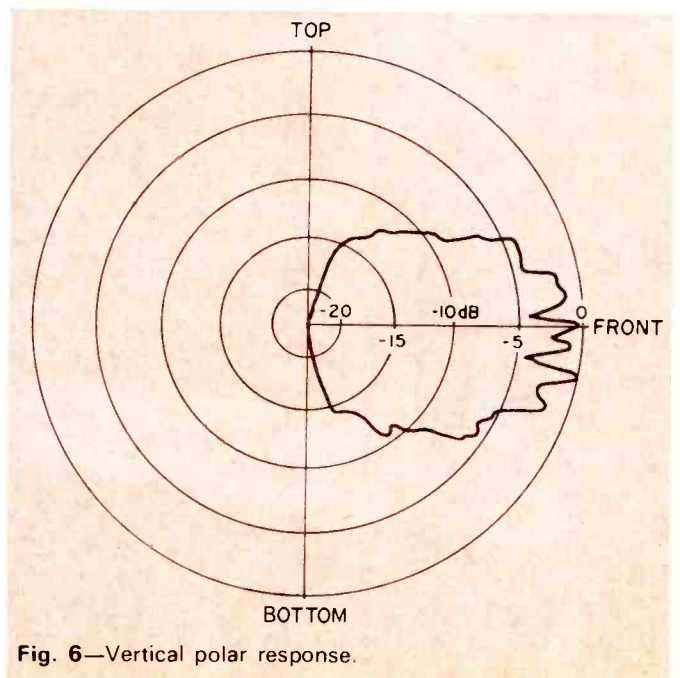


Fig. 6—Vertical polar response.

quency, the harmonic distortion measurements were made separately. Figure 7 shows the harmonic distortion for E_1 and A_2 , which are handled by the woofers, while Fig. 8 shows the measurement for A_3 and A_4 , which the satellites handle.

If you like pipe organ and have a large enough listening room, the Frankmann can provide thrilling reproduction. During all such tests, the output of the test microphone is monitored on an oscilloscope and listened to through an auxiliary speaker to note any signs of distress. No enclosure buzzing or driver problems were noted except for the second harmonic

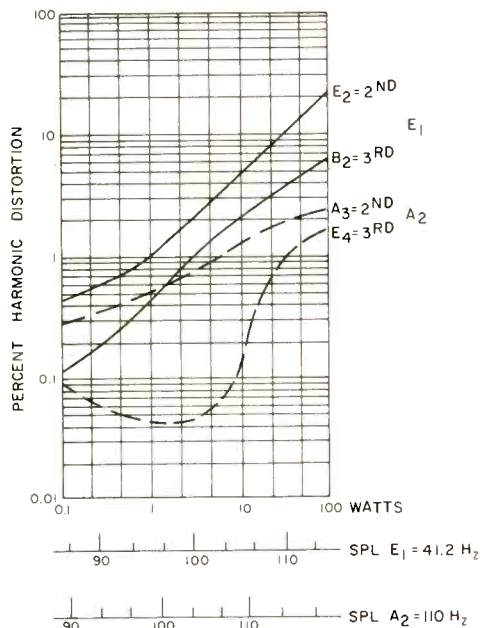


Fig. 7—Woofer harmonic distortion for musical tones E_1 and A_2 .

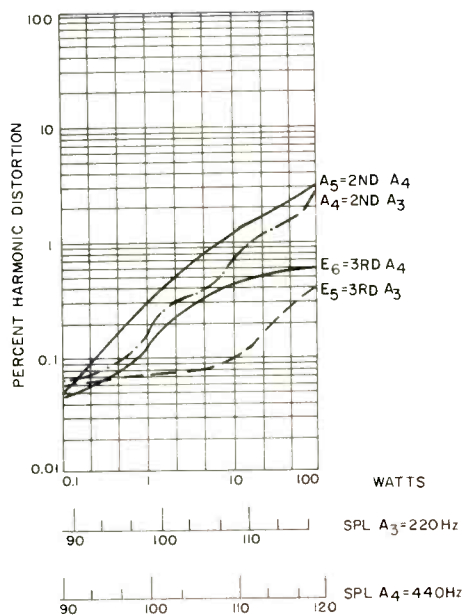


Fig. 8—Satellite harmonic distortion for musical tones A_3 and A_4 .

distortion at E_1 . The use of multiple drivers clearly relaxes the demand on any single speaker, enabling high intensity to be achieved at low distortion values.

To test the woofer which crosses over at 200 Hz, the intermodulation test was performed for the effect of E_1 (41.2 Hz) on D_3 (146.8 Hz). The intermodulation is plotted in Fig. 9 as a function of power. Again, the Frankmann had a very low distortion. The intermodulation was almost purely amplitude modulation with virtually no phase modulation in evidence. A spectrum analyzer display during this test disclosed that the harmonic distortion on E_1 was distinctly higher than the sidebands about D_3 due to E_1 . This is a desirable characteristic.

The crescendo handling capability of the Frankmann is extremely good. Musical test tones of A_2 and A_4 were not measurably modulated by superimposed broad-band noise with an average power level 20 dB above those tones even when the instantaneous noise peaks achieved 200 watt. Assuming an average acoustical transfer of 95 dB per watt at one meter, this means that an 87-dB tone is not measurably suppressed by a crescendo of incoherent tones with instantaneous peak levels of 117 dB when measured at one meter. If you like it loud, this speaker will give it to you.

The energy-time plot is shown in Fig. 10. This is a direct measurement of the arrival time pattern of total energy density for spectrum components from d.c. to 20 kHz. The Frankmann does not fare so well in time delay distortion. The equivalent acoustic positions of selected physical components is indicated on this figure. The measurement is made one meter directly in front of a satellite enclosure which has eight speakers. The speaker directly in front of the microphone is a diffraction horn tweeter. This is what is labelled "center tweeter" on this figure. On either side of this tweeter are 8-inch direct radiators which are labelled "middle speakers." On the outer side of each of these direct radiators are diffraction horn tweeters and then direct radiators, labelled "outer transducers," to complete the eight radiating elements.

What is labelled "enclosure lateral extremity" is the time that would be taken by a sound wave expanding from the center tweeter as a spherical wavefront to traverse the major length of the enclosure and radiate from the acoustic discontinuity due to the enclosure-air boundary.

The voice coils of the horn tweeters lie behind the front panel by a number of inches. The voice coil of the direct radiators is nearer to the mounting surface and a cone compressional wave which travels much faster than sound in air would, if not elastically terminated by the cone surround, launch a sound wave that would appear to come from near the position of the front panel. This would be expected to be very low in energy.

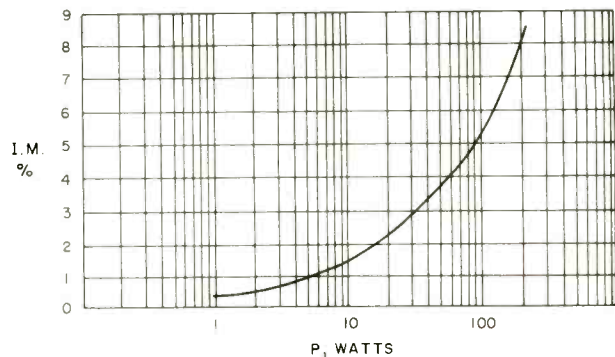


Fig. 9—Intermodulation distortion of musical tone D_3 (146.8 Hz) by E_1 (41.2 Hz) mixed in equal power.

Listening Test

The Frankmann represents a challenge for listening for a variety of reasons, not the least of which is its bulk and the requirement for satellite mounting. When you purchase this system, have a good idea where you want to place it since it is one piece of furniture that does not lend itself to experimentation in placement.

For listening test, the Frankmann was mounted against a flat wall with the satellites also against the wall but raised so that the bottom of the satellite enclosure was just below the top of the bass enclosure.

The first impression is that of a lot of sound for a little power. A ten-watt amplifier would supply all the sound most people would want, if the amplifier were clean. This is a mixed blessing since amplifier hiss and hum will be quite a bit more audible with such an efficient system.

One expects, and gets, a lot of clean bass from the woofers. However, there is one listening problem with the bass which this reviewer found serious and could not solve completely. Stated simply, the natural tendency when listening to a geometrically symmetric stereo installation like the Frankmann, is to sit with the bass section in front of you and the satellites symmetrically displaced to front left and front right. When you do that, there is generally a wall somewhere behind you that is parallel to the wall against which the Frankmann is placed. This is a classic setup for a grave room normal mode. Advertising copy to the contrary, the physics of a localized bass source with that geometry will create standing waves. In the case of the Frankmann, this created the sonic illusion of pipe organs with missing notes in the lower register and tympani with, to this reviewer, an unnatural change in timbre. When the Frankmann was positioned against a wall which had an uninterrupted path of about 32 feet. This reviewer can recommend the Frankmann bass unit only for very large rooms when the Frankman was positioned against a wall which had an uninterrupted path of about 32 feet. This reviewer can recommend the Frankman bass unit only for very large rooms when you are sitting far back from the speakers.

The satellite units provide a well balanced midrange from the standpoint of frequency response, but the stereo imagery is diffuse and does not lend itself to pinpoint localization. Massed choral groups, organ music, and symphonic material were well reproduced with the exception of the previously mentioned room mode problem. Percussive instruments, single vocals, and piano were not reproduced to this reviewer's satisfaction.

The satellites must be oriented vertically. A brief experi-

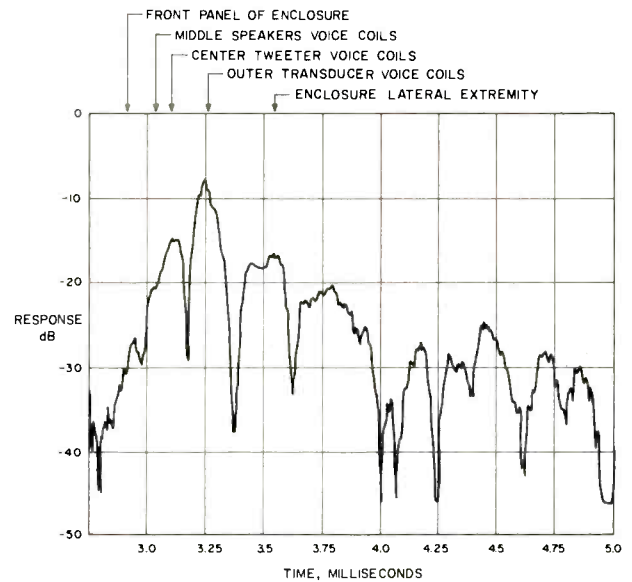


Fig. 10—Energy density for first two milliseconds of sound for perfect impulse with all frequency components from 20 Hz to 20 kHz.

mentation with listening to the satellites spaced horizontally soon verified why. The polar fingering in a horizontal direction is so substantial that even without moving one's head, stereo center stage vocalists hopped kangaroo-fashion from left to right as they performed.

A very interesting effect was noted when wide-stage material was reproduced in a location where the opposite wall spacing was only 14 feet. This close spacing was deliberately chosen to represent reproduction in smaller rooms. If one turns his back so the sound source is to the rear, the stereo quality is almost as good as that when facing the speakers. This would suggest that smaller problem rooms could be used with the Frankmann if the speakers were directed so as to increase the ratio of reverberant to direct sound. In any event, the Frankmann can provide both outstanding bass performance and low distortion high sound level in very large rooms.

Richard C. Heyser

Check No. 52 on Reader Service Card

Addendum

In our May, 1974 equipment profile of the ESS preamplifier and Model 200 amplifier (page 56), we inadvertently inserted an incorrect graph. Here is the proper version, with our apologies for the error. Ed.

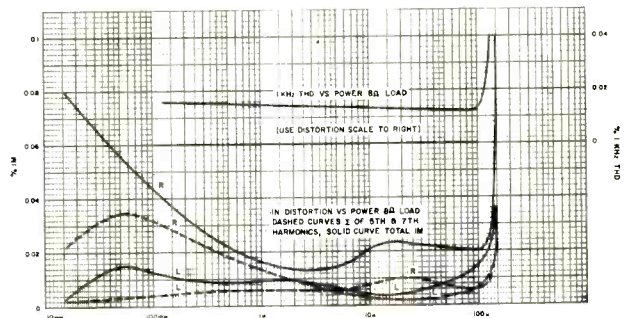


Fig. 14—THD at 1 kHz versus power and IM distortion versus power. Note that right channel IM distortion fell to levels achieved by the left channel with a small adjustment of the bias pot.

Classical Reviews

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AMERICANA

The World of Louis Moreau Gottschalk. Eugene List, Reid Nibley, pfs., Utah Symphony, Abravanel. **Vanguard VSD 723/4**, 2 stereo discs, \$11.96.

The World of Scott Joplin. Max Morath, piano. **Vanguard Everyman SRV 310 SD**, stereo, \$2.98.

The Dawning of Music in Kentucky (A. P. Heinrich). American Music Group, Neely Bruce, pf. and dir. **Vanguard VSD 71178**, stereo, \$5.98 (also *SQ: VSO 30028*).

Astonishing—the first “real” U.S. composer, at last given real depth here. Out of New Orleans, a travelling virtuoso in 50s and 60s, he is of P.T. Barnum era, extrovert and not exactly profound—but his (European-trained) writing is 100 per cent pro, fluent, sophisticated, tuneful and surprisingly American. No naive composer, this! He’s excellent and Eugene List is ideal pianist for him (2½ sides), dry but affectionate, never overplaying. Two big orchestral works too, a piano showpiece (Nibley) and a semi-tropical symphony, prototype film music. No fake and hokum in *this* revival.

Well yes, gotta have Joplin these days. This pianist isn’t hothouse—he plays the rags manfully and with sinew. Helps no end, even with a rather grand piano. Joplin, plus other rags—two by this pianist (after the fact; he’s not *that* old), and Marshall, Scott, Lamb, blending right in with J. himself. A bit of rag goes a long way—jazz is enormously more flexible. But it’s tuneful, and moderately varied here within the rigid rag style.

Here’s the more usual Americana. The “Beethoven of America” alias (his own idea) “log-house composer from Kentucky,” a transplant from Europe, writes showy, can’t-be-taken-seriously (by us) music to now-corny texts, for a laugh. *Hail to Kentucky* (why quotes of “Rule Britannia”??), *Voice of Faithful Love*, etc. plus a long *Barbecue Divertimento*. Piano pieces, little vocal cantatas, a Beethoven-period sound but with curiously jagged 19th c. key changes, not very convincing. For most ears, definitely on the quaint side. Cf. Nonesuch’s Stephen Foster material.

NEAR-TO-MODERN

Erich Wolfgang Korngold: Symphony in F-Sharp, Op. 40 (1950). Munich Philharmonic, Kempe, **RCA ARL1-0443**, stereo, \$5.98.

A revealing disc. Korngold in 1910 was a child genius, acclaimed by Mahler et al., an opera produced at 13—a new Mozart. In 20s he was out-styled by modernism; in ’38 he arrived in the U.S.—and Hollywood. This 1950 Symphony tries to pull it all together, painfully for my ears; it is classical “modern” but keeps falling into embarrassing Hollywoodese. Too bad. He might have been, but wasn’t our Mozart.

Bob Greene’s The World of Jelly Roll Morton. (Live at Carnegie Hall.) Narration by Bob Greene. **RCA ARL1-0504**, \$5.98.

Liszt: Symphonic Poems. No. 7 “Festklänge”; No. 12 “Die Ideale.” London Philharmonic, Haitink. **Philips 6500 191**, \$6.95.

Liszt: Symphonic Poems. No. 5 “Prometheus”; No. 8 “Héroïde funèbre”; Mephisto Waltz No. 1. London Philharmonic, Haitink. **Philips 6500 190**, \$6.95.

Why not! The Jelly Roll Morton concert is on RCA’s fanciest Red Seal

label, right out of Carnegie Hall, a re-creation of music approximately 50 years old. The two Liszt records (part of the complete recording of 13 tone poems, mostly unknown today) recreate concert music that is only about twice as old, from the 1850s. In the long stretch of musical time our “pop” and “classical” categories are ephemeral, mainly useful in the record stores. Jazz is by now almost wholly out of pop. In effect it is already “classical.”

All of this music now must pass through the presto-changeo of the recording medium, straight into the living

room, where it must be judged strictly as listening material in a new environment. Neither Jelly Roll nor Liszt had any such thought (though Jelly Roll did make early records). Anyhow—it is an irony and a pleasure that two such opposites should end up in the precise same listening league! But here they are, and if Liszt costs more it is merely because he is imported.

Of course the Jelly Roll music is the easier to enjoy. I basked in it. Even his 50-year-old style is of our century, the chamber-music clarity of the solo instruments and the even tenure of the

volume ideal for microphones and just naturally comfortable for home listening. Set it and leave it. Liszt, though, is the extreme opposite—he's rewarding but you must work hard, to get the sense and pace. So slow! No hurry—the stuff goes on and on until you think it will never end. Not good as background, either, because it is loud—then soft, and you run for the volume control. The big Romantic moods, the tears, the bombast, were thrillingly new in 1850 but now they sound like film scores. (That's where the films got it.) You must gear yourself down, take time and more time, give all you have, and then the old man comes through; because he was strong and his music is strong, if not to our style.

As for Jelly Roll, this is a fascinating performance because it is at the extreme stretched-out tail end of a living tradition, with three old-timers of the actual period, the rest younger but in direct ear-to-ear descent. You can tell in moments. It's real! Scott Joplin, only a few years further back into rag-time, already has gone, the tradition broken—he returns in revival by those who could not have been there, and the difference is enormous. Joplin is a treasured antique. Even Liszt, via the more precise orchestral tradition, is more directly alive than Joplin, who is mostly played from the printed notes, not from the aural memory of heard sounds.

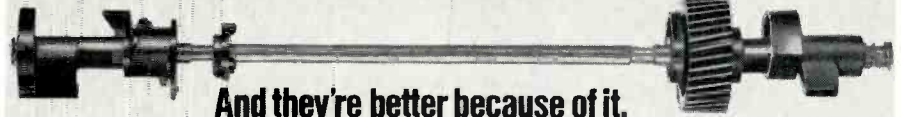
Amazing, finally, to realize that Morton, still so alive in music, is on the far distant side of the entire big-band swing era of the thirties and forties, so much harder, so impersonal and big and chrome plated. The early jazz is wonderfully relaxed and human in comparison.



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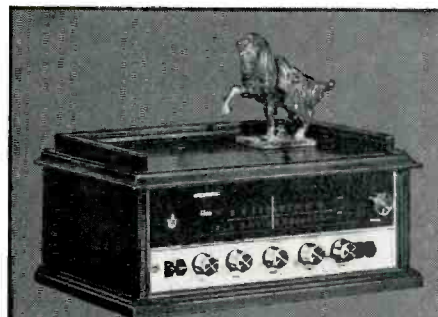
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The Column

Fred DeVan

HEADHUNTERS. Herbie Hancock. Columbia KC-32731, stereo, \$4.98.

Who knows what to call it? Jazz? Jazz/Rock? Or what? For now let's call it music, very together, usually non-verbal, usually inspired, usually very personal music! Herbie Hancock has long been a practitioner of such music. This album provides a very clear indication of what a craftsman he is in the art of making music. Neither Papa John Creech, Doctor John nor Rick Derringer would be totally out of their element performing on this album and likewise—the Concord String Quartet. It's happening all around us—music—forget the “type cast” junk that seems to be an everpresent augery in our lives today. This music is more universal than most around. Let's all listen to music and not exclude its appeal by sticking a label on it.

Herbie Hancock has a definite and personal style and maintains a marvel-

ous sense of humor plus enormous energy. Take the version of *Watermelon Man* that's on this album as an example. It's quite a surprise if you know the tune from its Mongo Santamaria introduction. It really is exactly what you don't expect. The whole album is full of such surprises in form, instrumentation, and texture. It is just a great record.

We have been getting an incredible number of records that can justifiably be called great. This should not diminish what I have to say about Herbie Hancock, but he is part of the sudden lift that is being given to the quality of music that is being recorded.

Herbie is eclectic throughout, no matter what instrument he is playing and he plays many, from the expected Fender/Rhodes, to clavinet and synthesizer. He also plays—pipes? Listen to *Watermelon Man* again. The whole group (5) is as perfect as perfect can be. Which is in keeping with the recording in every way—perfect! Give us more!

RUTA AND DAITYA. Keith Jarrett and Jack de Johnette. ECM 1021 ST, \$6.98.

How would you like to hear an album made by two established musicians that creates a new idiom for itself? “Music,” just plain music as an idiom. Not jazz or rock nor classical or avant-whatever is in style now and all the rage! Just music. No clichés, no patterns, no strictures or structures, no *kula se mama* either! Just a flow of organized sound, harmonies and rhythms. The record is organized as any normal record with cuts, tunes and titles, but these are window dressing. There are definite and defined sections but the music just flows, sort of like an endless loop. (That's not a bad idea.) You will find it hard to listen to at first hearing because it demands your total attention. It is not contemporary chamber music, but I can imagine bits of it being used as background behind the announcer or as a time fill before the appointed news break. You will never know what record

it is, however, you will certainly be aware of some lovely music. I find Jarrett difficult to listen to with frequency (I grew up with McCoy Tyner), but I'm never bored by him. His sense of time is unbelievable. His sense of melody is always fresh and full of air and warmth. De Johnette is an idol to me. He can do little wrong. The fabric these men weave on **Ruta and Daitya** is music, and music that owes either nothing to anyone or something to everybody. If you take it off and stop its flow, it could impel you to follow it with anything. From Sobotnic to Santana. From Miles to Mahler. From Deodato to Delius. It could impel you only if you could stop playing it.

Ruta and Daitya is just lovely music. This is one where the guys with the big systems will get the most. (As if they always don't.) The sound quality and recording is flawless, as is the music. ECM, wherever you are, please make a good round quadraphonic mix out of this one! Although this does great played back via Quadraflex, QS, RM or whatever you want to call it now. The Germans that did the remix really have got their act together. It's really a shame music like this always seems to get lost or buried. It's too lovely not to hear. Bravo again, ECM! And most of all, Bravo Keith Jarrett and Jack de Johnette! Bravo music!

PIANO IMPROVISATIONS, VOLUME ONE. Chick Corea. ECM-1014 ST, \$6.98.

Neither Chick Corea nor ECM will in all probability make a cent on this record. It should not be that way, but only the adventurous among us will buy a copy. Those of us that do will pull it out often when a quiet mood strikes and be delighted with what we hear and feel. Corea devotees will at first be disappointed, then elated on second hearing at the very personal nature of what he does. It's like being a voyeur. Like standing with your ear to the keyhole of Chick's living room on a Sunday morning. One man, one piano, one flood of ideas. He is playing

Why I don't write Negative Reviews, Usually.

I AM NOT a masochist. Nor am I usually angry enough to listen to a bad record twice. Every record I review is listened to at least four or five times, and if I out-and-out don't like it the first time around, I rarely will subject myself to being bombarded by the ugly. Who needs it? I don't think you do either, so that's why I don't write negative reviews. I will only relegate a record to this status after a re-listen at some time other than when it was first listened to.

Okay, so what about the “usually”? All that means is that occasionally a good artist goofs. Like even the Stones and Dylan have put out bummers. And I'll tell you if I think so—as short and quick as I can, so we can get back to the good music. Because I would rather take my time and this space to dwell on all the good music that's happening and at times rescue a worthwhile sleeper from oblivion (if that's possible). F.D.V.

for himself and makes no bones about improvisations of a wide reaching musical mind. In its way this is very much a concept album. There is a flow in it that maintains a frame of mind conveying a singing, melodic, lyrical improvisation. Corea is a craftsman intimate with his instrument. The totally gentle expressions are those of an artist whose ability to communicate is as solid as the Rock of Gibraltar. From beginning to end this first volume of improvisations holds true to its title, the sense of performing is not there. Chick just brings you into his senses and expresses. It is as if he recorded this, totally isolated in a vast alone place, a piano and he transported to an endless, warm, silent void. The recording is noiseless, popless, distortionless, and hissless perfection. It had to be! (If only the classical world had it so good.) The piano was miked without flaw and the fact that records can be made without noise is proven once again.

The two sides are at the same time different and yet alike. His speed and startling lyrical phrasing are developed in contrapuntal lines that find their own peaks and valleys and end where they end. No form, no pattern, but always that consistency of flow that makes you feel that you are hearing through an acoustic peek hole someone who is unaware that you or the microphone are there.

Side one contains the following titles: *Noon Song*, *Song for Sally*, *Ballad for Anna*, *Song of the Wind* and *Sometime Ago*. Side two is entitled *Where are You Now?* and is a suite of eight pictures. The only "liner note" is one sentence: "This music was created out of the desire to communicate and share the dream of a better life with people everywhere," signed, Chick Corea. *Picture Five* is 32 seconds long. *Sometime Ago* is 8:20. In every moment of the whole record, he fulfills his desire—beautifully. This is a wonderful album. This is volume one. Enjoy! Volume two is on its way.

FULL SAIL. Loggins & Messina. Columbia CQ 32540, quadrasonic, \$6.98.

Well, if Paul Simon did it, so can Loggins & Messina. The opener is a Reggie Bandwagon tune—what a downer. Fortunately it is 2:29 short! They will sell a million of 'em. From that point on, it's all uphill towards pure Kenny Loggins & Jim Messina. By the time you get to cut four, you are really glad you put it on.

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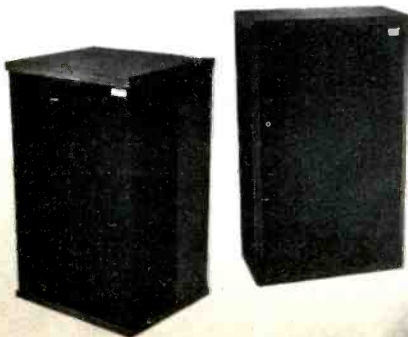
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Full Sail gets underway with a Jamaican oriented fart. I guess you have to start somewhere! A refreshing breeze grabs them and blows away the concessions to those guys who count the beans and the Loggins & Messina ship gets its spinnaker unraveled and they chart a course to fill the jib and mainsail. *My Music* (cut three) is just too short. *A Love Song* (cut four) is just as nice a song as you will ever hear. But they don't really get their bow and rudder going together till cut five *You Need A Man*. *Coming To You* (cut six) shows you they have found their heading and are under full command. I don't know if this is a "concept" album or not! The jacket is full of palm trees and island motifs and has six boating photographs. Cat Stevens and the Stones recorded their last two albums in Jamaica and no Reggie. The Tidbits (if you don't know who they are—you will) live in Jamaica and little "Johnny Nash" gets into their work. The strangest thing about this disc, with all its coconuts and bronzed bodies, is that it was recorded in downtown Hollywood!

Fortunately, the Caribbean is not all that big and they leave it in their wake on side one and get it on real nice on side two. Side one certainly has its merits and moments of brilliance, as you would expect from Kenny & Jim, but side two is what counts as together music. Each is a separate album—one side each. Here on side two Loggins & Messina are definitely under full sail!

The quadrasonic mix throughout is super and gimmickless. Bravo! Good quadrasonics is a hallmark with them. *Pathway To Glory* is a winner. They really stretch out on their voyage, and even if the rest was a dud this cut is a work of art. The whole crew gets into a perfect groove. It's a fine, fine crew with a captain and helmsman that have long ago assured us that they will never really let us down. And they don't! I won't compare this album to its predecessor since **Loggins & Messina**, CQ-31748, is so different. With full sail they behaved like the competent artists they are and stuck their necks out a bit. These guys always seem to win no matter how deep or shallow the water is. **Full Sail** is a good album and logical in all that growing and sailing around means. Let's face it, after *Your Mama Don't Dance*, *Golden Ribbons* and *Angry Eyes*, what do you do? I guess you do an album like **Full Sail**. They will never have to look back and feel bad about anything except maybe the gastrointestinal problems of the first cut.

AUDIO • JULY 1974

Jazz & Blues

Martha Sanders Gilmore

Cleo Laine: *I Am a Song*

Musicians: Cleo Laine, vocals; John Dankworth, orchestra.

Songs: *I'm Gonna Sit Right Down and Write Myself a Letter; Early Autumn; Friendly Persuasion; There Is a Time; Day When the World Comes Alive; I Am a Song; It Might As Well Be Spring; Music; But Not For Me; Two-Part Invention; Talk To Me Baby; Thieving Boy; Hi-Heel Sneakers.*

RCA LPL1-5000, stereo, \$5.98.

Come languish in the loveliness and lyricism of *Cleo Laine*. Her cool liquid tones will enchant and embrace you.

Singer Cleo Laine became an overnight sensation in New York following a Carnegie Hall concert on April 26, 1973. Her repertoire is exceedingly extensive and varied and includes a live album from a memorial concert to the renowned poet T.S. Eliot with such luminaries as Peter O'Toole, Laurence Olivier, and Paul Scofield, a cast album and personal triumph for Cleo from the London production of *Showboat* which occurred in 1971, and song cycles by several "serious" composers. Among her other accomplishments is a version of William Walton's *Facade* and numerous other more conventional albums as well as singles, including one which took its place among the "Top Ten" charts when Miss Laine was prima donna in a Kurt Weill opera in Sadler's Wells in London. In addition, Cleo Laine recently made her Washington debut on September 17th at the John F. Kennedy Center for the Performing Arts in the Center's Shakespeare and the Performing Arts Festival, offering a program appropriately entitled "Shakespeare and Other Things." It received rave reviews.

In this album also Miss Laine extends herself material-wise, reaching deep into the Bach bag for a swinging version of one of his *Two-Part Inventions* in which she scats mightily over J.S. Bach's fugal configurations, sounding for all the world like one of the Swingle Singers, which all goes to prove that Miss Laine can sing *anything*.

On hand with her here is her husband, the very talented John Dankworth, a composer, the best known bandleader in England, and a musician as well who

plays clarinet and alto saxophone. It was Dankworth who did the fine arrangements on this LP along with Ken Gibson and one assumes that it is he playing clarinet and alto here as well although the record doesn't ever state it.

Side one features Cleo with full orchestra, Dankworth extracting lustrous playing from his forces. The second side has Miss Laine with a smaller, more intimate group and is all the more bouncy for it.

A composer of sad songs, Dankworth plays some fine clarinet in his composition *Thieving Boy*, a melancholy carol-like tune in which he and Miss Laine perform pleasing intervals apart. And Cleo Laine truly does Dankworth's bluesy *I Am a Song* justice. She doodles along quickly in *I'm Gonna Sit Right Down and Write Myself a Letter*, projecting her extremely flexible voice against Dankworth's alto, displaying a cool charisma. Non-stop and without a break, she goes into a bossa nova-ish *Early Autumn*, showing off her real sense of pace in a voice that has hints of Sarah Vaughan, traces of Ella Fitzgerald, and glimmers of Morgana King.

In the Quaker song *Friendly Persuasion*, Miss Laine will soothe and envelop you in a cushion of velvet, permitting no sharp edges to peep through. She enters the bittersweet world of Charles Aznavour in *There Is a Time*, full of mixed tempos that rush forward, then relax pensively. It resembles a Broadway hit as Miss Laine creates genuine excitement with her plush, opulent voice and her curvaceous intonations.

Day When the World Comes Alive has a Blood, Sweat, and Tears flavor to the arrangement, the sound of today as Cleo demonstrates her far-reaching range. But most startling of all is her way up, incredibly high "G" in Carole King's rollicking *Music*. Her voice is at its luminescent best in *It Might As Well Be Spring*, having a firm round sound to it and displayed here with a minimum of accompaniment.

She sings a heart-felt rendition of *But Not For Me* by George Gershwin, (Continued on page 63)

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(Continued from page 57)

then really belts it out and gets a beat going in Johnny Mercer's *Talk To Me Baby*, an inexplicably obscure song by one of the greatest songwriters of all times.

Jim Cullum's Happy Jazz: Listen Some More

Musicians: Jim Cullum, Jr., cornet; Mark Hess, trombone; Gene McKinney, trombone; Cliff Gillette, piano; Buddy Apfel, tuba; Jim Newell, banjo; Harvey Kindervater, drums; Bobby Gordon, clarinet.

Songs: *The Eel; Playin' Hooky; Westermoreland Weave; Savoy Blues; All My Love; Kansas City Stomps; Wherever There's Love; High Society; Whinin' Boy Blues.*

Audiophile AP 120, stereo, \$5.95.

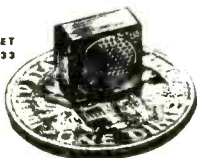
With all due respect to the sincerity of Jim Cullum's happy warriors, this is another one of those stiff, plodding revivalist collections by a group of white, middle-class buff/musicians self-consciously playing old time New Orleans jazz.

What is lacking here, and what is present in authentic New Orleans music is the intuitive, joyous ensemble-building; the genuine compulsion to swing. The trouble with bands like Cullum's and with other New Orleans revivalist groups is that they lack the elastic swinging beat, the danceable lilt of a true New Orleans or Dixieland jazz band. *John Lissner*

Sound: A Performance: C-

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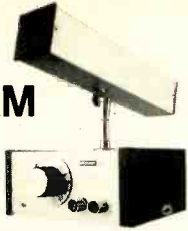
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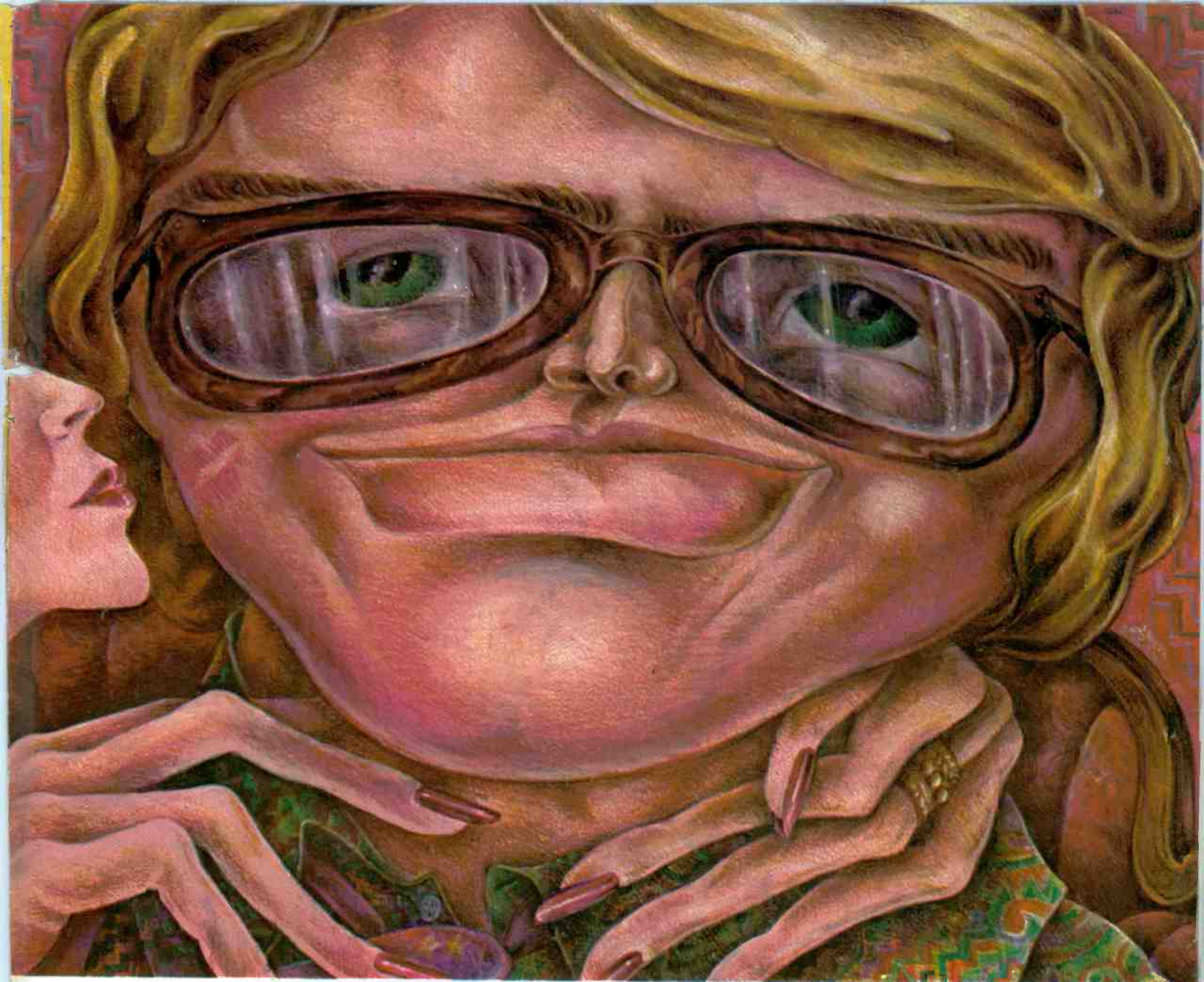
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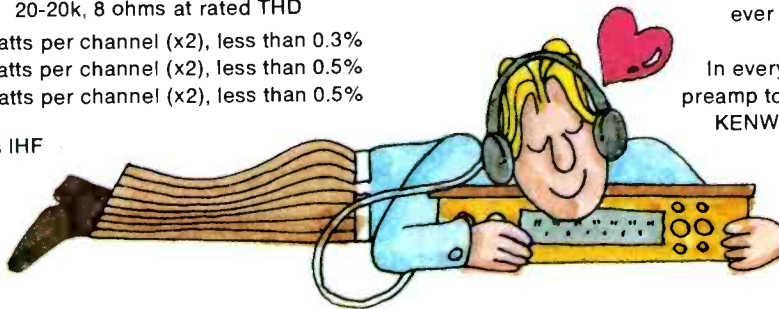
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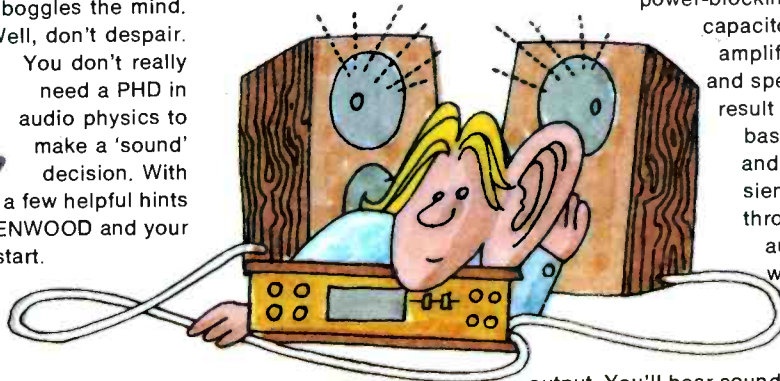
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