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AUGUST 1978
VOLUME 9 — NUMBER 4

Recording engineer producer

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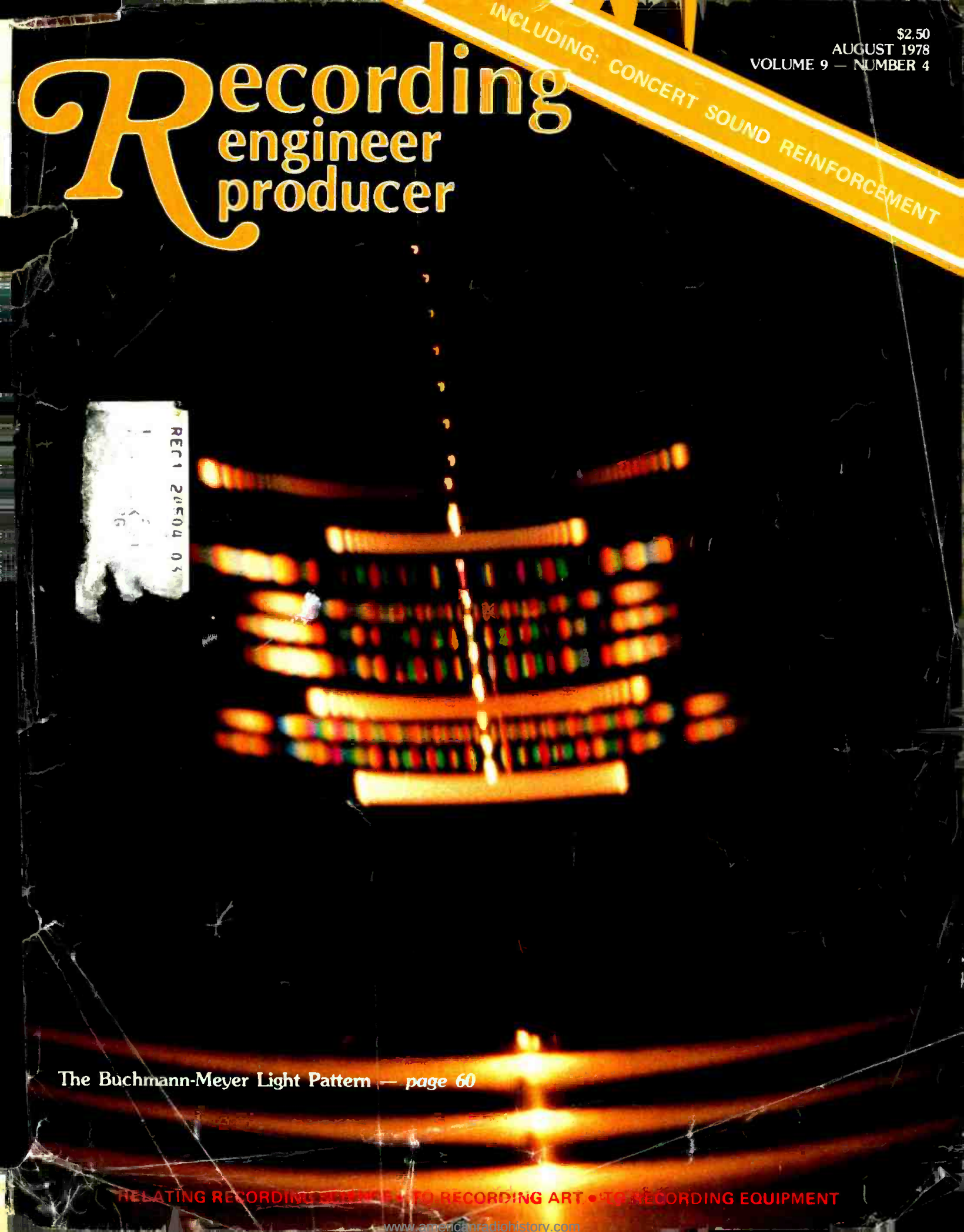

The Buchmann-Meyer Light Pattern — *page 60*

RELATING RECORDING SCIENCE • TO RECORDING ART • TO RECORDING EQUIPMENT

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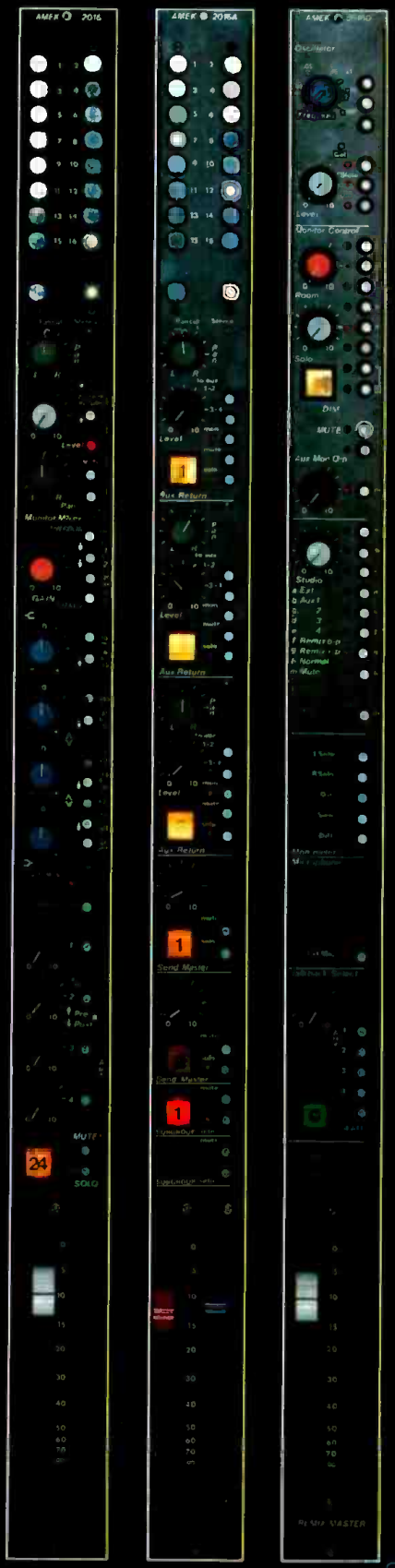

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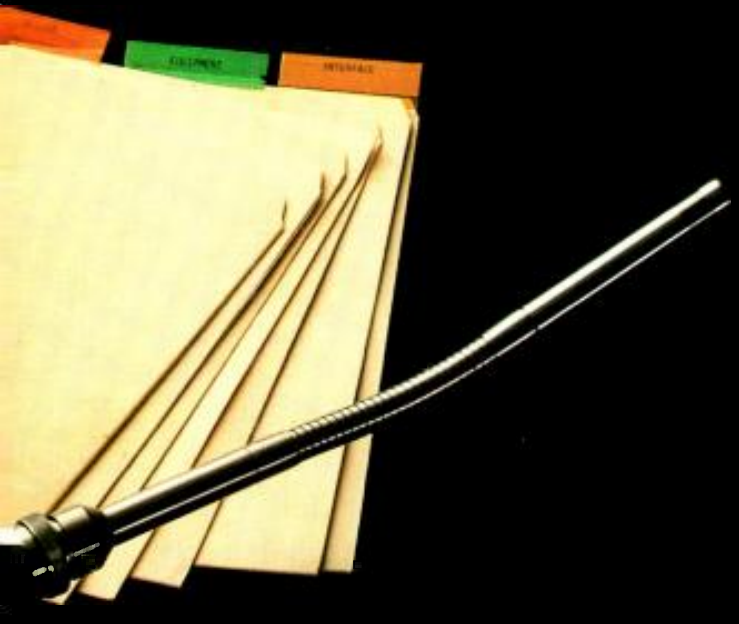

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— the magazine to exclusively serve the **Recording Studio** market . . . all those whose work involves the recording of commercially marketable sound.

— the magazine produced to relate . . . Recording **ART** to Recording **SCIENCE** to Recording **EQUIPMENT.**

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AUGUST 1978
VOLUME 9 — NUMBER 4

— Contents —

the cover —
Reflected light from a test record forms a plot demonstrating an application of the Buchmann-Meyer technique for measuring cutting head frequency response. The bands represent test tones of frequencies from 100 Hz to 30 kHz, which were cut at different levels. The spectrum effect is achieved by moving the light source from a perfect 45° angle from the plane of the record. (See page 60.)

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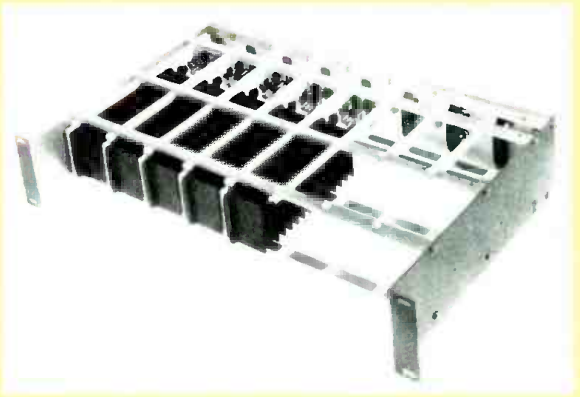

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These are typical specifications measured by MIDDLE RIVER RECORDING in the "Hands On Report", October 1977. The unit reviewed was a Model 1202, which the Model 3216 surpasses with even cleaner and quieter performance.

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for additional information circle no. 3

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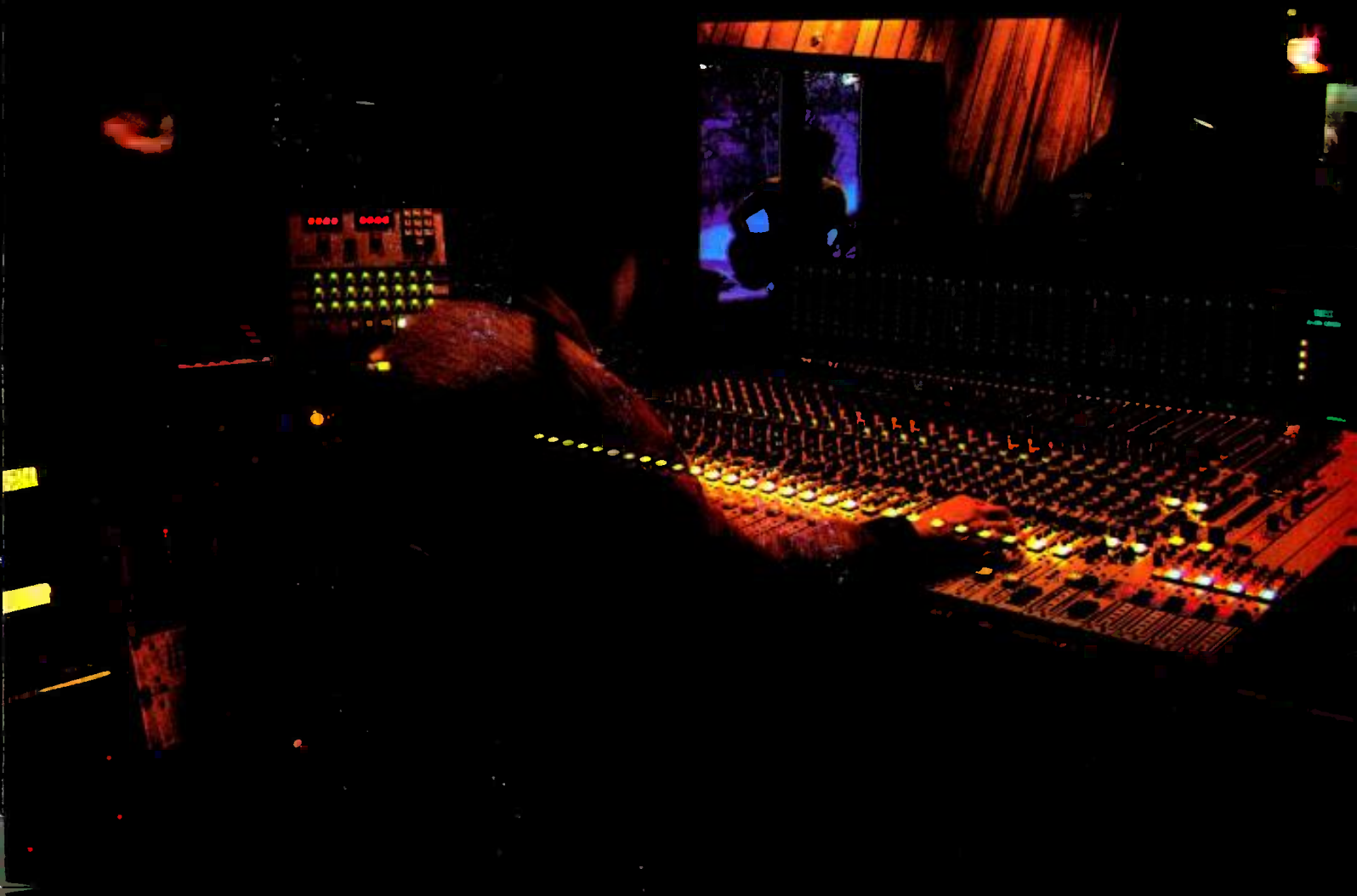
Andy Watermann

Andy Watermann, Owner
SHADE TREE STUDIO, Lake Geneva, WI



for additional information circle no. 4

FULLY AUTOMATED 24 TRACK **SHADE TREE STUDIO** PLUGS INTO LAKE GENEVA RESORT.

Jerry Milam and Andy Watermann behind the MCI-528 console.

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You know, Jerry's client list reads like 'Who's Who' in the music business, and they all swear by him. That's because his installations are equal to anything available in Los Angeles, New York, Nashville or anywhere else."

"Jerry introduced me to his friend, Rudi Breuer, who's probably the top studio builder in the business. He's really the craftsman who made the acoustics and sound-proofing become so comfortable and beautiful. In fact, Rudi added a soundproof window that can either be fitted with sound and light absorbent panels or left open for a fantastic view of the woods and rolling countryside. Rudi and his own crew controlled the quality and costs, then finished on schedule. It's no wonder that Jerry collaborates with him on all the big jobs."

SHADE TREE's main studio features exposed sound absorbent ceiling beams and acoustic surfaces framed in rich redwood.

"Jerry started in this business as a musician and his heart is always in the music. That awareness makes a tremendous difference in the completed studio."

The view outside can inspire a performance inside.

"Jerry flies his own company plane and covers the Midwest like his own backyard. So, before you talk to anyone else about a studio, I'd suggest you talk it over with Jerry Milam. He'll deliver the sound."

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Ask the professionals about Jerry Milam. A complete list of clients and previous installations is available upon request.

Letters

from: **Michael Rettinger**
Consultant on Acoustics
Encino, CA

This is in reference to the article *"Acoustical and Architectural Design of Studios"* by Woody Smith in the June, 1978 issue of your magazine.

The paper is flawed by numerous grammatical and technical inaccuracies. Examples of the former occur in writing "boundries" for boundaries, "symetry" for symmetry, "aleviate" for alleviate, "it's" for its, "cocophony" for cacaphony, and others. Examples of the latter occur in listing only the axial modes of a 10' x 12' x 15' room and ignoring both the oblique and tangential modes or resonances, which far outnumber the axial ones.

How can such an article be convincing?

---

reply from:
Woody Smith
Vice President, Engineering
Abadon/Sun, Inc.
San Antonio, TX

Thank you for your letter of July 11 regarding the "grammatical and technical inaccuracies" of my article as published in *Recording Engineer/Producer* magazine in the June, 1978 issue. I'd like to extend my most sincere apologies for the grammatical and typographical errors which occured, however I do not feel that the technical value of the article should be overshadowed by a needless concern for spelling mistakes.

As to the "technical inaccuracies", it was clearly pointed out in the article that the initial calculations are merely a basis for design and not applicable to real world conditions. Further, we felt that a lengthy discussion of axial, tangential, oblique and any other resonant modes would have drastically added to the complexity of the article without adding to its practical value. My intention was to provide *basic* information about our method of room design in a format which anyone could understand and utilize. Whenever the technical aspect exceeds the practical value, the article must become a burden on the reader. Our intent was and is to serve the reader, not confuse him.

I should also point out that less than one-third of the article has been mentioned in your letter. I sincerely feel that the remaining two-thirds is the important part, not the first third. Considering the article as a whole, I am very pleased with it and the practical information it contains. If great quantities of equations and calculations are necessary for an article to "be convincing", I think this one might have failed. But if practical informa ion and new insight make an article successful, then I think the article is both convincing and successful.

---

from: **Orrin Charm**
Audiovisual Systems
Hollywood, CA

"Shielding, Grounding, & Safety", by Ken Fause *(June, 1978)* is the first, clear, comprehensive, and (almost) accurate article on the subject to be published recently in audio journals. I can personally verify that his system works, having used it in the design of recording consoles, studios, and other audio gear. In the design of any audio system, the grounding and shielding must be considered as an electrical *circuit*, and not just connected together indiscriminately.

Ken's point: "No loop; no magnetically induced noise voltage" must be considered along with the fact that some form of loop is absolutely necessary in a signal circuit to enable current flow; only in the shielding circuit can the loop be left open. Signal circuits, shielded or not, are still susceptable to induced noise currents. However, "B" (flux density) is proportional to current (if electrically created) and to the square of distance. Thus, routing sensitive signal leads away from high-current cables, power transformers, and loudspeakers is far more cost-effective than trying to enclose everything in mu-metal. Also, signal leads should be run in *steel* rather than aluminum conduit to afford shielding from stray magnetic fields.

The one apparent error in Ken's excellent article is in the circuit diagram for a separate "technical" grounding system (Figure 5), apparently a typographical foulup. The diagram should read as shown. The receptacles with isolated ground pins (GE8200-IG or equivalent) are made for hospital use and are *not* U. L. approved yet.

Unfortunately, many of the ground-loop-noise problems I have encountered have been in pre-existing situations — it is really quite simple to design a quiet and safe ground system when starting from scratch — where it was not practical to completely rewire the equipment. In these situations, an "Over-Ground" or "Brute-Force Ground" scheme has usually been effective. Since ground loop noise is caused by the flow of current between ground points, and returning through signal leads, by providing a direct line of *significantly lower impedance* to a reference ground, the noise currents will be divided and the noise induced into the

continued overleaf . . .

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signal will be proportionally attenuated.

This can be accomplished by connecting a #12AWG or larger wire from each major piece of equipment's ground point directly to a reference or earth ground. For long runs, a #1/0AWG or larger may be used and securely bonded to the #12's. All connections must have extremely low resistance. The lower the impedance of this extra lead to ground, the greater will be the attenuation of ground loop hum.

I repeat that this system should only be used where it is impractical to impose a proper grounding design. Misapplied, overgrounding can create worse problems!

My thanks and gratitude to Ken Fause for his extremely "sound" article, and for his valuable assistance in evaluating previous grounding and shielding designs.

---

from: **Douglas Kramer**
Seattle, WA

I've read Morrison's book on grounding and shielding. In your article *"Shielding, Grounding, & Safety"* you've filled in the specifics that he only generalized about. Thank you.

Three questions: Your diagram on page 61, copied here, has three *loops* in the safety ground — *both* ends of each mains power conduit are tied to the safety ground (green wire). (The panelboard-end of the green wire is attached to the conduit through the wire which is bonded to the panelboard.) This is a direct contradiction of your statement (italicized) *"Each piece of audio equipment and each type of ground associated with that equipment connects to a single defined point by a single path."* Are these ground loops intentional exceptions to your rule? Your later statement (page 62) "All signal shields should be insulated from conduit and enclosures" makes me believe the connections should be severed where I've shown with three red x's.

Second, you say "By code, the neutral . . . also must be bonded to ground at the service entrance point." Yet you don't show this connection in the drawing. Is this an oversight? Or is the ground incorrectly bonded?

Third: You say all receptacles "should be tested for correct polarity" but you give no reason or advantage for doing so. Apparently, the hot and neutral are treated *identically* in your diagram, neither connected anywhere to earth ground. Please clarify for me.

Thanks for the fine article.

---

reply from:
Ken Fause

My thanks to the above readers and the many others for their kind compliments about the article. My apologies for the confusion raised by Figures 4 and 5. Due to personal commitments the article manuscript was submitted quite too close to press time for the comfort of either the publisher or the author. In the resultant haste, the rather complex artwork went awry. Corrected versions of Figure 4, Audio Ground via Equipment Safety Ground (printed last issue on page 61) and Figure 5, Clean Technical Ground (page 62) appear with this letter. The corrections to Figure 5 are identical to those Orrin calls for.

Orrin is quite correct in noting that isolated ground receptacles are *not* currently U. L. listed devices — they are considered strictly special purpose receptacles and are manufactured in a distinctive color to prevent confusion with standard devices. There are many situations in electrical construction where a wiring *method* may be approved but there is not a complete U. L. listed *device* available to accomplish the task. In this case the complete installation, including the component devices, is subject to field inspection and approval by the local authorities having jurisdiction. Therefore, as stated in the article, it is essential to verify that a "clean ground" scheme will be acceptable to these officials — *before* beginning construction.

The point about routing of signal leads is well taken. Good practice demands the segregation of cables according to function and signal level — forming separate bundles for power, logic, microphone level, line level, loudspeaker level, video, and so on. These should be run in separate conduits as well. Ah, yes, conduits . . . I should have raised the specific point that Orrin mentioned: aluminum conduit is lightweight and easy to install and therefore popular. It is also virtually worthless as a magnetic shield. In our own consulting practice, we add the following note to electrical construction drawings:

> Make technical power, utility power and signal (audio) runs in steel raceway (conduit). Aluminum raceway is acceptable for lighting circuits only if spaced more than 4 feet from signal raceway runs. Cross power and signal raceway runs at right angles. Route all circuits to maintain maximum spacing between power and signal runs.

As to the "Brute Force" approach to grounding: It seems to me this is audio's equivalent to sweeping the dirt under the carpet — the dirt doesn't go away, you just hide it and wind up with lumps in the carpet. I am forced to agree, though, if time and budget will not permit doing things correctly, the approach *may* reduce noise

— *continued on page 86*

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There is a difference between so-called consumer decks and professional decks. Several, in fact.

That's why TASCAM SERIES created its Model 40-4 Recorder/Reproducer. While consumer decks are designed for play, our Model 40-4 is meant for work. Hard work.

It's a tough, heavy-duty deck with the professional specs, features and functions it takes to qualify for professional, in-studio use. But our Model 40-4 costs a lot less than its in-studio peers.

Our Tascam 40-4 has a suggested retail price of $1600.* That's more than most consumer decks, but it's designed to do a lot more.

The 40-4 transport is the same as our 80-8 half-inch eight-track deck. Designed to move heavier half-inch tape, the 40-4 handles lighter quarter-inch tape smoothly without strain.

It's rugged enough to take the constant wind and rewinding to build your tracks to where you want them. The 40-4's tape transport system is a good example of the mechanical overkill that separates our 40-4 from lesser decks.

Okay. If you're just beginning, you can buy any consumer deck; TEAC makes the best around.

But if your commitment is serious enough to require a four-track recorder/reproducer you can rely on for a long time and produce studio-quality results, it's our Tascam 40-4.

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The impedence roller is strictly professional caliber. Along with the heavy dynamically-balanced flywheel, it guarantees better tape-head interface. Therefore, reducing the possibility of dropouts during a critical recording session.

Our exclusive Function Select initiates TAPE/SOURCE, PLAY-BACK/RECORD and dbx ENCODE/DECODE modes with just one button. Additionally, FET circuits (not mechanical relays) enable you to punch in and punch out without pops.

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Thanks to our single record/playback head, you'll hear existing tracks in sync with full frequency response while over-dubbing at 15 ips.

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Heavy-duty motors, bearings and brakes assure you of smooth tape handling throughout the long hours of the multitrack recording process.

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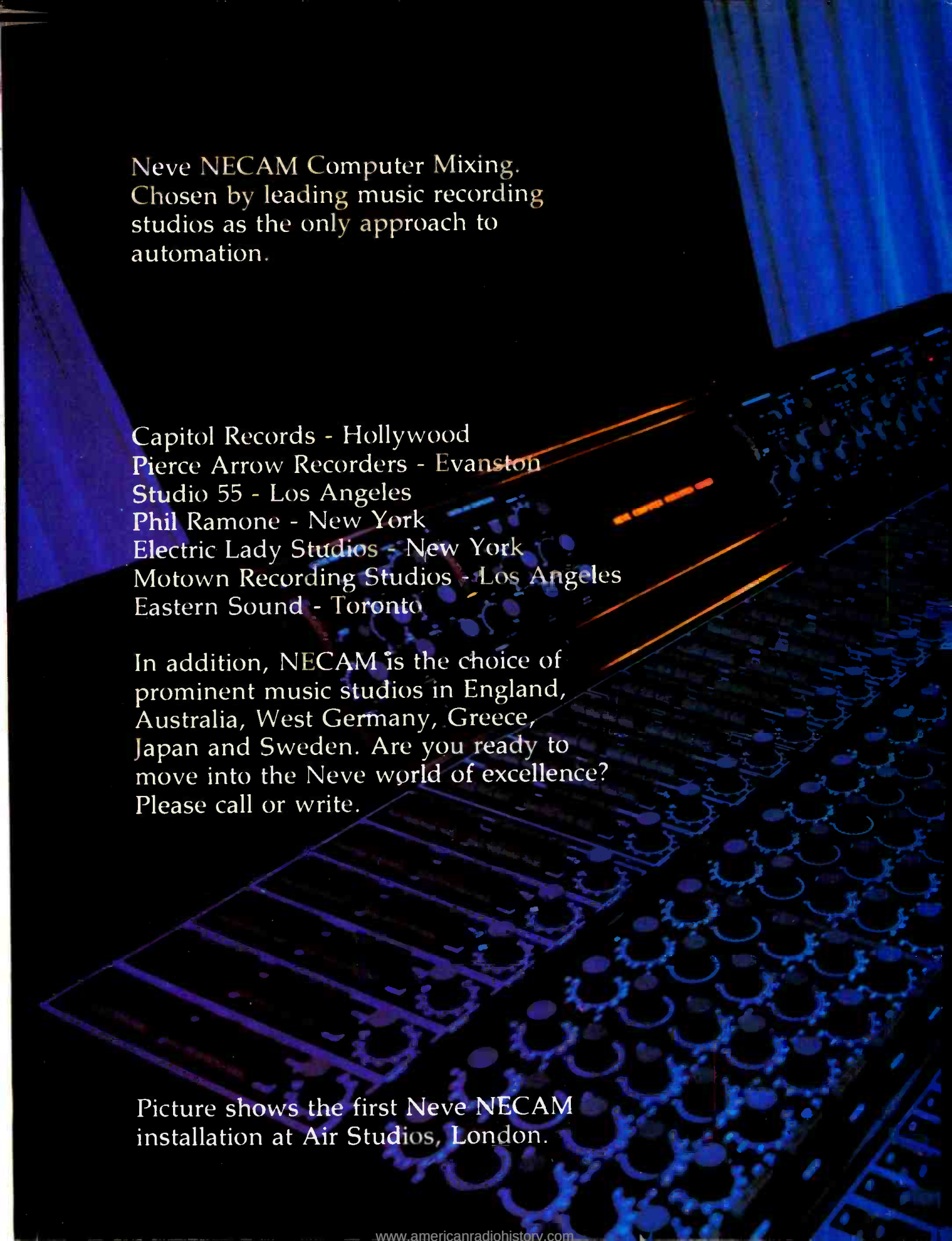

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Neve

Bill Szymczyk Ed Mashal Joe Walsh and the Eagles

by Tom Lubin

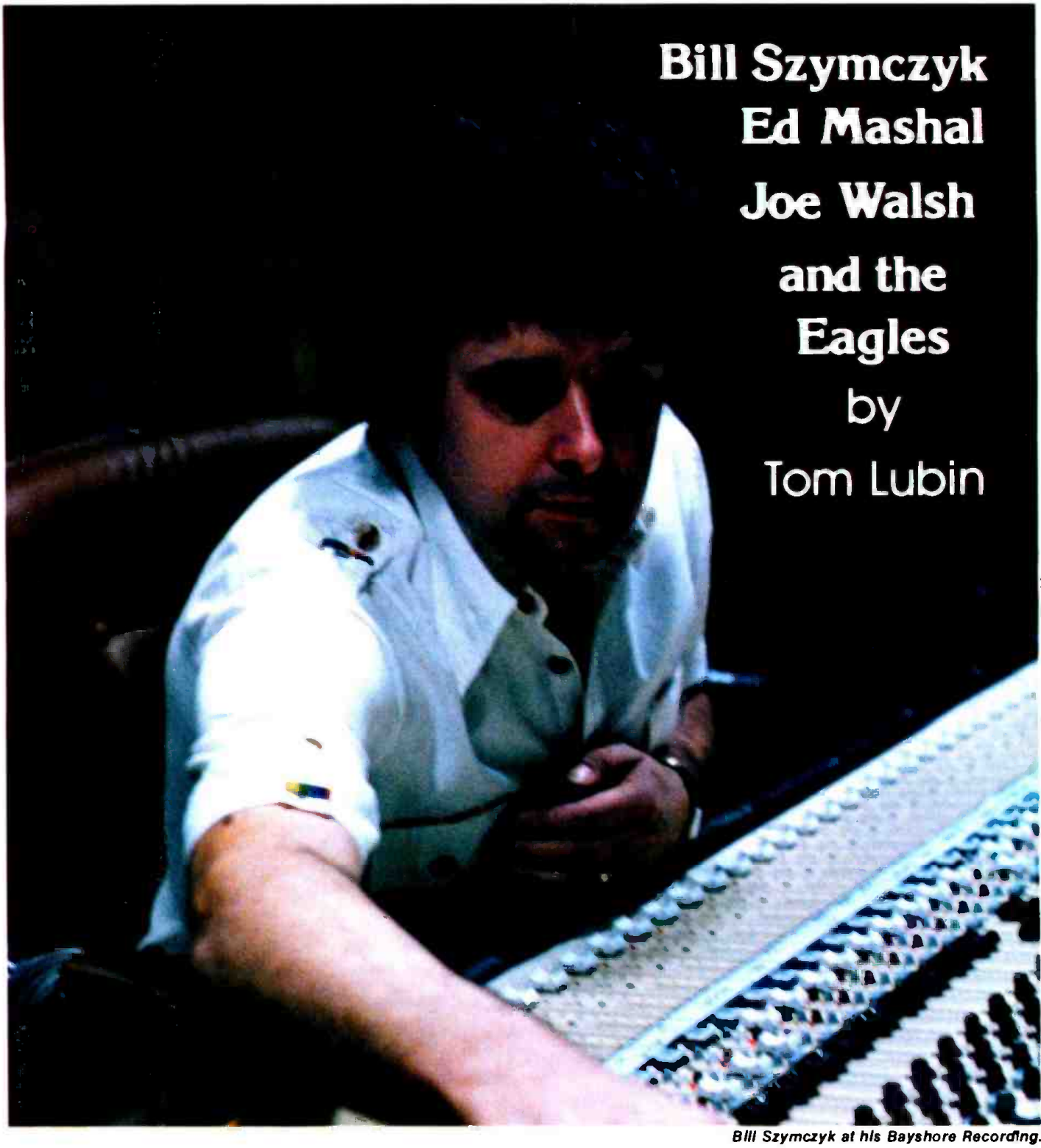

Photo by Jann Ziotkin.

Bill Szymczyk at his Bayshore Recording.

Tom Lubin: How long did it take to do HOTEL CALIFORNIA?
Bill Szymczyk: Overall — over a period of nine months.

Tom Lubin: Have any idea hour-wise?
Ed Mashal: It's hard to say.

Tom Lubin: I know, but when you say months, the band could be on the road.
Bill Szymczyk: We were working a good three weeks and maybe two weeks off. So we had to work four months — I would say five solid months — 10 hours a day.

Ed Mashal: I can look back at some of my Criteria checks and I was in the studio for 100 hours in one week . . . I still have the stubs.
Bill Szymczyk: When we work, we work. We do minimum 10 - 12 hours a day.

Tom Lubin: You like working that way?
Bill Szymczyk: That's the only way to do it. When we are in the studio, the only thing we have to do is work on this thing, this project, this record. The only other time we need is for sleeping and eating. It condenses it — that's all you think about. Then the time you're out of the studio you're done, you can think about something else for awhile, before you have to go back and think about that project again. I can't work on two or three projects at once.

Tom: So you like to totally immerse yourselves in one project?
Bill: I do. I'm just trying to figure out this hour thing. I would say 2,000 to 3,000 hours.

Ed Mashal: Easily.
Bill: Over nine months. They are perfectionists.

The Soundcraft Series 3 console is ideal for 16- or 24-track recording studios demanding technical sophistication at a reasonable cost.
It has been designed with all the facilities the professional engineer expects plus a few extra features you're sure to appreciate.
The technical specifications are excellent, partly due to the use of new integrated devices, giving high slew rate, extended power bandwidth and ultra low noise. The front end circuitry is truly state-of-the-art giving a 1dB noise figure.
The extended range of modules allows up to 32 tracks of monitor mix independent of the input channels whilst the layout allows engineer and producer to work together without getting in each other's way.
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4-band EQ, each band with sweepable frequency.
8 auxiliary sends.
Auto Solo-pre fade or stereo post fade.
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16, 24 or 32-track monitor mix into mix buss.
Extensive TT patch bay.
XLR or punch block interface.
VU or LED array metering.
Channel assign to groups and stereo mix buss.
Series 3 is backed by Soundcraft's comprehensive 2-year warranty.

THD	+4dBv line input to any line output at +4dBv, 20Hz < 0.03%, 1kHz < 0.01%, 20kHz < 0.05% Signal at mic input with 50dB gain (200Ω at source), 20Hz < 0.1%, 1kHz < 0.01%, 20kHz < 0.1%
Frequency response	+4dBv line input to any line output at +4dBv, 20Hz to 20kHz: −1dB Signal at mic input with 50dB gain (200Ω at source), 20Hz to 20kHz: −1dB
Noise	Relative input noise voltage, 20kHz Bandwidth, now −128.5dBv true RMS (200Ω source). Mixing noise, 24 channels routed to mix all at unity gain,< −80dBv (DIN audio weighted)
Input gain	Maximum mic, 85dB Maximum line, 70dB
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Tom: It sounds it. Did you cut all the basics at Criteria?
Bill: No, *ON THE BORDER* was done at Record Plant here in California.

Tom: HOTEL CALIFORNIA?
Bill: No — *HOTEL CALIFORNIA* was done half at Record Plant in L. A. and half at Criteria.

Tom: Where did you mix it?
Bill: Criteria.

—The Cast—

BILL SZYMCZYK: **When Bill Szymczyk left the navy in 1963, he began preparing for a career as a television director/producer. But the New York City recording scene proved to be a stronger attraction than colleges offering radio/television curriculums. His "temporary" summer job at a recording studio led to work at such noted facilities as The Hit Factory, Caribou and Criteria. Szymczyk's credits as engineer and/or producer include albums by J. Giels, B. B. King, Rick Derringer, Johnny and Edgar Winter, Phil Ochs, The James Gang and more recently Jay Ferguson, Joe Walsh and the Eagles. He recently opened Bayshore Studios, his own 24-track recording facility in Coconut Grove, Florida.**

JOE WALSH: **Recording artist Joe Walsh first met Szymczyk in Cleveland in 1968 and the two soon became good friends. During the next decade, their paths crossed many times. Hit albums by Walsh including *BARNSTORM; THE SMOKER YOU DRINK, THE PLAYER YOU GET* and *BUT SERIOUSLY FOLKS* were produced by Szymczyk. Walsh is a former member of The James Gang and performed as a solo artist before joining the Eagles.**

ED MASHAL: **After completing audio engineering studies and finding no paying recording work in New York City, engineer Ed Mashal moved to Miami. Persistence in job hunting paid off when Criteria hired Mashal in 1973 and his employment there brought him together with Szymczyk. Mashal has handled engineering on recent Szymczyk-produced albums and now works out of Bayshore Studios.**

TOM LUBIN: **Interviewer Tom Lubin is chairman of the Audio Department at the College of Recording Arts in San Francisco. An experienced producer and engineer, Lubin is also a writer with several credits including an R-e/p article on voltage controlled attenuators. He spent six years with Columbia Studios in San Francisco and has recording credits with numerous artists including Steve Miller, Confunkshun and many Berserkley Records acts.**

Tom: You must like it . . .
Bill: At the time I did — yes. I got introduced to MCI equipment. And it was only 20 minutes from home. [Laughter]

Tom: What sort of monitors do they use at Criteria?
Bill: I don't care what they had. I had 4311's. [Laughter] When I arrived on the scene, they didn't have any Dolbys, they didn't have 24-track, just a 16-track non-Dolby studio when I got there. And now they have four studios, all 24-track, all Dolby.

Tom: If you have your choice between 30 or 15 ips and no noise reduction Dolby or dbx, what's your choice?
Bill: 15 ips Dolby.

Ed Mashal: I'll go with that, too. And I'm a young guy!
Bill: Something happens to the bottom at 30 ips in the mix, you crank it and it just ain't there.

Tom: On HOTEL CALIFORNIA, *how long did you go into rehearsal?*
Bill: Maybe about a week.

Tom: Did you have most of it wrapped up?
Bill: No — we had about three tunes ready to go when we started that album. The rest of it came down in the studio.

Tom: The strings — there's quite a bit of strings in the intro.
Bill: Jim Ed Norman wrote those charts.

Tom: Where did you do those recordings?
Bill: Record Plant Studio here [Los Angeles] with Sid Sharp and his boys.

Tom: Did you use any special techniques with the mike? It sounds very symphonic.
Bill: That was the only technique I knew. We had a huge room to do it in. I don't know if you ever saw Studio C at the Record Plant. It was built in an old movie sound stage so it was just monstrous. Had a tile floor and I'd say at least 50 - 60 foot ceilings. I used two or three 87's for mikes and maybe RE20's on the basses and cellos. Worked my way up to 87's on all violins. I like putting everything in stereo on six or eight tracks and then eventually mixing them down to maybe two, three tracks, for the whole string section.

Tom: You seem to strive for a textural sound, in many ways, a theater for the ears.
Bill: Hopefully, yes. I like to cover the entire spectrum on every record — anything from a simple country acoustic to the entire group. I want everything from 20 cycles on up to 20,000 cycles if you can hear that high. I want to have something going on in all that.

Tom: Do you go for a number of takes and then combine them to get the best of each take?
Bill: On the basic track, oh yes. Lots of 24-track editing. Making Eagles records is almost like making a movie where in film you go shoot one scene 50 times from different

Ed Mashal. Photo by Jann Zlotkin.

angles — two shots or closeups or a master shot and all that stuff. That's basically what we do when we make an Ealges basic track.

Tom: And then cut it together?
Bill: Yes, we'll fill up 10 reels and then listen to them. We call Don Henley our Listen Man. We'll sit down and just listen to each part intently. And then we'll A/B the same verse out of 10 tapes to get the primo scene, the primo shot of that verse. Then we use that. It just involves a lot of editing.

Tom: Do you record your drums with the bottom heads off?
Bill: Yep. All the toms.

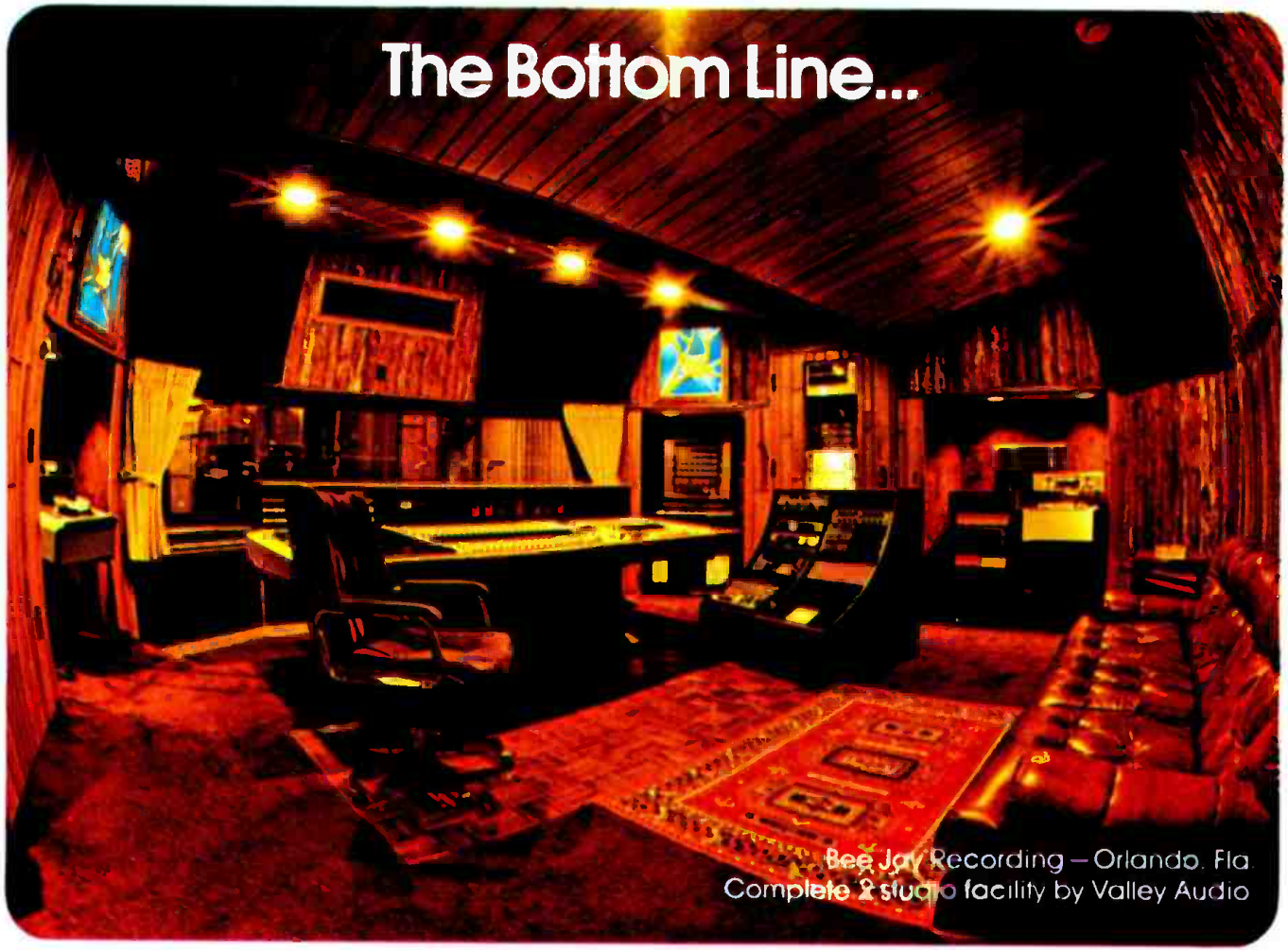
Tom: How big is the kick?
Bill: That one's old — 21-inch — because he didn't get the 25-inch until this album.

Tom: How many drums does he have?
Bill: [Laughter] A lot of drums! Just to set up now, there's got to be a 10-foot-long stack of snare drums in two rows. That's just snare drums. And he's got to have another 20 toms of various sizes and various makes.

Tom: What do you usually use for a microphone on the toms?
Ed Mashal: Well, when we were in Criteria, we were using 87's. Since we moved into our own place, we use Sennheiser 441's. They're great mikes on toms.

Tom: What do you use on high hat?
Ed: It's a little lavalier mike that Sony makes called the ECM50.

Bill: It's got no bottom in it whatsoever.



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Ed: Yeah, all kinds of snap. We lay that on top of the high hat and it kicks ass.

Bill: It's cool. And I've got some overheads for cymbals. I found a pair of mikes in the New York Record Plant, PML's, Swedish mikes. They're just gorgeous.

Tom: What model, do you know?
Bill: PML-DC73.

Tom: On "Hotel California", was the acoustic guitar recorded at the same time as the drum and bass?
Bill: In most instances, yes.

Tom: Do you use an isolation booth?
Bill: Yeah.

Tom: A basic Eagles session.
Bill: Your basic Eagles session? Drums, bass, two guitars and piano or three guitars. Or sometimes drums, bass and one guitar and two keyboards.

Tom: If they say to you, they want to record an acoustic piano and guitar along with an electric guitar and drums, do you worry about mixing the acoustical instruments with electric instruments or save them for overdubbing?
Bill: It's not my concern at all. If they want to do it, that's what we do. At Bayshore, I built what we called a Polish piano trap. I've been bitching and moaning about the way studios treat grand pianos for years. Everywhere you go, you've got to put the top down on the piano and put 80 million packing quilts on it and then you've got to have the mike three inches away from the strings. I said this is dumb.

So we built out of wood what looks like a half of a log cabin, took the top of a nine-foot Kawi piano that we have and pushed the piano inside. We can mike it from five or six feet up, but it's totally isolated. The inside is all treated with insulation. There's no leakage at all.

Ed: Not in or out.
Bill: It's the purest sound you're going to get in a rock and roll studio.

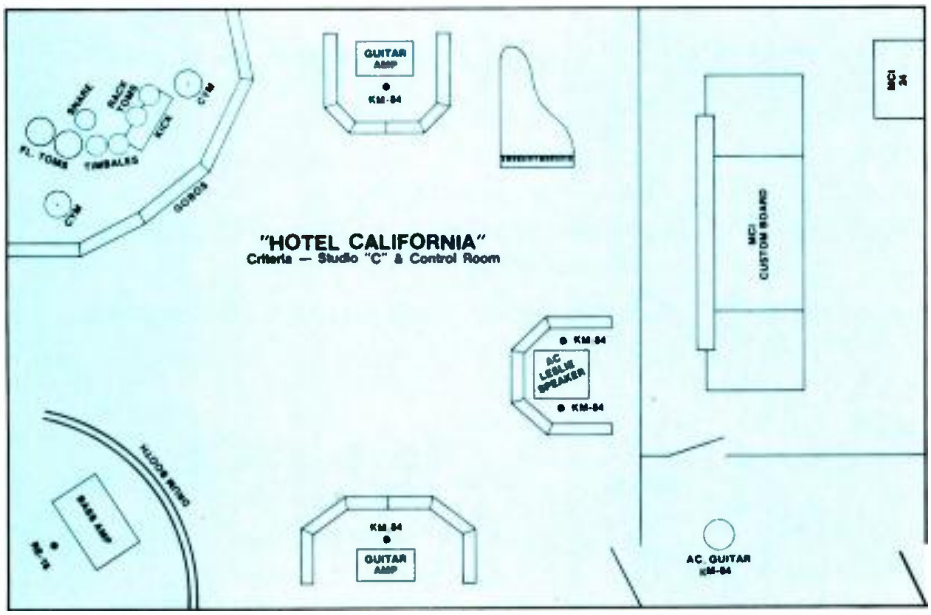
Tom: Is that the piano that you used on Joe's record?
Bill: Yeah. We went out keyboard shopping and found this baby in Miami and it's gorgeous.

Tom: Your responsibility for equipment brings up a broader question, Bill. As a producer, what do you think your function is?
Bill: Henry Kissinger.

Tom: Good answer.
Bill: That's it.

Tom: Any advice for a young producer?
Bill: I'd say, good luck buddy! [Laughter] Yeah, I get five letters asking that question each week.

Tom: Right. What do you say to them?
Bill: I don't know what to say. I really don't. A lot of times I start thinking how the hell did I get in this position? How did I get here? And I don't have the answer. It was just a series of events that led me to be here. I didn't even set out to become a record producer. I just wanted to be in TV.



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Tom: Well, how did you get "here"? How did you break into the recording business?
Bill: Sweeping floors in a place called Dick Charles Recording Service in New York City back in February 1963. Screen Gems demos were the biggest client they had. It was strictly mono to mono. Two mono machines and I think that near the end of my tenure there, they got a stereo machine. So we would just do ten generations back and forth for mono overdub.

Tom: Is that where you are from, New York?
Bill: No. I was originally from Michigan but I was in the Navy from 1960 to 1963. I was a sonar man so they taught me electronics. I went through a year's worth of Sonar School in Key West. So then I got out of the Navy and was waiting to go to college. I had been accepted at Columbia and a couple of other schools in New York. I had been hanging around in New York and had met a lot of people, so that's where I wanted to go after I got out of the service. I was looking for a job to last me until the fall when I was going to go to college to become a TV director/producer.

Tom: That's what you wanted to do as a kid?
Bill: Right. I got out of the service in February and went to work in the studio half as a janitor and half as a maintenance man, changing tubes. They had two amps to work with — two mono Ampex 300's and that was it. So it was not real hard. I did mostly the floor sweeping in the lobby and very little of the maintenance.

Tom: How long did you stay there?
Bill: Eight months. When the end of the summer came all of the colleges were asking me to send them the bucks. They wrote me, "You're accepted where is your money? Let's go."

But by then I was having too much fun watching records being made. So I said, I'll just have to blow college off here and stick with this. This looks pretty cool.

Tom: So you were in engineering right off the bat?
Bill: Yes. I totally came up through this thing as an engineer. Strictly through studios.

Tom: Were you able to start engineering at Dick Charles?
Bill: Just began. I got underway doing little three piece demos.

Tom: Where from there?
Bill: I went to Regent Sound in New York. Bob Lifton is one of the guys. He and I are still great friends to this day. He had a four-track studio then. So when I first walked into there, I said, wow that was the first time I had seen half-inch tape. Four track meant I could record something on there and then add some things later.

Tom: When did you leave Regent's?
Bill: 1967. I really cut my teeth there. Lifton

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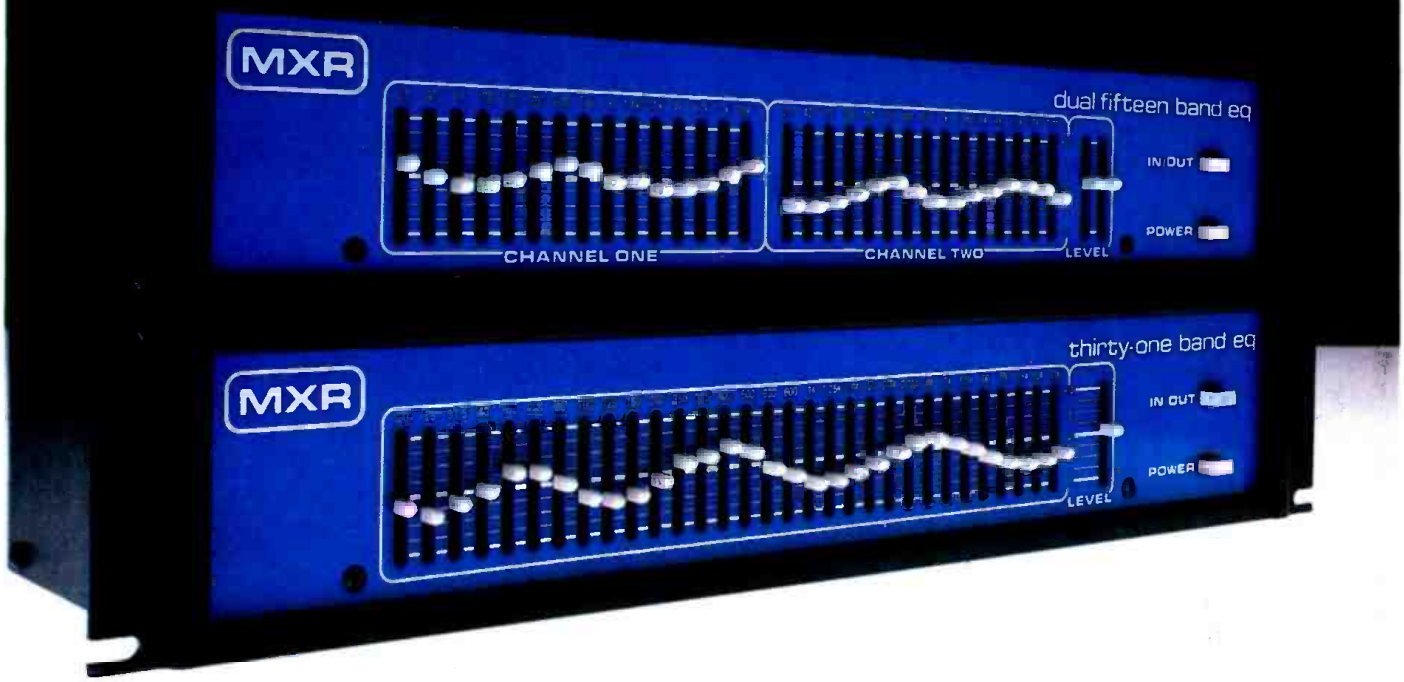

for additional information circle no. 11

taught me damn near everything that I know about it. He had a huge room. You know, it was going from three pieces up to 50 pieces, 10 strings, five horns, rhythm section, background singers and a lead singer. We would have all of that to do on a four track. You would do union dates involving three or four songs in a three-hour period.

Tom: You don't make mistakes on those kind of dates?
Bill: No, and you don't have an assistant either. You had to set all of that up in front and go with it. You had to be really on your toes. By the third or fourth run down, they wanted to know that you were ready.

Tom: What did you do after Regent?
Bill: Jerry Ragavoy opened a place called the Hit Factory. I was his first engineer.

Tom: What were you doing when you were at Regent?
Bill: I started off editing together a Morey Amsterdam children's album. That was the first job at Regent Sound. Slowly but surely he brought me along. They did a lot of agency stuff. Very little pop stuff or R&B music.

I started to get my own little clientel then. Van McCoy and I met. He liked me. We started doing things together. There were a few other people, too — Arthur Gordon, who had a bunch of old acts — Phil Ochs and Tom Rush, Jim and Jean, David Blue and people like that. The Electra Asylum. Or then it was just Electra. Slowly but surely I started to do four-track dates that were going from demos to masters. I was actually doing albums.

Tom: Was it about then that you were able to get involved in productions?
Bill: No. Not for awhile yet. It was not until I started working for Ragavoy. I realized that, wow, he's a producer — one of the living legends in the music business so far as I am concerned. It wasn't until I started working at the Hit Factory that I said, "Well, hell, I can do this as well as anyone else." By then I had built up enough clientel and I was a free lance engineer at that point. I had enough people believing in me as an engineer.

Then after awhile I started to realize that the reason that they were believing in me was I was doing all of the work. They loved it. Here's an engineer that will produce for them and everything. They get all of the credit and pay him 20 bucks an hour and everything is cool. So after realizing that I said, "Hell, I'd rather do it for myself."

Tom: Did you go into it more as a co-production basis or did you really go out and actively look for bands?
Bill: Oh, I went out and actively looked. Very much so. Somehow I got hung up in Cleveland for awhile and that's where I found Joe [Walsh]. I found two or three other bands. That was actually a little later on in 1968 when I was working for ABC.

Tom: During the ABC period, you were also doing James Gang and B. B. King. Right?
Bill: Those were the first things of any success. But there were many things in front of that which went up against the wall and slid down — that didn't stick. I sang lead and two or three other guys would get together, musicians and myself. I'd engineer while they did the track. I sang lead and we would all sing background. It was a tune somebody wrote. So three of us would go in and do a whole monster group record, mix it down and call it some group and would sell it to Kapp for $1,000.00. It would cost us $29.95 to put it together and, hell, it was a great way to make a living. Just working off of the advance.

Tom: Were you able to make your own deals?
Bill: You mean as far as the legalities?

Tom: Yes.
Bill: Pretty much so. It was really simple deals. It was singles we were talking about, not albums. We would just do two sides. They would offer a contract and as long as the money was there we would say yes, sign it and give them the masters.

Tom: During that 1971 period with the James Gang and B. B. King, you produced one while engineering the other, but did not do both?
Bill: On B. B. King I did not engineer the tracks, that's right. Joe Zagarino did. He was a guy that I taught. I felt that I was still green as a producer and he engineered like I did because I taught him how. I wanted to have my mind totally free to worry about B. B. King and the musicians and the tunes — and not about buttons, levels and EQ. So for the first time I jumped back and said I'm just going to be a producer.

Tom: They were both live records, both rather unique.
Bill: One was outside, a day in Cook County Jail which was pretty far out.

Tom: Do you happen to recall what the set-up was?
Bill: We had a 16-track truck. An upright piano was the only thing that we could get in there. I would say that it was a usual set-up for what I would do then — four or five mikes on the drums, bass direct, piano, guitar and about four mikes for the horns. That would probably be about it.

Tom: Did they do one performance and you had to get it?
Bill: Exactly.

Tom: Was there much studio overdubbing after the remote recording?
Bill: No. I only overdubbed two things on the four B. B. King records that I made with him — the strings on the "Thrill Is Gone" and lead vocal on "Humming Bird". Everything else was done live.

Tom: What about the James Gang?
Bill: Tons of overdubbing because Walsh is a one-man army. He had a drummer and a bass player and he did everything else.

Joe Walsh and Bill Szymczyk. Photo by Tom Lubin.

Tom: What about the live album? Did you go back into the studio?
Bill: We did not overdub a thing on that. We recorded it on a Saturday night, mixed it on Sunday and we were cutting masters on Monday for that particular album.

Tom: Any particular problems with it?
Bill: No. It was a piece of cake! We were supposed to do two nights but the first night some clown cut the cables to the trucks so the guys had to stay up all night and wire it back together. The next night we had Pinkerton guards watching every five feet of that cable. So we had two shots at it and we only got one and that is the album. That's it.

Tom: During that period you were working with Johnny Winter, too.
Bill: I was just his engineer, that was all, later in 1971 or 1972. The James Gang live album was around 1969, 1970. It was sort of a one-shot deal. The earthquake had happened in L. A. and I was living in Colorado and I was actually looking for a gig. I quit ABC. Quit my job as staff producer and said I am going to be an independent producer. Well, not much happened. So then Joe said, hey, I want you to come and make a live album with us. But in three days I was looking for something else to do.

Tom: You were living in Colorado?
Bill: Yes. Moved to Denver right after the quake. Freaked me out. I don't see how you people live in San Francisco.

Tom: If you're raised in California, you don't think much about it. What did you do in Colorado?
Bill: A guy that was also working at ABC named Larry Ray. He and I set up our own record company, quotes, and had it through Famous Music. It was called Tumbleweed Records. We signed up about nine acts in Colorado and spent a million dollars of their money in a year. Then it all folded up. We survived for a year.

After Tumbleweed, which would be about the end of 1971 or the beginning of 1972, was when my career really started trucking. For a gig I was working with Rick Derringer. He and I were old friends. I was producing his album, *ALL AMERICAN BOY* — his first solo album, at Caribou. So he was

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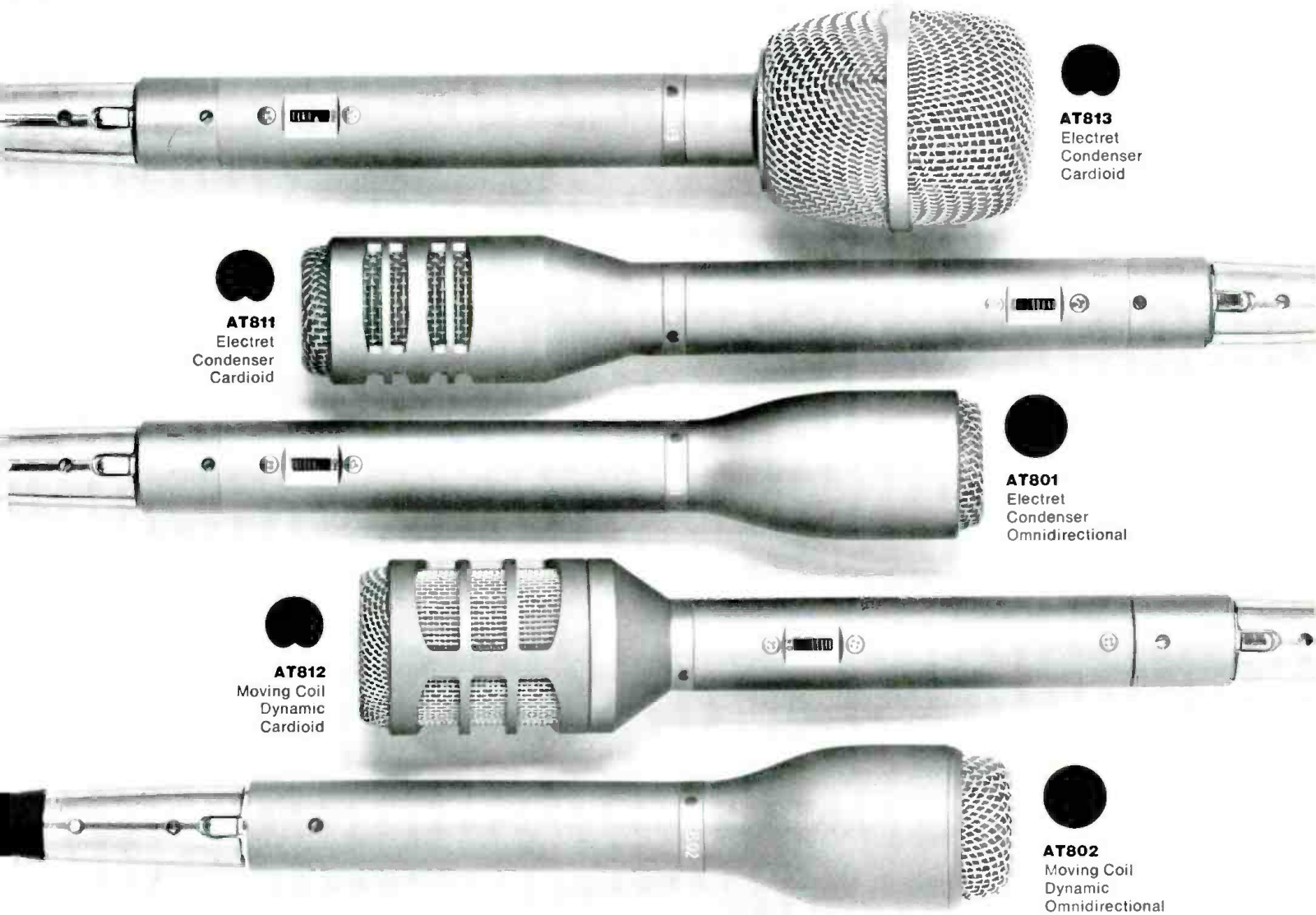

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producing a bunch of things and I was "a great engineer" according to him. So he said, "God, come to New York, I have to do a Johnny Winter album and an Edgar Winter album." I went and engineered *THEY ONLY COME OUT AT NIGHT* and *STILL ALIVE AND WELL*. "Saints and Sinners" was a tune left over from the *STILL ALIVE AND WELL* sessions. The album *SAINTS AND SINNERS* came out much later.

Tom: Where did you record those?
Bill: Hit Factory in New York, both of them. The studio I founded and then left to go to ABC. They moved me to L. A. and then I went to Colorado. It was like a big wide circle.

Tom: Was it about this time you met the Eagles?
Bill: Not for a while. Walsh and I were still making his solo records — *BARNSTORM* and *THE SMOKER YOU DRINK, THE PLAYER YOU GET*. It was around '73. I did a couple of J. Giels records. We did *BLOODSHOT* which had "Give It To Me" on it. We did two or three of those albums. We did the Fabulous Rhinestones and still worked with Walsh.

Tom: You were still living in New York?
Bill: No — I was living in Colorado — commuting. I was on a plane every Monday going to New York and every Friday going to Colorado. That happened for a couple of years for whatever I couldn't do at Caribou. We did a lot of work at Caribou. We did Walsh's album there on ABC. The Eagles were all through Irving Azoff.

When Walsh's career started to take off, around "Rocky Mountain Way", he didn't have a manager. We were all living in Colorado and he had no management. So he and I and a friend of his named Patrick Cully were sort of managing him, trying to direct him on our own. We had no idea what we were doing; we were just doing what felt good. But he and Joe met this guy named Irving Azoff, who was an agent at some funky little agency, and Irving totally believed in Walsh and started going on the road with him, taking care of his business and everything. Then Irving started working for Geffin and Roberts, and then the Eagles were there. So Walsh was opening for the Eagles on some tour and that's when they met. They'd sit up all night and play cassettes of their albums to each other . . . things like that. And the Eagles wanted to know how he did that sound. It was cool.

"Ain't like our records; ain't like Glyn Johns," they said. So Walsh says see Bill Szymczyk and they said let's get him. I think within six or eight months I started working on *ON THE BORDER*. Let me just say something. Glyn Johns has been my idol through this whole thing. When he was doing *HONKY TONK WOMAN*, I was just cutting my teeth in the studio. I have had two idols in this business. Glyn Johns for the English rock sound of the 60's and Tom Dowd for the New York R&B. He's a monster; he's legendary in New York, during the eight years I was there.

Tom: Did you remix the tunes that Glyn recorded?
Bill: Yes. Afterwards, after I finished that album, I went over to England and presented him with his own copy. We went out to dinner and got drunk all night long. I asked him what he thought and he said [accent inflection], "I don't like those mixes," and I said, "Baby, that's the way it goes. You got nothing to say about it at this point."

Tom: Have you done all of your recording in this country?
Bill: I've done all of it in this country — never recorded outside. But I have been everywhere *in* this country, I'll tell you that.

Tom: It is a loaded question to ask what your favorite studio is — outside of your own place.
Bill: [Laughter] Of course it's a loaded question. I've built the greatest studio in the country and possibly the world. But of course, it's built for me. Studios are individual places.

Tom: Who built it?
Bill: Rudi Breuer. He's here on the West Coast. He's built a bunch of Record Plants. He's built some studios in Canada and Chicago. He's built a lot. When he got to us, he'd built 40 some studios. The man came in, gave me a bid, told me what it was going to cost and told me when it would be done. It was within the penny and it was done within a day of what he said. And you cannot argue with that.

Ed: Really! When he came down, Bill asked how long it was going to take. The guy said 50 days. Bill said when can you start. He said tomorrow. And it was just one of those — and they just went right in and, boy, did they work their asses off!

Tom: What do you think is a realistic figure for building a studio these days?
Bill: Half a million, fully equipped.

Tom: How big would it be?
Bill: Not that big. It would be 40- or 50-feet long and 30-feet wide.

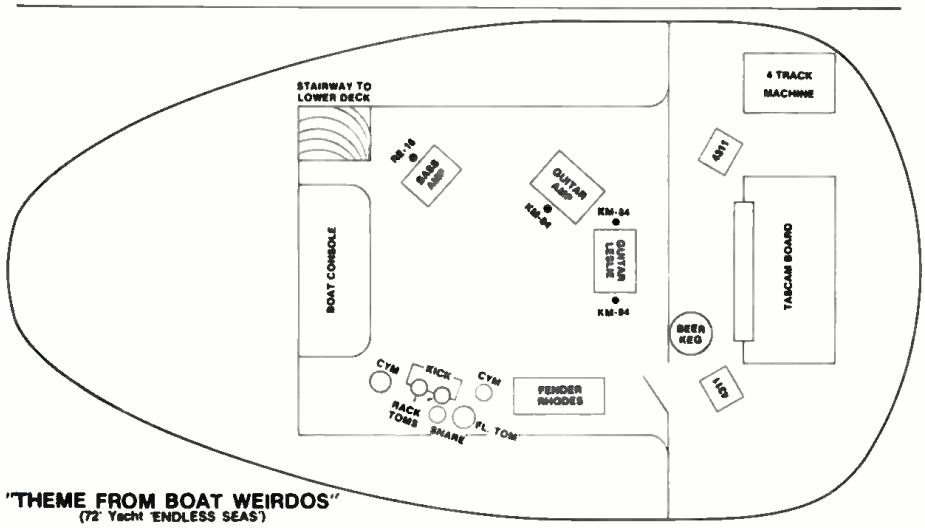
Tom: That's a pretty good sized room. High ceiling?
Ed: Not very high. Maybe 10- or 15-feet.

Tom: Big control room?
Ed: Fairly.

Tom: I'd still like to know what your favorite studio is — outside of your own — and why.
Bill: Gee, I think it's six of one and a half dozen of another. It's like what consoles are you used to, what machines are you used to and what kind of mikes you're used to. It's like, if you've got your act together, you can record good sound damn near anywhere.

Tom: You're very adaptable as far as studios go?
Bill: I'll go anywhere at any time.

Tom: Do you try to get certain monitors?
Bill: Yes, I do have a set monitor system. I have made all my records the past six or eight years on 4310's. Everybody says our monitor system is flat. There's no such thing as flat. Flat doesn't exist. That's a figment of everybody's imagination. So I just insist they get either a Crown 300 or a large McIntosh amp and drive two 4310's.



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for additional information circle no. 13

The Record Pressing Problem ?

The quality of pressings is a topic of great concern in the recording industry and participants in this R-e/p interview were quite outspoken on the subject.

Tom: I understand you are very dissatisfied with the quality of records being made today.
Bill: We've got a big thing going now about the quality of pressings lately and we're about ready to unleash a barrage on the industry of artists and producers banding together and demanding better quality — better plastic. It just bums me out intensely to work your butt off; you get Dolbys to take away the hiss; you get the best master unit you can possibly get; then you get your test pressing back and it just sounds [makes a grating sound].

Tom: Yeah, or the edges being so bad that it won't track on a changer.
Bill: Yeah. It looks like a waffle when you take it out of the sleeve and it's full of Rice Crispies, too. Every other bar, you've got pops and clicks and scratches.

Tom: What you're saying is that you feel that the way to treat this is by saying to the manufacturer . . .
Bill: To the powers that be — the record companies. They've got to upgrade their quality.

Tom: Do you think it's likely that in this country there will become a producers/artists organization? In England and in some parts of Europe there's a number of different organizations where, oh, engineers have banded together and they set certain standards and various organizations along those lines. Do you think that's likely to occur in this country?
Bill: Well, what have we got? We've got the RIAA and they do nothing. They send out gold and platinum records is all they do. I don't see them doing anything else, but I'd like to.

When Joe's test pressing came back, I showed the Eagles and said, look what you're up against, to the artist. And to be very honest, it pissed them off greatly. Henley, who is a born organizer, right away wants to do something about it and I can dig it. I'm on his side. We're thinking about getting a bunch of big acts together so that when we make an album, we press two million anyway, we'll demand somehow that they upgrade their quality. They have to do it. They keep raising the price of records, but the quality of records goes down. They used the energy crisis three, four years ago — when there was the oil embargo and all that — as the excuse for the grade of polyvinylfloride going down the tubes. It never came back. *

Tom: Do you want me to put in this article your opinion on this?
Bill: Sure. I'd like you to put it in there, because I'm bummed out. I hate it. Look at all the hardware manufacturers making all these great things to make the final tape more gorgeous and in the last step of the whole process, it goes right down the drain.

Tom: Well, I think the consumer is getting upset about it. I think a lot of consumers are buying an awful lot of expensive equipment.
Bill: The more equipment they get, the more they realize what a rotten record it is.

Tom: That's right. Places like Cal Stereo couldn't exist unless they had lots of people buying their equipment. So if there are people buying that kind of equipment, at some point, somebody is going to be upset about it.
Bill: Yeah. But it's the standard. You know, all the records sound that way. The Fleetwood Mac album on Warner's and they get another album on Columbia and another album on RCA and another album on Capitol, and they all sound the same.

Tom: You think European pressings are better?
Bill: Yes. Especially with classical, you can just look at them. They are twice as thick and black.

Tom: Do you think it's the vinyl manufacturer, technique or the equipment . . . ?
Bill: No. It's the bosses. They're too damn cheap to make good records. That's what it is. It's the corporate structure in America. I mean, that's really what it is.

Joe: We're talking revolution here! [Laughter] They don't care.
Bill: They *don't* care. As long as the consumer is going to buy, five million, ten million Eagle's albums, they'll press it on sand. They don't give a shit.

Tom: Do you work entirely on those?
Bill: Yes. Everything. Even now. Tracks, overdubbing and mixing.

Tom: So you must not monitor at incredible loud levels . . .
Bill: I did early on in my career and when I realized my ears were starting to go, I said, "Whoops, time to back off here."

Tom: [To Ed Mashal] Are you based in Florida also?
Ed: Yes, originally from New York. Went down there in 1973 because I couldn't get a job in New York. I thought of all the places to go and thought Florida would be a good place. It looked like it was going to happen. New York was on the way down; within the next five or ten years, there would have to be another city on the East Coast that would take the music business, so I went to Miami in 1973. By 1974 I was working at Criteria, and '74 Bill moved to Miami where I met him. And Miami's cool; you know, the BeeGee's stuff — that's happening now.

Tom: Where were you working in New York?
Ed: I was majoring in music, minoring in electronics. I got out, stumbled around, tried to get a job; got this job at Dimensional for no money. Worked for about a year. I was going to Institute of Audio Research, too.

Bill: Tell me how many similar stories have you heard. How much did you get paid on your first gig? [Laughter]
Everyone Responds: ***Nothing!***

Bill: It's a privilege to be in this business.
Ed: And when I finally did ask them for money, they said no. So I said, you won't be mad if you don't see me next weekend? They said, "Nope." So I just picked up everything I owned, put it in the back of the VW and went to Florida the summer of '73. I got down there and knocked on Criteria's door every other day practically. They got tired of seeing me and finally gave me a job as a maintenance person.

Tom: Is that where you first met Bill?
Ed: Yes, met Bill down in Miami.

Bill: When I got tired of getting on planes every Monday and Friday. I realized I had to move to a place where there's a studio. At this point, Caribou was totally booked. I got aced out of Caribou about three times and had to go either to L. A. or New York. I decided I couldn't live there anymore. It was ridiculous. So I moved to Florida.

Criteria was happening then. Walsh had done some work at Criteria and he liked it. I had spent a year in Key West going to Sonar School. I dug the tropics. I thought, hey, this is great. I'm gonna check that out. So that's how I wound up there and ran into Ed.

Tom: You went to the tropics for "Theme From Boat Weirdos" on Joe's album. It was quite a project from what I understand.

continued overleaf . . .

...five years ago, I've done all of Shaun Cassidy and Leif Garrett on it, most of Donny and Marie, plus Al Martino, Sammy Davis, Debby Boone, the Supremes and others."

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R-e/p 31

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How did it come about?
Bill: I own a little cabin up in North Carolina on five acres on the side of a mountain. We were going to go up there, take the band and take a two track or something like that and do some demos for a week or so before we actually went into the studio.

We planned this for about two months in advance and were going to do it in January of '77. Well, North Carolina went to 10 below and snowing. I couldn't even get in to my property. This happened a week before we were set to go. So Joe and I had to decide what we were going to do. We got all these guys coming down, so we said what about a boat? We knew we had to have one at least 60 feet or better to actually make a studio out of it. We found *The Endless Sea;* it's a real custom, one-of-a-kind boat that was built by one guy. It had two twin diesels and slept 10.

So we had them take all the furniture out except for a couch or two, and set up the drums and electric guitar. We had three amps set up and Willie had his bass set up. We rented a Tascam 16-in/4-out board, took my four track, with four Dolbys and a whole bunch of half-inch tape, and went down to the Florida Keys for a week. We'd work maybe four or five hours a day.

Tom: A low ceiling.

Bill: Yeah. Maybe seven feet. The four track was later transferred to 24-track for overdubs. But the drums and the bass were done in stereo mixed together on two tracks.

The actual cabin, the studio part, was set up great. The main cabin of the boat where we had the musicians was carpeted and curtained so it was tight enough for us. The fantail section of the boat, right behind the main cabin, was all plexiglassed in and had a nice big window about 10-feet wide between the cabin and the fantail; it was exactly like a control room and studio. Two 4311's and a four track. It was great. I think the spirit of what happened there comes out in the record; the comradery of that boat lasted all the way through that record.

Tom: There's quite a lot of bass on your records.
Bill: But not as much as on them Reggae records!

Tom: No question about that. Do you have any problems when you go into mastering? You must have a very good mastering unit.
Bill: Yeah, Sterling Sound.

Tom: Do you use the same fella?
Bill: I've been using the same fella since my first album, Lee Hulko, the guy who owns Sterling Sound.

Tom: When you do your mastering, do you try to make sure that everything that you hand to the master man is going to be exactly flat?
Bill: That's perfection — to be able to give the master tape to Sterling and not have them do a thing. But that's impossible to do, I've decided. You can always make it just a little bit better. But I have been doing less and less over the years. If I'm at Sterling, I'm only one step at 10K or one step at 12K, whereas five years ago I was two steps and ten years ago I was right over. But yes, the ideal situation, technically, in me doing my job is to get it down on the two-track exactly.

Tom: Will you take your mixes and make a leveled master?
Bill: No, I'll do that in the mastering room. For instance, on Joe's album, one tune was half a dB down and one was like a whole dB down. But the more albums I make, the less I have to do.

Tom: What's the best way for someone breaking in to learn the craft?
Bill: I came at it from an engineering point of view so my answer is to do what Ed's doing now, you know, hook up with someone that's in it and learn it.

Tom: Do you think an electronic and music background is essential?
Bill: Oh yeah, it's a must. I don't have the musical background as far as formal training goes. Every piece of musical knowledge that I've picked up, I've picked up through 16 years in studios. My entrance into this was electronics, so I'd say to a young guy, you've got to have one or the other — preferably both. That means the musical end and the electronics.

Ed: I came right out of school the perfect example of that. I majored in music and minored in electronics.
Bill: That's perfect. He's set up to do it.

Ed: While at the Institute of Audio Research in New York, I learned a lot.
Bill: You're involved with something like that up in San Francisco, aren't you?

Tom: I teach at the College of Recording Arts.
Ed: I'm amazed at how education has grown. When I was going to school, you couldn't go to learn anything about this, you know.

Bill: It's an organized thing now. It's not just a-learn-while-you-earn thing, on-the-job training anymore.

Tom: How are you able to both produce and engineer?
Bill: I produce and we both engineer.

Tom: Do you try to have Ed take a lot of the engineering stuff?

— continued on page 88

The Record Pressing Problem ?

Ed: All albums are to them is units.
Bill: It's like how many units of 6C104 did we sell last week?

Tom: Well, I've heard records equated to coffins.
Bill: Shoes is my favorite one. Shoe salesmen. So we have to go to the Clive Davis's and we have to go to the Joe Smith's and we have to go to the Walter Yetnikoff's and we have to say, look, we can't put up with this anymore. If one act does it, the corporate structure will, of course, totally snow them in. But if you get five or six monster acts — say Fleetwood Mac, the Eagles, Paul McCartney, and others — and then, like you say, have an organization, then we can demand that our records be pressed in Germany. Or at least if you're going to press them here, upgrade the plastic that you're pressing them on.

Tom: Do you think there is any existing organization that could handle this?
Bill: No. They're all owned by the corporate structure, too. The RIAA supervising board is ex-record company presidents. That's where they go to retire, to a meaningless organization.

Ed: We're going to also try to involve Ralph Nader in it, somehow.

Tom: I think that's a very good idea.
Ed: But if we do it, or the artists do it, it will affect every major label.

Bill: We love having something new to fight.

Tom: Do you think that record stores would go along with you?
Bill: I don't think so. Because they don't care. It's still "shoes" to them.

Tom: Yeah, but they have to deal directly with the consumer.
Bill: They'll just pass it back to the corporate. It's returns. They don't care. All they are is a clearing house. Once they sell a record, it's sold. They've made their profit. If the customer brings the record back and it's defective, they just trade him one. The record store keeps the record, sends it back to the manufacturer and gets his four bucks back. It all rests right back in the board room.

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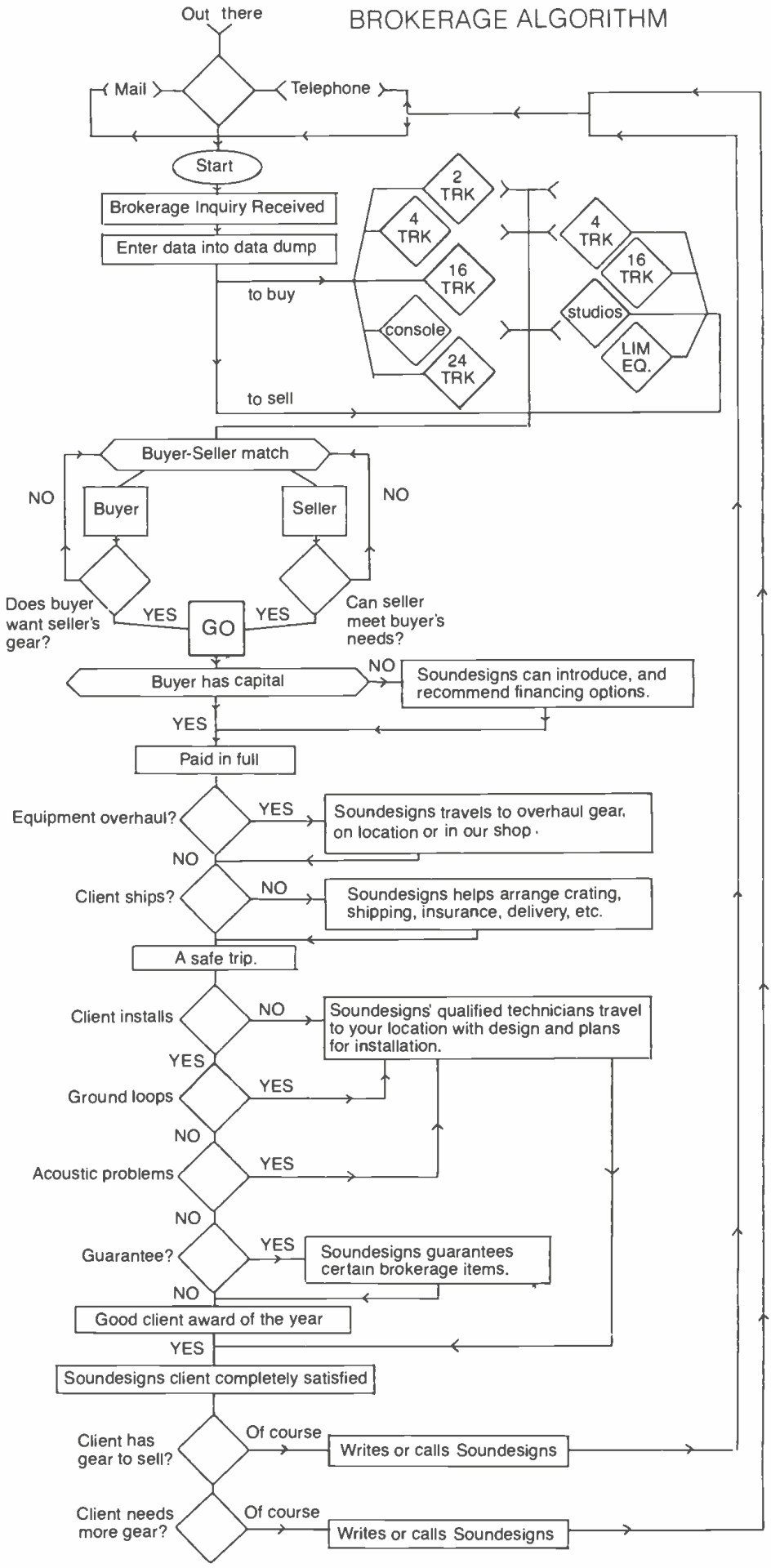

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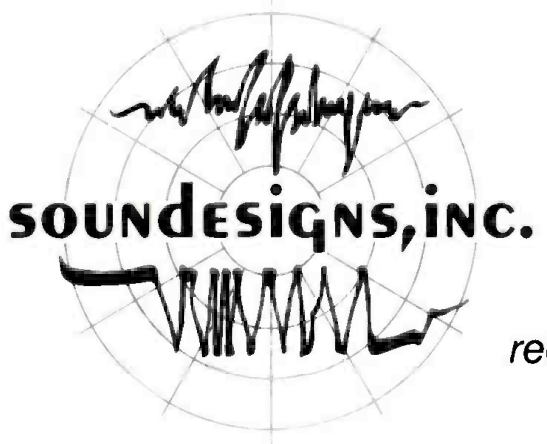

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SMALL and MINIATURE REVERBERATION CHAMBERS

the characteristics of sound transmission in Heavy-Gas filled enclosures

by
Michael Rettinger
Consultant on Acoustics
Encino, California

To introduce a reverberatory note in recorded program material, so-called reverberation chambers are used in the recording industry. These are very live rooms rarely smaller than 1,600-cubic feet with some having a volume as large as 5,000-cubic feet. They must, obviously, exhibit considerable sound insulation in their walls, ceiling and doors so that what sound can be transmitted into them cannot be built up therein by multiple reflections. Some studios have two or three such chambers, while for Capitol Records, Inc., this writer designed a quintuplet one below its parking lot, with each trapezoidal chamber extending wheel-spoke fashion from a central lobby.

Such large enclosures are necessarily expensive to construct and space-consuming, and considerable effort has been directed to effective substitutes, like EMT units, (essentially a large thin metal plate), multi-tapped delay lines of the analog or digital type, etc. They are chiefly two-dimensional reverberators, some of which can only generate a simulated decay effect but not one of a sound growth variety. For this reason less costly and smaller reverberation units are of interest to the recording industry.

Over the past 17 years this writer has been contacted several times each year by persons interested in his patent of a miniature reverberation chamber. The patent, which expired on May 30, 1978, is numbered 2,986,228, and is assigned to the Radio Corporation of America, now RCA Corporation.

The chamber is a device based on the idea that an enclosure filled with a heavy gas, in which the sound velocity is slower than in air, has a longer reverberation time than an equally large room filled with air. This is true because time is inversely proportional to the speed of sound in the gasseous medium with which the room is filled.

The pertinent equation describing this fact is the Sabine formula which follows:

$$T = 13.8\,(4V)/cSa$$

where

- T = reverberation time in seconds
- c = velocity of sound in the gas = 1130 feet/sec. at normal temperature for air
- S = total interior surface of room room in square feet
- a = mean absorptivity of boundary material
- V = volume of enclosure in cubic feet

The same equation holds true in the MKS system, where c is expressed in meters/sec. (344 m/s), υ in cubic meters and S in square meters.

The reverberation time of a room is defined as the time that is required for the mean squared sound pressure therein, originally in a steady state, to decrease 60 dB after the source is stopped.

The velocity of sound is given by the following formula:

$$c = (gP_s/d)^{1/2}$$

where

- g = ratio of specific heat of gas at constant pressure to that at constant volume. For practically all gases at normal temperatures this ratio varies little, being in the range of 1.2 to 1.5.
- P_s = static pressure of medium (essentially the atmospheric pressure in the absence of a sound wave travelling through the gas)
- d = density of gaseous medium

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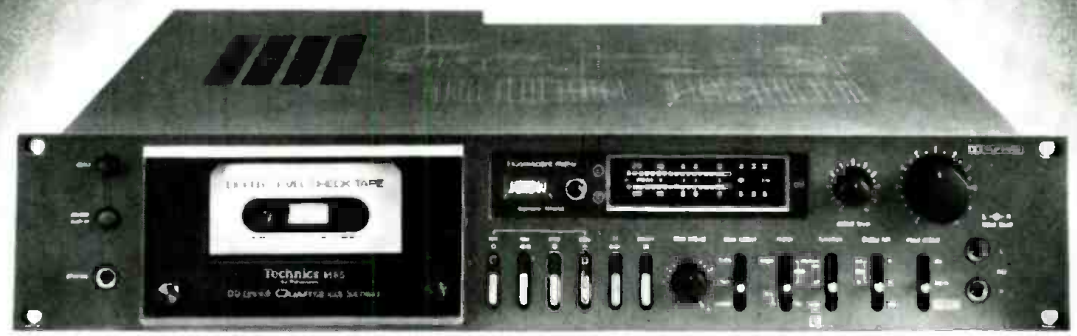

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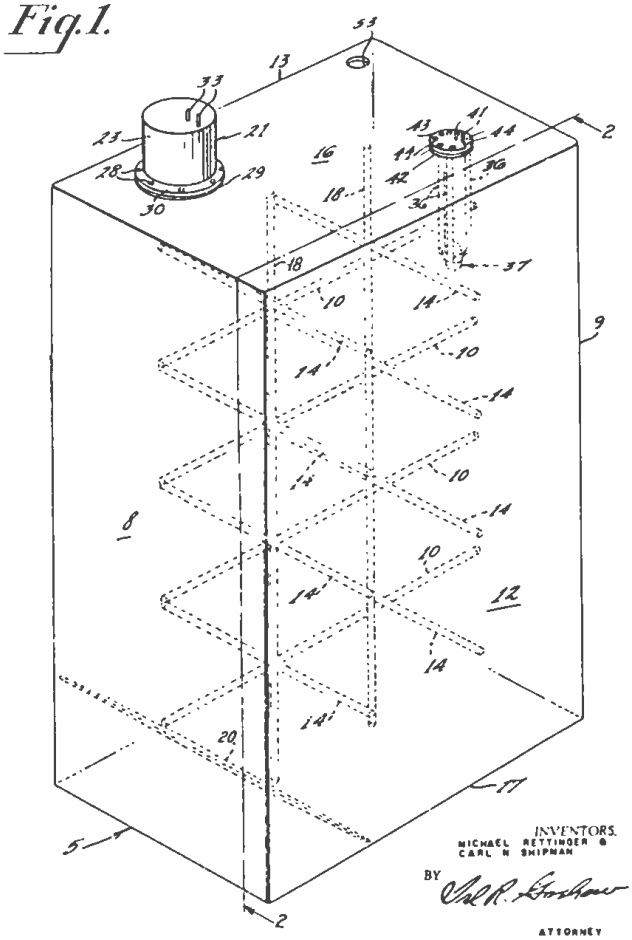
R-e/p 37

May 30, 1961 M. RETTINGER ET AL 2,986,228

MINIATURE REVERBERATION CHAMBER SYSTEM

Filed May 8, 1957 4 Sheets-Sheet 1

Fig.1.



INVENTORS.
MICHAEL RETTINGER &
CARL M. SHIPMAN
BY Carl R. Gaebler
ATTORNEY

May 30, 1961 M. RETTINGER ET AL 2,986,228

MINIATURE REVERBERATION CHAMBER SYSTEM

Filed May 8, 1957 4 Sheets-Sheet 2

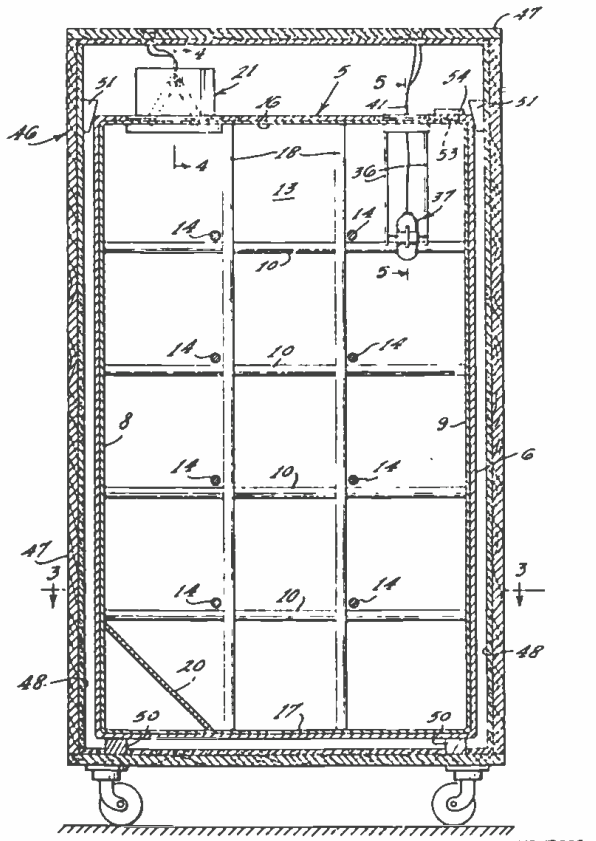


Fig.2.

INVENTORS.
MICHAEL RETTINGER &
CARL M. SHIPMAN
BY Carl R. Gaebler
ATTORNEY

Rettinger . . .

REVERBERATION CHAMBERS

Thus, the sound velocity in a gas which weighs nine times as much as air per unit volume, like Freon 12, is one-third that in air. This is true assuming no change in the ratio of the specific heats and no change in the atmospheric pressure of the gas. In the case of Freon 12, the sound velocity has indeed been measured close to one-third that in air, so that the reverberation time of a chamber filled with dichlorodifluoromethane is three times as long as when the same chamber contains air.

Similarly, for the same reverberation period, a chamber filled with Freon can be much smaller than one filled with air when both exhibit the same average boundary absorptivity a. This reduction in room volume is represented by the factor $4V/S$, which is the mean free path of the sound reflections in the room, or the average length of sound reflection r. In the case of a cubical enclosure with side x, when we equate $4x^3/6x^2 = r/3$, it turns out that the Freon-filled cube may have 1/27th the volume of the larger air-filled cube for the same reverberation time.

For the general case we may write these statements:

$$T_1 = (13.8)(4V_1)/caS_1$$

$$T_2 = (13.8)(4V_2)/(caS_2/3)$$

$$T_1/T_2 = (V_1S_2)/(3S_1V_2)$$

$$T_1/T_2 = 1$$

$$V_1/S_1 = 3V_2/S_2$$

For a cube, there is the following relationship:

$$x_1^3/6x_1^2 = 3x_2^3/6x_2^2$$

$$x_1 = 3x_2$$

Thus, when $x_1 = 30$ ft., $x_2 = 10$ ft., the following can be said:

$$V_1/V_2 = 30^3/10^3 = 27{,}000/1{,}000$$

or $V_2/V_1 = 1/27$

For other parallelepiped enclosures, the ratio is similarly large. This is not to say that miniature reverberation rooms should be parallepipeds; indeed, they should not be of such a shape. Preferredly they should have non-parallel walls, so as to avoid coincident reinforcement of the normal modes of vibrations in the chamber and thus avoid a tone bias.

The three questions most often asked of this writer in regard to his patented device were "How well does it work," "Is such a chamber commercially available," and "Would you recommend that one build such a unit as a commercial item?" The following is a brief history of the test data of the device, which is illustrated on Figures 1 and 2 taken from the patent paper.

The 3 x 4 x 5-foot model chamber was built of 1/16-inch thick steel, reinforced internally by bars 10 and 14 with the intent of reducing pronounced low-frequency panel resonances and placed inside a plywood box 48 made of 3/4-inch plywood.

Unfortunately, the model chamber walls were insufficiently treated on the outside with a viscoelastic compound. This lack of mechanical resistance on part of the walls, plus the fact that the chamber had parallel walls, resulted in a pronounced resonance of the chamber at 407 hertz. The reverberation times for most of the audio frequency range from 100 to 4,000 hertz, however, were well above three seconds for the 60 cubic foot chamber, which theoretically was equivalent to one of approximately 1,600 cubic feet, (10 x 12 x 13.6 feet).

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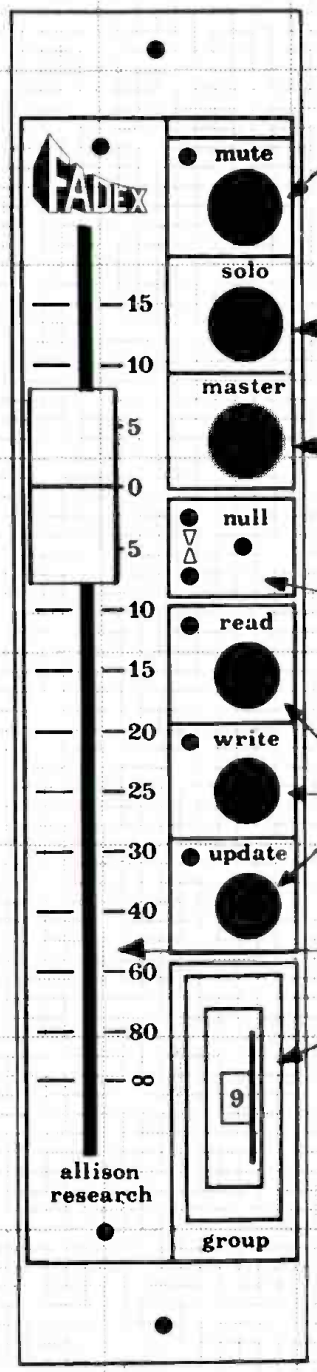

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1965, he occasionally experimented with such a unit and found that the best materials for such a chamber were either lead or concrete. The concrete chamber should be painted with a sealer on the inside to prevent transpiration of the Freon through the pores of the concrete. Also, the loudspeaker diaphragm should be of plastic and the moving microphone element should either be a coated crystal or a metallic diaphragm to minimize any corrosive effect which the Freon might have on these moving parts.

By itself, a lead sheet is not strong enough for the construction of a five-foot high chamber without buckling, so that it must be applied against a sheet of plywood or plasterboard. Because of its high internal resistance, such a lead-plywood chamber does not exhibit the pronounced metallic ring which the model steel chamber exhibited. A concrete chamber acts similarly without much frequency accentuation due to wall resonances.

We are here not concerned with the normal modes in a room, whose number is dependent only on its volume. Coincidental resonances can be avoided by slanting the walls and not employing an integral relationship for the three orthogonal mean dimensions.

The 407 hertz ringing of the model chamber was due to the resonances of the wall panels. Even so, the effect could be very much reduced by the installation of a dip filter, either in the loudspeaker or the microphone line.

As far as this writer is aware, such chambers are not commercially available. RCA made a limited market survey and felt there was not enough demand for such an item to construct it on a mass production basis. And this writer is not about to enter into production of such a unit, even on a limited order basis. However, if he were in the recording business, he might just have two or three built, in place of buying solid-state reverberators or other types of one dimensional- or two-dimensional sound delay devices. There is simply no substitute for using "the real McCoy", even in miniature form, when it comes to reverberation chambers with their random phase and amplitude relationships in three-dimensional reverberation.

The acoustic conditions of a small, air-filled reverberation room have been documented. In 1976 the National Bureau of Standards in Washington, D. C., built a concrete reverberation chamber 7.4-feet (2.26 m) long, 6.24-feet (1.9 m) wide and 5.28-feet (1.61 m) high. (This project is described in the article, "A Small-Scale, Multi-Purpose Reverberation Room", by D. S. Pallet, E. T. Pirce, and D. D. Toth, *Applied Acoustics*, October, 1976.) The

enclosure had a volume of 244 cubic feet (1.9 cubic meters) and was built entirely of concrete. The walls consisted of standard concrete blocks while the ceiling was cast concrete, eight-inches thick. The ceiling was actually removable and was isolated from the supporting walls by a strip of Neoprene-jacketed fiberglass board. The chamber also had a steel door with an air-borne sound insulation rating of STC-50.

The measured reverberation time "T" at 200 hertz was four seconds and at 1,000 hertz it was two seconds. From the Sabine reverberation time equation, the following can be computed:

$$T = 0.05V/aS$$

where

S = total interior boundary
= 236 square feet
V = volume of chamber
= 244 cubic feet
a = average boundary absorptivity

The results indicate that a = .13 at 200 hertz and .26 at 1,000 hertz. This means that the total absorption "A" at 200 hertz was 236 x .13 = 3.07 sabins and at 1,000 hertz it was 6.14 sabins. It could have been that at 1,000 hertz the 2.7 square feet of Neoprene-jacketed material at the ceiling contributed substantially to the absorption at that frequency, but this is only a theory.

	Reverberation Time Seconds			
	200 Hz	500 Hz	1,000 Hz	5,000 Hz
Before Treatment	5.0	3.2	2.0	1.8
After Treatment	1.2	0.6	1.0	1.0

Excepting for the steep rise at the bass, the reverberation characteristic of this small-scale reverberation chamber was remarkably smooth.

To flatten the reverberation time characteristic of the enclosure, the Bureau of Standards introduced some low-frequency absorbers in the form of thin panels and also made sure that the relative humidity in the chamber was at least 50%, since a lower relative humidity tends to absorb the higher notes more than the lower ones. The reverberation times of the small reverberation chamber before and after the introduction of some low-frequency absorbers are described in the accompanying box.

The question whether a reverberation period of 1 second or slightly less between 100 and 5,000 hertz is sufficiently long for introducing an effective reverberatory note into a recording depends, of course, on the type of music which is to be so modified, or the type of signal, like speech, which is to sound as if it were uttered in a deep cave, etc. Generally, the level of a reverberated signal may be markedly low compared to the direct sound or music level which is to be so affected. Indeed, the reverberated signal may be 20 dB below the direct signal and still, the modified signal sounds remarkably reverberant. This is probably because the reverberatory character of such signals is not judged by total decay time, but by the first 10 decibels after decay has started. This reverberatory effect may be increased by employing a great distance between the loudspeaker and microphone in the reverberation chamber and by placing the loudspeaker in a corner of the enclosure.

It may be noted that this writer had to also install low-frequency absorbers in a "standard-size" reverberation chamber of 2,500 cubic feet or larger to flatten the reverberation tone characteristic of the room. In addition, no room, no matter how large or how its boundary surfaces are treated, can have a reverberation time longer than one second at 10,000 hertz because of the molecular air absorption. The calculations for this effect may be found in the writer's "Acoustic Design and Noise Control", published by the Chemical Publishing Company in New York. ■■■

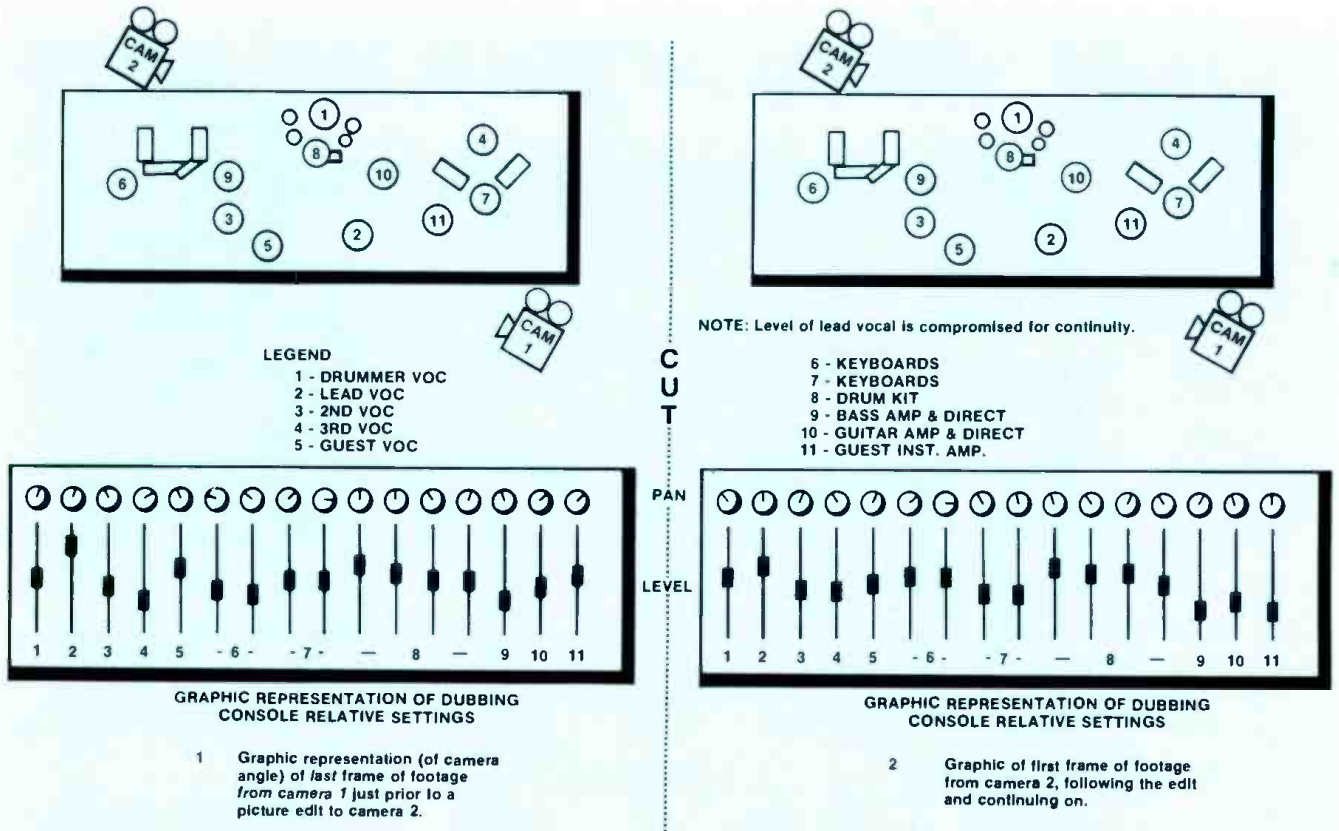
THE BAND
THE LAST WALTZ

BY ED LEVER, CANYON RECORDERS

In preparing the "script" for *The Last Waltz*", producer/director **Martin Scorsese** and The Band's **Robbie Robertson** defined the audio/visual objective as . . . *a front row — Winterland Auditorium — Thanksgiving Day, 1976,* perspective for every theater-goer, with audio emanations very closely related to visual camera angles.

The concept of continuing, close-up framing of musicians (few wide-stage shots and no audience reaction scenes) put special demands on the soundtrack for a precise mixing process to match sound to picture. For example, in producing the soundtrack to correspond with what a movie viewer would hear if he were located at the emanating camera positions during the concert, as the camera angle changed from edit to edit the relative level and pan position of each instrument and vocal track in the mix had to be adjusted spatially. If the drummer was framed in a given shot, drum audio tracks were accented in the audio mix. If the drummer was both singing and playing, both the drummer vocal and drum instrumental tracks were highlighted. Thus integrated, the combined audio and visual perspective gave the viewer/listener a unique sense of realism. The mix flexibility could only be achieved by using multi-track record-recording hardware and techniques in preparing the soundtrack.

Because of a continuing relationship with



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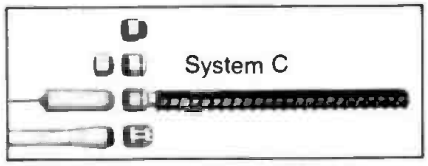

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The Band and its Shangri-La Studios, Canyon Recorders assumed a major role in conceiving and assembling the post production system that allowed the interface of record-recording type hardware with film post production machinery, described as follows.

Standard Film Procedures

To fully understand just what made this motion picture's soundtrack so strikingly different from others and why it made such an extraordinary contribution to the film's impact, it might be helpful for those of us in record recording to briefly review the standard procedures and equipment currently in use by our audio engineering brethren in the Movie Biz. To begin with, a motion picture audio format typically consists of three basic elements: dialog, music and sound effects. Dialog is generally recorded on magnetic tape while simultaneously shooting the film (environmental acoustical control and ambient noise conditions permitting). Associated pertinent audio information (such as rustling bedsheets, doors slamming, heavy breathing, and so forth, can, if possible, be captured at the same time. If not, these sounds as well as some dialog, which for various reasons may not have been satisfactorily recorded, can be generated later during the "re-recording" (jargon for film people's equivalent of overdubbing).

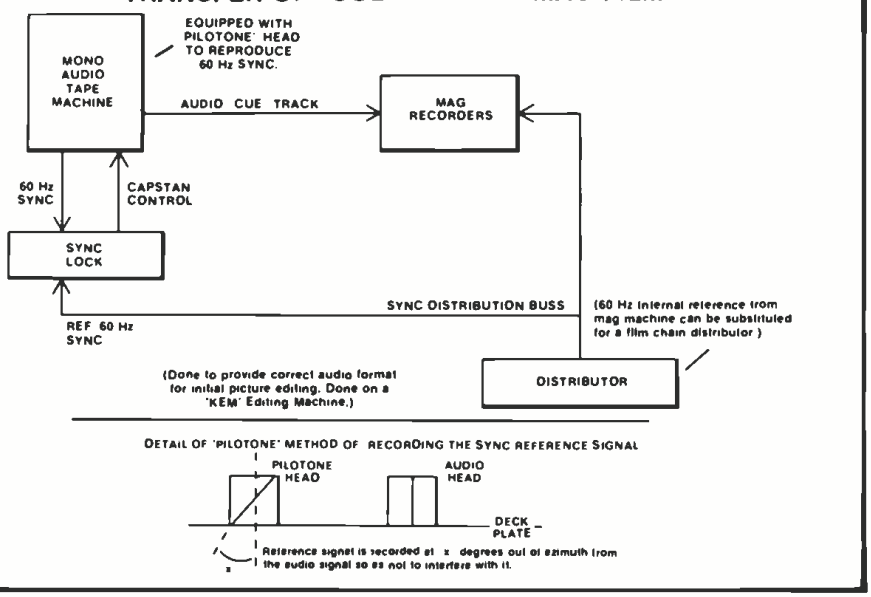
The dialog, additional sound effects and the pre-recorded music score are all maintained as discrete program tracks on separate reels of mag (or magnetic) film until the final audio combining takes place. The mixing process, called "dubbing", is actually accomplished while viewing the edited picture to insure proper synchronization and level correlation between the many various sound tracks and the picture.

What results after all of the mixed segments are assembled is called the "dub master", analogous to record-recording type of quarter-inch stereo master. The entire dub master is then transferred and a new generation made while making periodic changes to achieve continuity in overall level and equalization. The transfer is called the "print master", which is analogous to the disc master obtained through a somewhat similar mastering procedure.

It is important to mention here that one significant distinction between record-recording and film sound recording is in the audio storage medium. Initial dialog and music may be recorded on magnetic tape similar to that used in record-recording. This is then transferred to 35 mm mag sprocketed format identical to that used for storing the picture image, except that the photographic emulsion is replaced by a magnetic-oxide coating.

Although seemingly cumbersome, this format is actually very appropriate and practical for motion picture purposes. By using similar transport drive mechanisms for both picture and sound, a high degree of precision and special form of flexibility in both synchronization and multiple editing can be more easily achieved. Sprocketed film can never slip on a toothed "capstan" driving element so that by phase-locking the driving element motors from a single power signal source, called the "distributor", numerous reels of film (each carrying separate audio tracks) can be made to move together sprocket-by-sprocket in either direction as if mechanically linked as one piece. A group of such linked machines, including the film projector, is called a "film chain". In this arrangement, the many reels of film can be perfectly synchronized, yet at the same time kept discrete. Temporarily disengaging any machine's drive motor from the master distributor buss permits a mixer to "slip" (or re-adjust) information on a particular track. Correct relative timing of all the tracks can ultimately be achieved again during the dubbing assembly.

TRANSFER OF "CUE" TAPE TO MAG FILM



Synchronization Systems

Because the primary purpose of music in most films is simply to support or enhance visual presentation, it is customary to pre-mix music down to a few tracks. Although this method is both adequate and efficient within the context of a regular film, it obviously limits the ability to re-mix what might have originally been discrete music tracks while dubbing the picture. Nevertheless, most motion picture sound dubbing facilities are set up to accommodate only this "pre-dubbed" music format. As a result, prior movies of live concerts have followed the same practice in which the live tracks are pre-mixed in the studio to provide a familiar format for the dubbing mixers, who then simply cut the music to match the edited picture.

The problem with this approach is that a recording engineer, while mixing in the studio, would be tempted to treat the program as he would for an album mix. Thus a soundtrack ends up representing what someone would hear if seated in some ideal spot in the concert audience. Although the camera angles would change and give the movie viewer a changing visual perspective, the *audio perspective* would remain fixed.

To keep many tracks of music synched up with picture, a system was developed combining the conventional 60 Hz resolving system called Sync-Lock and a more sophisticated system employing the EECO SMPTE time code synchronizers which we had successfully used on a number of previous record projects.

Using the Sync-Lock device, a 60 Hz reference signal is recorded on one channel of the tape and used as a sync "code" later during the transfer phase. The reproduced code from the tape and a corresponding reference signal from the film chain or sprocketed machine (designated as the "master") are combined in a phase comparator, from which a resulting error signal is generated. This error signal (whether a voltage or frequency) is then used to control the speed of the capstan motor in the "slave" tape machine. By varying the tape velocity, relative changes between two respective sync code signals can be compensated for, to correspond exactly to one another in frequency and phase.

However, there is a major drawback to Sync-Lock. The program material on the two machines will maintain synchronization only after they have first been matched together manually. Since Sync-Lock cannot distinguish between the identical pulses in the code, shuttling and restarting the two machines to establish sync requires constantly going back to physically align a "start mark" reference on both the film and tape before initiating program sync.

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Otherwise, it is obvious they will run together, but with some constant "offset".

EECO SMPTE Time Code

Although originally designed to lock two video tape machines, SMPTE time code synchronizers can sync any two magnetic tape machines together. It is similar to the 60 Hz Sync-Lock in that the synchronizing unit controls the speed of a slave machine to match the master by reading and comparing the pre-recorded time code signals from the respective machines.

What makes this system far more sophisticated is the signal which both identifies exact address and provides fine timing pulses. Rather than being a constant frequency of identical pulses, it is a complex code made up of numerous bits of binary information. These binary pulses are grouped into 80 bits, which comprise a frame. Its speed is 30 frames per second, which corresponds to the frame rate of magnetic video tape machines which the time code was originally designed for.

Instead of presenting a continuous sequence of pulses defining time code address only, two kinds of information (fine timing pulses with address) can be separated when read by the synchronizer so that each form of information appears as a continuous flow of data. Within the 80 bits of each frame are eight binary words denoting address. Each of these binary words are broken down into four fine timing pulse subgroups.

The timing pulses within the code appear 10 times per frame (thus 300 per second), and provide a signal to the synchronizer which is used in a manner analogous to the 60 Hz resolver. A *much* finer degree of resolution, however, is achieved due to the higher frequency of these timing pulses. While one part of the circuitry is reading the fine timing pulses, another comparator or circuit is constantly comparing the frame address information from the two machines.

When initiating the system, the synchronizer first compares this frame information and then automatically goes into the "address mode". In this mode a coarse form of synchronization take place, in which the slave machine is rapidly sped up or slowed down until the frame comparator sees the same frame address information. At this time the unit automatically switches to the "flywheel mode" in which the fine timing pulses are compared to achieve an even closer degree of synchronization. (In this mode of operation, an electronic buffering circuit is incorporated to prevent any erratic movement of the slave tape.)

The major advantage of the SMPTE system is that it eliminates the tedious and time consuming problem of lining up tapes to a "start mark" each time prior to engaging the synchronous play mode. In other words, a mixer can start a tape machine anywhere and the slave machine will automatically search out the correct relative address prior to engaging synchronous operation.

Preparing Tracks For Mixing

Before post production mixing of *"The Last Waltz"* began, there were numerous other tasks which had to be completed.

The basic live tapes had been recorded by the Heider/Filmways Remote Truck with Elliot Mazer engineering. Picture editing was now started. The seven hours worth of recorded music was brought to the Shangri-La Ranch and reviewed to ascertain the quality of the individual tracks and the suitability of the various performance segments.

During this reviewing phase, a number of problems were discovered in the live multi-track masters. For example, a 60 Hz hum had somehow been printed along with the program on random tracks. (This was the result, perhaps, of low line voltage fed to the remote truck from the concert hall power service.) Some of this hum could simply be eliminated through the use of filters (actually UREI Little Dippers). In addition, occasional microphone or instrument amplifier failures during the concert produced some tracks which required restoration either by overdubbing in the studio or by a complex recovery technique involving phase-compensated combining of other tracks so that only the leakage of the instrument in question would remain. This technique involved the use of noise gates and rather drastic equalization to recover a usable track constructed from the remaining leakage signal.

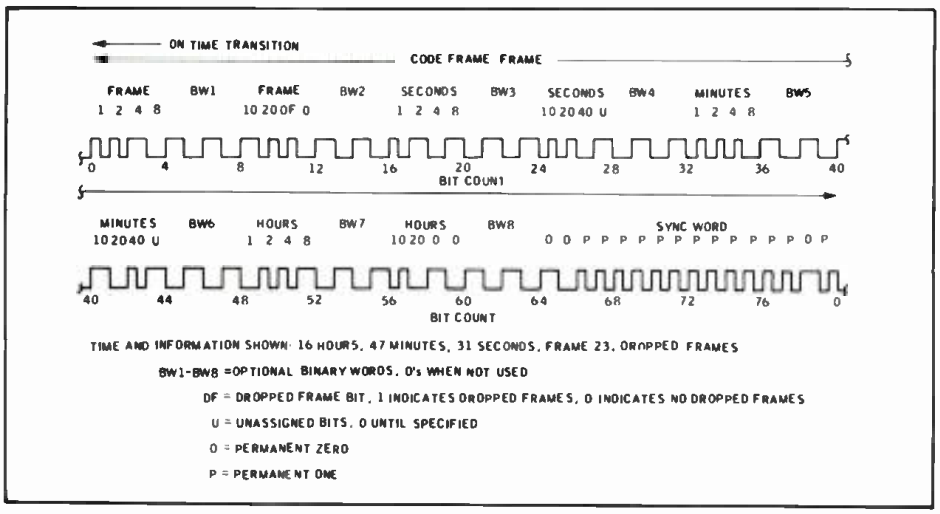
To facilitate the ease of eventual post production mixing, most of this repair work and general clean-up was done at the Shangri-La Ranch studio. From this activity, detailed logs and notes were generated to systematize the extensive tape library (more than a quarter-of-a-million feet of two-inch tape) and to indicate particular problems very explicitly so that further corrections could readily be made during dubbing.

Meanwhile, another situation developed which might have become a further complication, but in fact turned out to be both a successful piece of production and a vehicle for a demonstration experiment. An additional sequence was written into the script by director/producer Martin Scorsese who decided to record and film The Band, The Staple Singers and Emmylou Harris on the MGM soundstage for a special scene. Using the MGM soundstage would permit a carefully staged and complex sequence of camera shots. The problem for the performers was to maintain the same music tempo and performance continuity in each take of "live" studio tracks while doing numerous re-takes from different camera angles.

Rather than lip-syncing to pre-recorded music, it was decided to pre-record only the basic tracks and the background vocals. These pre-recorded tracks were used strictly as cue mix and were not recorded for use on the final master. They were done in a studio on 24-tracks and afterward, during the soundstage shoot, played back from the Enactron Remote Truck via small stage monitors as low level cue mix to which the groups performed live. Vocals and instrumentals from the soundstage were recorded on a second 24-track machine which ran in sync with the 24-track playback machine. The EECO SMPTE time code synchronizer (BE450) and the edit code reader (BE420) were used to lock the two machines together, the combination hereinafter called the "B" system.

Since each tune had to be performed over many times, numerous lengths of tape were pre-striped (pre-recorded) with SMPTE time code on one channel. After each good take, the particular tape segment was slated and logged to identify it with the corresponding camera take, whereupon a new segment of tape was loaded on the record machine and the process repeated.

Since each of the live recordings were



SMPTE Edit Time Code

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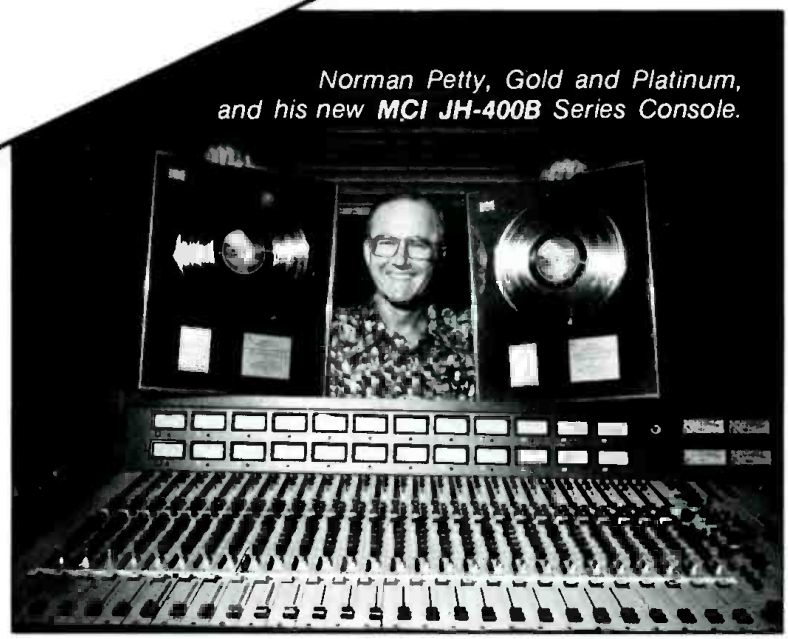
It has been, and still is, a privilege to know and to depend upon you and your people for all of your help and to feel that your personal as well as your good-business thinking is always available to us at any time. Knowing this makes it less difficult to grow gold and platinum in such an unlikely place as Clovis!

If you look carefully, you can probably see that you are actually in the enclosed photo of the lucky musician who values your recent update of recording equipment as being necessary for a future filled with planting and harvesting of even bigger and better golden crops for every musical taste.

Best,

Norman Petty



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made while the two machines were synchronized, they all matched the pre-recorded reference and thus matched one another exactly. This method made for flawless intercut editing so that not only tempo, but also vocal phrasing, would match when the music recorded with each camera shot and take was compositely edited together to make the edited final picture. (To insure that the final edited tapes of the live recording synchronized to picture, the 60 Hz reference signal from a generator was used to interlock camera and the multi-track record machine.) Using the SMPTE system to synchronize the two multi-track machines together completed the chain so that the 60 Hz film sync reference signal, when transferred to the new live masters, would provide the means by which to interlock these new tapes back to the picture.

The production at the MGM soundstage was Canyon's first opportunity to use and demonstrate to the producers the accuracy and flexibility of this type of equipment and its value during an actual production phase of the movie. The system worked so well that the producers recognized its potential in the post production process.

Alternative Approaches To Music Dubbing

With filming of selected sequences at the soundstage completed, post production commenced. As there were no existing facilities where The Band could effectively mix the multi-track tapes directly to film with recording studio equipment and procedures, several possible approaches were proposed to deal with this problem.

One way would be to do it at Shangri-La Studios by pre-mixing 24 tracks to 35 mm mag film using a ¾-inch video cassette of the work print edit. In this way, it was felt that superior quality product would be obtained not only from the use of The Band's own equipment, but also because the group's engineers could actually perform the mix themselves. (Under most circumstances, the mix would have been done by the film sound union post production engineers.)

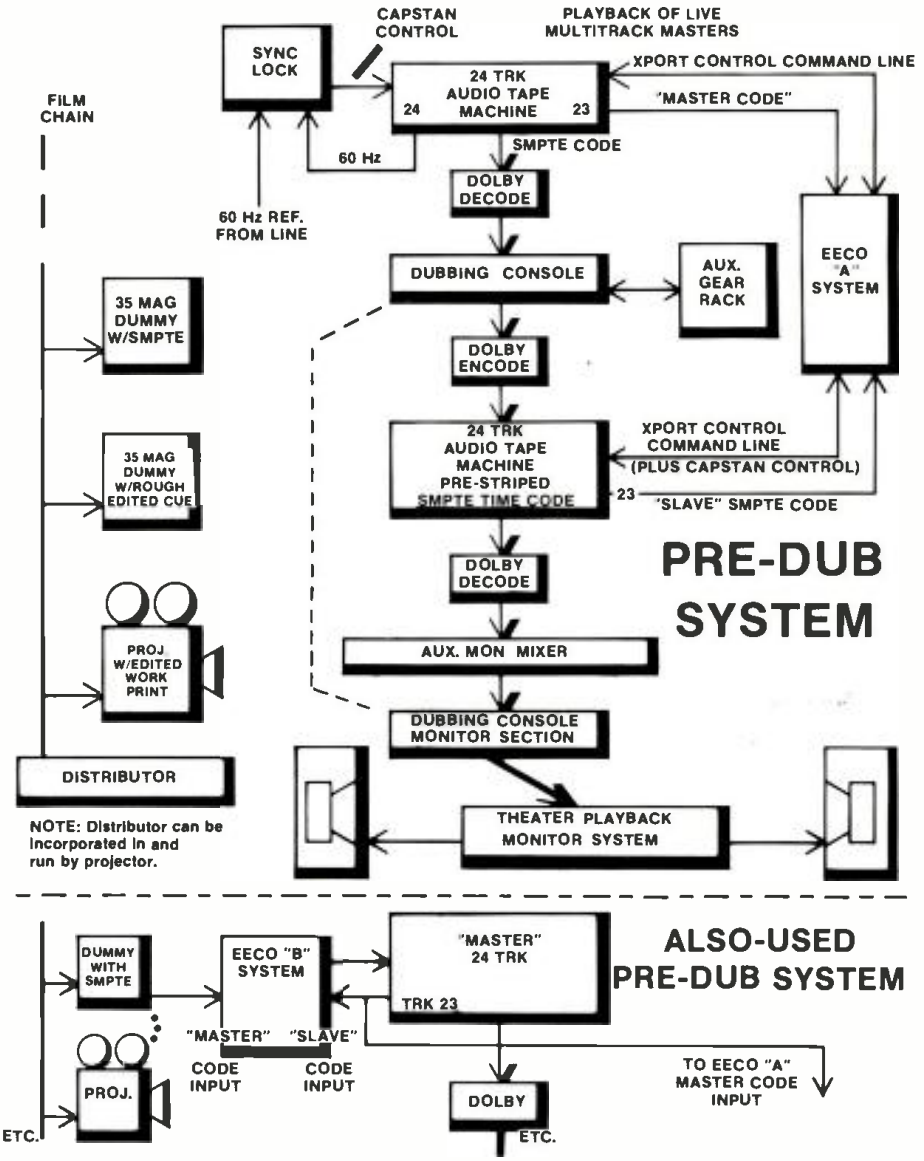
This solution, however, proved unfeasible because the studio was in use for mixing *"The Last Waltz"* record album. But even if this had not been the case, the picture couldn't have been seen in full screen because the monitor and room characteristics were very different from that of a typical theater. It was felt that an effectively realistic mix could not likely have been achieved. Also, a horrendous task of setting up mag machines and associated circuitry would be required to make the audio mixing studio suitable for film post production activity.

Another approach would have been to transfer 24 tracks directly to sprocketed mag format and mix from the 35 mm mags. This would create problems, as 24 individual reels of mono mag film (or eight reels of 3-track mag film) would have to be used for *each* tune. What would result is a requirement for a massive library and film storage — as well as thousands of splices and the loading and unloading of a multitude of reels. This would involve finding and lining up a "start mark" on every reel before engaging and interlocking the system.

The approach that was finally used involved the set up of multi-track recording equipment and associated interfacing in a motion picture dubbing stage (film's equivalent of a mix room) whose facilities would be modified to handle 24 or more channels of music. The effective combining of the two types of facilities into one seemed to provide the best of both worlds.

Dubbing Stage Layout

The Samuel Goldwyn Studios were selected primarily because they had one of the only two ultra high speed film chain systems operating in the country. In addition, the executives and staff were extremely cooperative with respect to scheduling and were willing to accommodate and assist the production in trying something unconventional. The Goldwyn dubbing stage is essentially a replica of a motion picture theater in which a mid-section of the seating has been removed and replaced with a flat open area to accommodate the mixing console, patch bay, and producer's desk. The normal film sound equipment — that is, the film chain consisting of numerous 35 mm mag transports — is located elsewhere. This arrangement isolates the producer and mixers from the noisy, distracting activities of the 35 mm mag transport operators, who load and unload reels constantly. Since the mixers' area was open except for the Quad-Eight mixing console, Canyon installed its multi-track equipment and EECO synchronizers right there next to the console. Aside from the extensive wiring connecting the two 24-track Ampex machines, 40 channels of Dolby, auxiliary monitor mix and EECO synchronizer control lines together (without the benefit of concealed conduit or troughs, by the way), the usual line inputs and buss feeds to and from the



dubbing board were hardwired directly from the mag machine room upstairs. Without the benefit of auxiliary line access connectors — both the interfacing cables and connectors from the multi-track equipment had to be routed to enter the console at the patch bay. (This consisted of 96 lines to access all 48 tracks plus a few dozen more for all the aux gear!) The cabling had to be tagged for easy identification since the room was booked with other projects during the day and mixing of *"The Last Waltz"* was scheduled for nights.

Pre-Dubbing of *"The Last Waltz"*

The difference between a standard movie pre-dub and the corresponding steps in the post production procedure in *"The Last Waltz"* (which we also called the pre-dub) is that, rather than mixing down all the channels of the multi-track audio tapes to stereo at once, the pre-dub was basically a form of multi-track transfer wherein as many channels as possible could remain discrete.

This was done because a great many individual tracks were erratic in level and some, for various reasons, were of poor quality. To achieve continuity on each of these tracks it was therefore necessary to compensate for discrepancies between the live performances and how they sounded recorded on tape. For example, a horn player or vocalist weaving in front of a microphone is acceptable in a live performance, but the recorded signal on tape would not be usable.

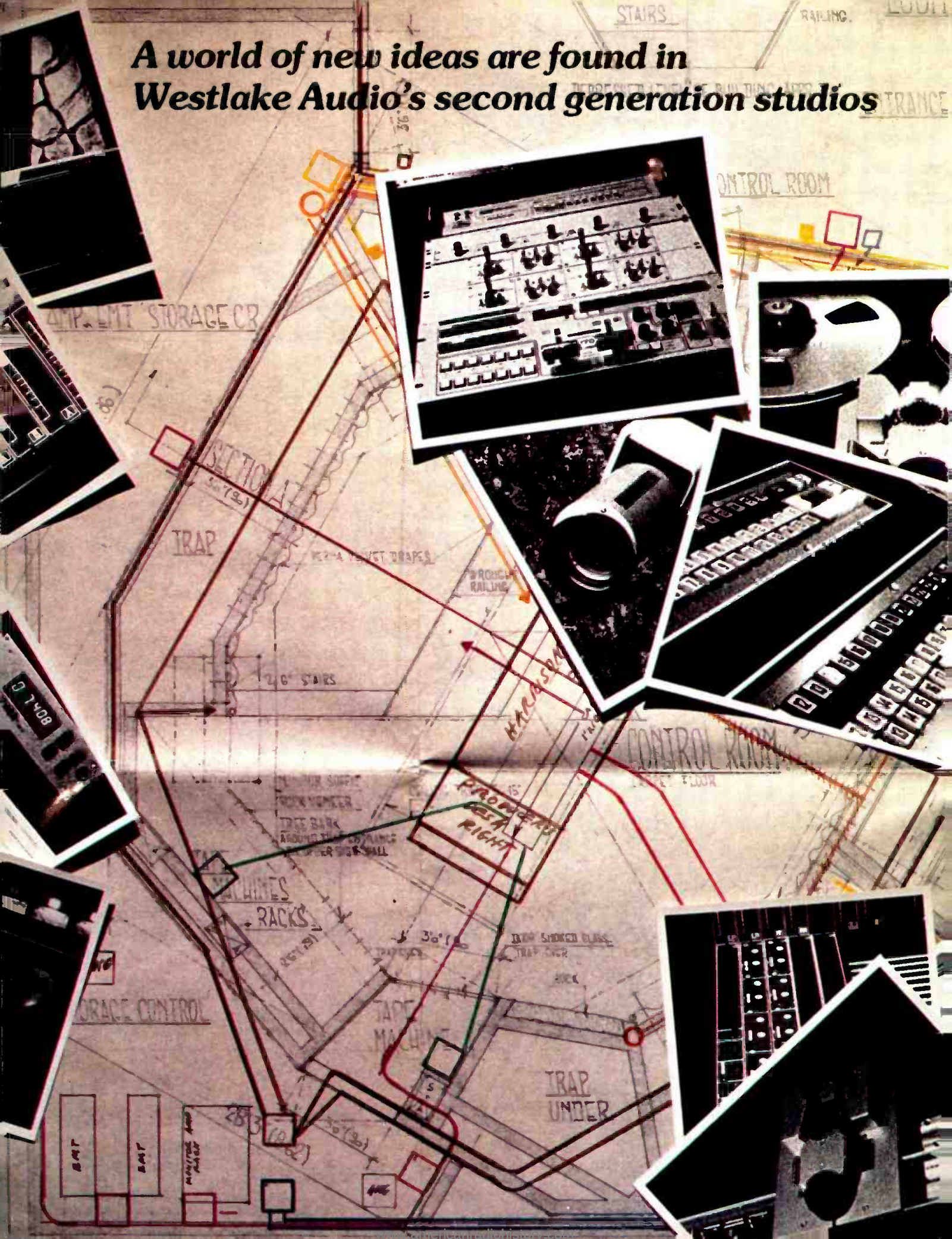
Occasionally it was desirable to combine certain groups of tracks during this pre-dub transfer process while still providing maximum flexibility to adjust pan, level, equalization, etc., from edit to edit during the music dubbing. In order to know which tracks were possible to combine without losing this necessary mixing flexibility, it was necessary to review the work print of the picture (though it was not necessary to do this in exact sync with the live tapes).

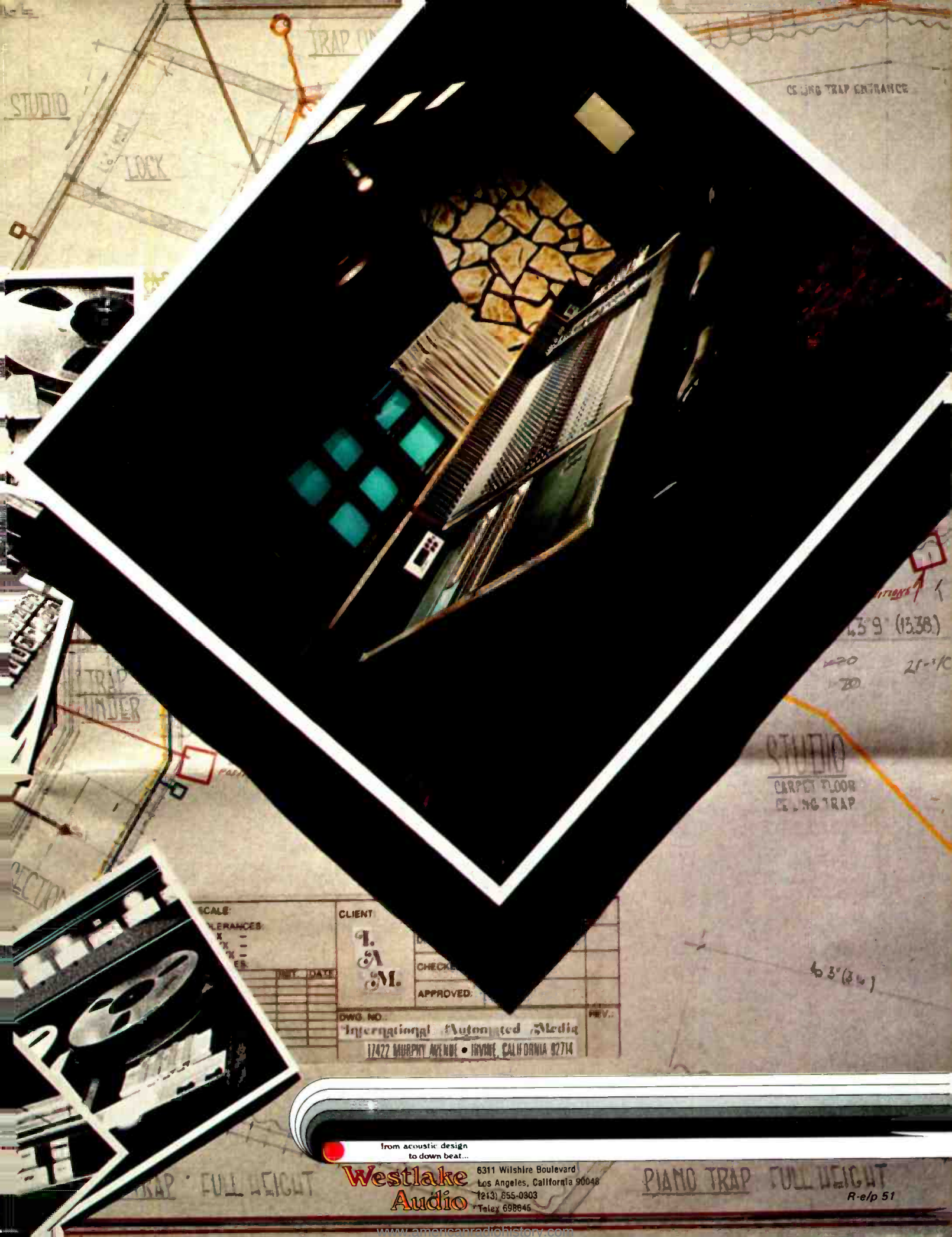
Before pre-dubbing could even begin, however, SMPTE time code had to be printed on the multi-track masters and the 35 mm mag film prints in order to provide a reference pulse for the EECO synchronizing system. Ideally this should have been done during taping at the live concert.

Since it had been decided to use a second multi-track machine as the pre-dub transfer recorder, the EECO "A" system was used to lock the two Ampex 24-track machines together. (The "A" system differed from the "B" system in that it employed a computerized dual cue controller accessory.) Monitoring the second pre-dub machine through an auxiliary mixer, a number of individually restored discrete tracks as well as some group-combines (two or more discrete tracks mixed down to one track)

— continued on page 52

A world of new ideas are found in Westlake Audio's second generation studios





continued from page 49 —

were transferred one at a time until the pre-dub was completed. Due to the fact that numerous passes had to be made over each section of the tune, the EECO "A" system was used because its chase and cueing features could automatically shuttle and re-synchronize the two tape machines together from the controls of a single machine. This had the incidental advantage of group-combining sections to be re-mixed or updated if necessary, simulating some of the benefits of automated mixing.

Ideally, a simultaneous view of picture while repairing or transferring the live tracks was desired. This, however, was only feasible in cases where there had been no picture edits for the duration of the song or musical segment. It must be remembered here that the film and tapes of the seven hour concert were ultimately condensed into a two hour movie. Obviously, wherever a picture deletion edit appeared during a song, a corresponding music edit would be required.

Also, any hard edits of the two-inch masters had to be ruled out at this point, as these tapes would also be used for mixing the live concert album. Furthermore, any tape edits would interrupt the continuity of the pre-recorded SMPTE time code tract. While passing over the edits, the disjointed code information would momentarily confuse the synchronizer, causing a glitch or flutter in the slaved audio machine. In the case of picture deletions, then, corresponding edits in the music were done at a later time (after the entire song or selection of music from the two-inch tapes had been transferred to mag format) by the music editor.

When it was possible to re-mix and transfer while viewing the picture, a system was devised so that the two multi-track machines and the rest of the film chain (including projector) would run in exact sync. Since the projector and the associated mag machines comprising the film chain used a different format for interlocking, (60 Hz resolving with a sprocketed format) a second EECO synchronizer was used to join the two separate systems together. This was accomplished by printing SMPTE time code on a reel of sprocketed mag film (35 mm) which was then loaded onto one of the dummies in the film chain. Because the dummy followed the projector, the SMPTE time code output could be used as the master time code source, enabling the second EECO unit to slave the first multi-track machine to the dummy. Since the other EECO system slaved the second audio multi-track to the first, the two previously independent systems were thus joined so that the projector, the mag machine film chain and the two multi-track recorders would all run together.

Once all the tracks had been transferred, thus completing the multi-track pre-dub master tape, a stereo rough mix was generated and recorded directly to mag film. This was easily done after completing the pre-dub since the sync system needed for this purpose was already set up. Before beginning the rough mixes, a "pop" was generated at the dubbing stage on the master pre-dub tapes used as a reference for synching the mags. Now, the pre-dub from the slave machine was simply placed on the master machine.

These rough mag stereo mixes were then sent to the music editor (Ken Wamburg) who ran them together with the edited picture and hard cut the stereo mag to match the picture edits. Starting with the "pop" as a reference index, the music editor then generated an "editor's code" describing in feet, frames and perfs (perforations) exactly where the edits occurred.

Meanwhile, the final pre-dubbed mixes, each consisting of from 18 to 22 finished tracks (only a handful in conventional films) on two-inch tape were then transferred via the EECO "B" system is a sprocketed format using 35 mm mag machines, with heads changed to accommodate first six tracks and then three tracks, so that all the tracks in each tune could finally be transferred (starting with two groups of six each and then in groups of three as needed). Again synchronization was achieved using SMPTE-striped magnetic film as the time code source to lock the multi-track to the film chain in the same manner as was used to lock the multi-track reproducer to the projector.

Once the pre-dubbed multi-track "master" tapes had been transferred to 35 mm mag film, each group of reels comprising one song or musical segment was then manually edited to match the edited rough stereo mix using the editor's code. Next, the edited pre-dub transfers contained continuous (non-interruped) music tracks for each song or musical segment and could thus be loaded on the film chain for final dubbing to picture along with dialog and effects.

Actual Dubbing

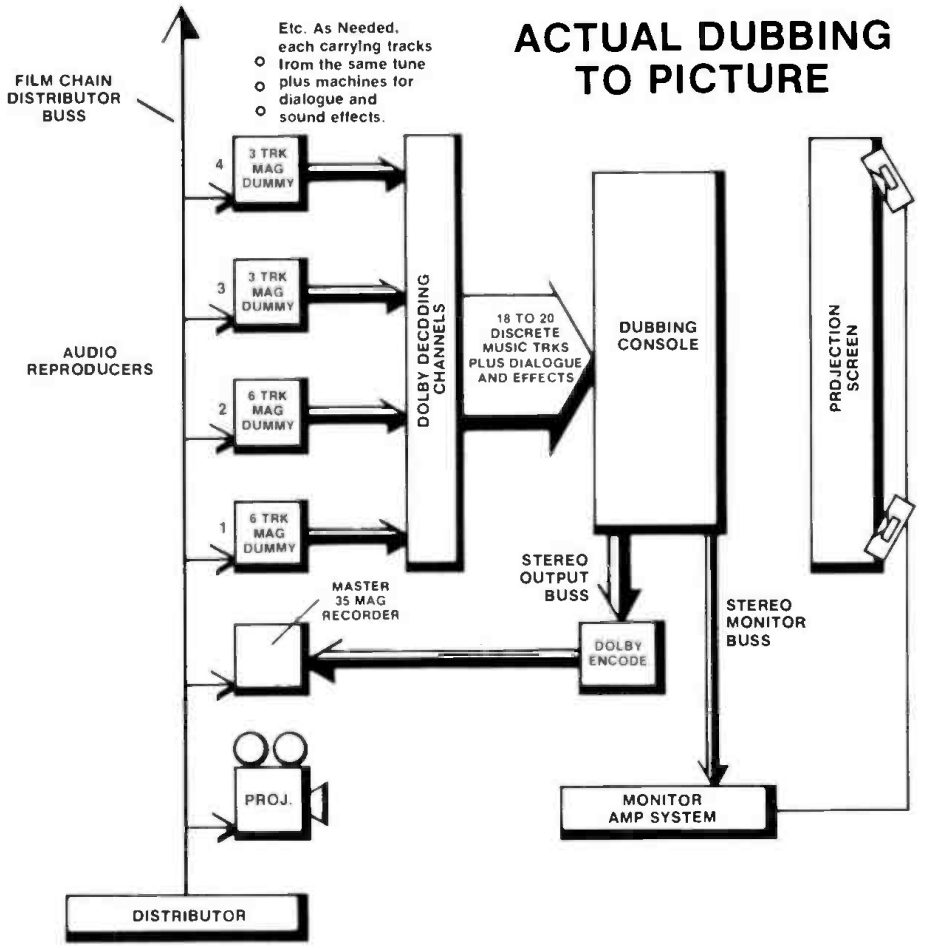
Dubbing is the actual audio mixing of all the tracks down to stereo which is analagous to the stereo mix-down process in record recording. Since most of the erratic EQ and level changes in the various individual instrumental and vocal tracks were corrected during the pre-dubbing process, so that all the mixers had to really do was to adjust the relative level and pan changes of the pre-dubbed tracks in order to make the stereo perspective follow picture. The more complicated fader moves had been rehearsed during the pre-dubbing, so the conventional dubbing of sound to

picture was mostly finer tuning.

One interesting departure from conventional film dubbing was console layout and seating, which is usually divided into three sections with one section and mixer each for the dialog, music and effects. Because most of this film centered around music, pratically the whole console was devoted to music dubbing — with as many as six music mixers working the board at one time.

It should also be pointed out that dubbing for a film is performed in a piecemeal fashion. All the individual audio mags used for each section of the film being worked on are loaded onto the film chain, including the reel on which the mix is actually recorded. Since standard film speed at the rate of 24 frames per second works out to 90 feet of film per minute, the 1,000-foot reels used limit the length of a continous mix to roughly 11 minutes. So even if an entire reel is mixed continuously (without interruption), the various reels still have to be edited together to compose the final soundtrack.

The resulting stereo mag mixes (each reel containing 11 minutes or less of continuous music) must be edited together by the picture editor while viewing pictures (again, visual and dub master are kept in sync by the film chain). The final assembly of these mag reels forms the "dub master" and is similar to assembling the quarter-inch stereo master for an LP record.



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MQS Synchronization System

As in any new endeavor to improve or create product, a first attempt involves a good deal of experimentation. Because the pre-dubbing and dubbing stages of this project involved so many tedious and cumbersome steps, Canyon Recorders had no trouble conceiving new applications for the SMPTE-based EECO MQS synchronization system that would eliminate many time-consuming operations. Coupled with Goldwyn's new automated console and dubbing stage, much work could be condensed when applied to future "music" movie soundtracks.

The MQS synchronizing system is the most recent development in the evolution of the EECO line of synchronizers. It is microprocessor-based, unlike its predecessors, giving almost unlimited flexibility in function. It can synchronize as many as three audio or video tape machines at once. To execute even more complex functions, it can be interfaced with a computer terminal.

The basic MQS unit is small, portable and very easy to operate. Coupled with an automated mixing console, such as the Quad-Eight that Goldwyn recently installed on its new dubbing stage, Canyon Recorders feels that the MQS synchronizing system has many capabilities that have yet to be explored.

Specific Application Of The MQS System

Although there are many possible applications of the MQS synchronizing system to film sound post production, the ones reviewed here are only the most obvious in relation to our application of synchronizing systems to *"The Last Waltz"* film soundtrack.

It is necessary to first deal with the MQS system without the benefit of automated mixing. "Pre-dubbing" audio to mag sprocket format is still necessary to transfer tracks for recovery and for adjustments in continuity of each individual track before dubbing to edited picture or, more typically, needed to obtain, in one operation, a multi-track "master" which will continuously match the picture if the film has been edited to delete sections of a performance. But instead of having to use two EECO synchronizing systems — one to sync up the two multi-track tape recorders and the other to sync the SMPTE-striped mag dummy of the film chain with these two multi-tracks — the MQS system can sync up all three at once.

But that's not all — one very important feature of the MQS synchronizer is that it can achieve address sync without having to manually (as in prior EECO systems) offset it each time. This is invaluable during the pre-dubbing process because the old EECO system with the BE450 has limited offset capabilities. Before being able to offset, it first had to achieve address sync. Once in the "flywheel mode", the operator of the machine would have to manually advance or retard the offset, one frame at a time while viewing the offset meter. This involved trial and error listening until the desired amount of offset is achieved. The desired offset would then have to be noted and then manually attenuated in the final run. Even though the operator knows the correct amount of offset, he must first achieve address sync *each* time prior to manually returning to the selected offset. Because it was necessary to engage address sync well in advance of the program material to be offset, this becames a very tedious and time consuming process.

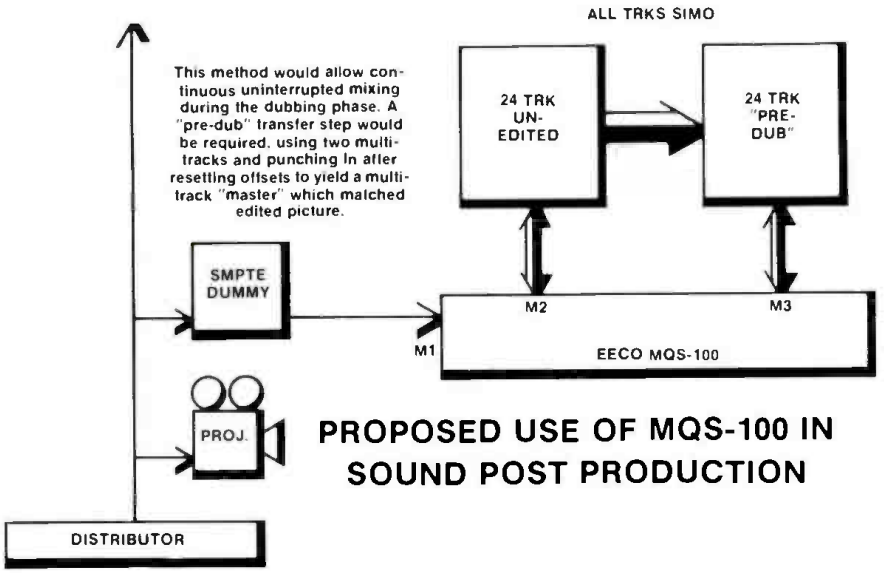
The MQS system, on the other hand, although it too must first achieve address sync, can be pre-programmed for a specific address offset between two tape machines. Once the desired offset is determined, the MQS computer will remember it and automatically search to it every time the tape machines are started. It does not need to be manually set each time. In addition, the engaging of address sync well in advance as with the EECO BE450, is not necessary.

Because of the offset feature and its ability to sync up three machines, the MQS-100 system could have been used to create a continuous pre-dub multi-track transfer. This would eliminate the need to edit together the discontinuous pre-dub mag transfers of each song or section in which deletions corresponding to picture edits have been made.

Using the MQS synchronizer, the procedure for the pre-dub is as follows:

1. Roll picture and tape machines with "0" offset while transferring from machine #2 to machine #3 until picture edit deletion is reached.
2. Stop. Determine and set cue point (offset) on machine #2.
3. Roll picture back to a point just before the edit and stop. This will allow enough time once the picture is started for all the machines to get up to speed and achieve relative sync before reaching the desired edit point. While rolling the picture back, the other machines will automatically follow and "park" at the same cue point, with machine #2 parking at the desired offset.
4. Start picture. All the machines will follow in sync.
5. To continue transfer, punch in record on machine #3 exactly when passing edit point.

If one is fortunate enough to be equipped with an automated console capable of



PROPOSED USE OF MQS-100 IN SOUND POST PRODUCTION

programmable mixing, then most of the tedious process of pre-dubbing can be eliminated altogether except in the case where picture edits occur to delete sections of a continuous song. The various changes in level and pan can be performed one at a time, track-by-track (while viewing the edited picture) and memorized in the console computer.

Once a satisfactory mix has been achieved, the *entire* song can be mixed (dubbed) directly to the mag film master recorder. However, if picture edits have occurred during the song, the mix must be done in sections, in a manner similar to the previously described pre-dub procedure employing the MQS offset feature, except that the transfer machine #3 is now the master mag machine on the film chain. Not only does the MQS synchronizing system save many time-consuming steps in such instances, it also saves tape wear and generation loss, as well as allowing the flexibility to mix directly to picture.

Looking To The Future

Combining efforts of professionals from the film and music industries proved to be an enlightening experience for both groups. This kind of undertaking is a growing trend, of course, as a result of several recent blockbuster films centering around music themes — most notably disco music and science fiction.

The technique for mixing audio to correspond more closely to picture developed in the production of *"The Last Waltz"* is in itself unique and now that it is becoming refined, similar mixing effects can be employed in soundtracks of future films. By taking the mixing process as "far" as we did, Canyon Recorders discovered that closer coordination of sound and picture can greatly enhance the emotional impact of a film. This is, of course, our subjective evaluation. But almost every reviewer, whether he liked *"The Last Waltz"* or not, complimented the effect created by the soundtrack.

The growing interest in film sound will, in turn, necessitate better quality sound systems in theaters. Hopefully, the overall impact of *"The Last Waltz"* and other concert or music oriented movies will spur the industry to make greater improvements for the sound-conscious movie-going public.

■■■

DISC MASTERING

Views From Around the World

SEVEN LEADING MASTERING ENGINEERS DISCUSS THEIR CRAFT

from interviews by Howard Cummings*

With the rising interest in record quality, the industry has become increasingly concerned with the way recordings are treated after master tapes leave the studio. As a result, the role of the disc cutter, which until 10 years ago attracted little attention, has become the focus of great interest. Howard Cummings talked with seven cutters about their craft, which is a key link in the chain that delivers the studio intent of the artist, producer and engineer to the consumer.

The two basic formats of the disc — the seven-inch 45 and 12-inch 33-1/3 LP — each present unique demands on the work of the disc masterer. Aside from obvious differences in diameter that affect the mechanical cutting process, the two types of records are intended for separate markets.

"The 45 is the worst part of the disc-cutting business," said Bernie Grundman, a disc masterer with A&M Records in Hollywood, California. "Forty-fives are the primary way of getting the artist before the public and, for that reason, we have pushed the playback systems to their limits. As the systems were improved, we've just pushed them further and we're *riding just a touch under intolerable distortion.* A lot of producers want this loudness so it will attract attention."

To illustrate his point, Grundman described his typical 45 mastering set-up when referenced to a 5.5 centimeter per second cut at +4 dB. LP's are cut at +2 to +4 dB above the meter reference zero while a +4 to +6 reading is common for 45's. As a result, a +4 dB is a "hot" setting for an LP, while for a 45 this is considered "cool". Though Grundman has gone as high as +7 or +8 dB for a "super hot" 45, he explained, "I would prefer to cut at reasonable levels. I hate to see levels pushed over +6 dB because of inside diameter effects."

A high frequency loss from program material put on 45's and inner grooves of LP's is referred to as the so-called inside diameter effect. Studies indicate the phenomenon is first noticeable at 2,000 Hz and grows more severe at high frequency. The reason for the loss is well documented. The rate a turntable rotates is, of course, a constant. On the other hand, the linear length of grooves decreases when moving toward the center.

Using an LP disc as an example, a stylus will move at a faster groove speed (linear distance a stylus travels in a given unit of time) on an outer groove as compared to an inner groove. If identical program material is being transferred to disc, the outer grooves offer a greater linear length for storing audio information. A playback stylus tip, measuring seven-tenths mils (.0007) in diameter typically, is too large to detect high frequency modulation curves crammed into small diameter 45's and inner grooves of LP's. This situation is called scanning loss. Such scanning loss is accompanied by increased distortion.

Inside diameter effect is one of several reasons cutting engineers may use a +2 to +5 dB higher drive setting for 45's. Though it won't increase the dynamic range, the additional power will create noise at middle and low frequencies (distortion) resulting in the additional "loudness" many producers desire. Other factors for cutting 45's at higher power levels include an awareness that such discs are destined for juke box and AM radio play as well as the fact that the records are often used on cheap, poor quality playback equipment by consumers.

"The 45 is a bastard," concluded another cutting engineer.

Rapport With Producers

While the different marketing and technical requirements of 45's and LP's are usually obvious to the disc masterer, other factors relating to program material are not

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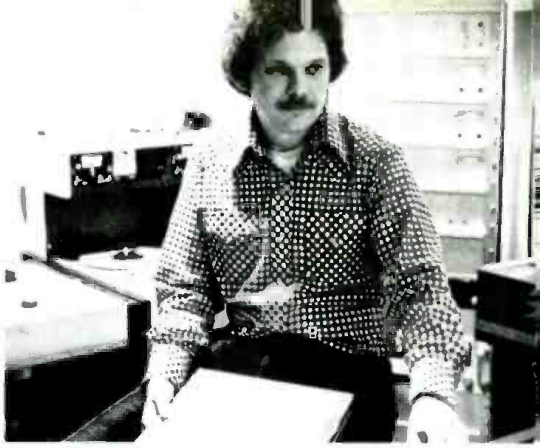

Bob Ludwig,
Masterdisk, New York City.

always as clear cut. As a result, cutting engineers say close communications with producers is critical to achieve the desired sound. In some instances, a disc masterer will take the initiative to suggest or make changes in the mastering process based on his understanding of the product a producer wants.

"Often, it all depends on who it is," said John Golden, a cutting engineer at Kendun Recorders in Burbank, California.

"There have been times when I've made a comment that will be a fairly inventive idea the producer will consider for the artist," he said. "I do get involved in certain edits, which is one of the few things you can get involved with in the cutting room, unlike a mixer who has more control."

Several other disc masterers said they will often limit or compress, particularly when cutting works of popular artists.

"There's a certain amount of freedom we have to generate an esthetically good product," explained Mac Evans of Masterphonics, in Nashville, Tennessee. "It's not a matter of where a client walks in and says, 'I want +2 dB at 10 k, 3 dB of limiting, 6 dB of compression and cut-off filters.' It's more like — 'let's see what we can do with this.' It's working closely with the client and understanding what the client desires. If you have a client that desires an 'AM sound', we'll go for it."

Bob Ludwig of Masterdisk in New York City added, "When you're cutting classical, you use a classical technique of doing the least to the product. When working with disco or rock, there's more compression and limiting." Ludwig, who has formal music training, is a well-known masterer of classical music.

Different Mastering Philosophies

Though cutting engineers in North America generally consider it their responsibility to "improve" program material — based on what a producer is trying to achieve — disc masterers elsewhere in the world have traditionally taken the opposite view. Outside of North America, the dominent philosophy for years has been that a disc cutter transcribe taped program material as literally as possible. If poorly engineered master tapes are received, it is not uncommon for the disc

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The Buchmann-Meyer Light Pattern Technique

Because common electronic signal measuring devices could not be used to check the frequency response characteristics of a cutting head, at one time no reliable method existed for evaluating the transfer of electronic audio information to a lacquer or wax disc by the cutting head. It was known that reflected light from record grooves seemed to be related to the audio information on the disc, but it was not until 1930 that the phenomenon was clearly explained. In that year the German scientists — Gerhard Buchmann and Erwin Meyer — published a paper that, among other things, described a method for using light pattern plots to check the frequency response of cutting heads.

Now known as the Buchmann-Meyer technique, the test was based on the principle that a properly calibrated electromagnetic cutting head will register a constant stylus-tip velocity at all frequencies when activated by an alternating current of constant voltage. To understand how the plot of light can represent frequency response, it must be remembered that an electronic signal is transferred to vibration of the stylus tip. The movement of the stylus tip is etched into the lacquer in the form of grooves — the level of which is measured in stylus velocity.

Cutting a series of test tones on a disc is the basis of applying the technique. The test disc is held in direct sunlight, or other columnated light source, and, when the plane of the disc is positioned at a 45° angle to such rays, a series of bands denoting each test tone can be viewed by the unaided human eye (see cover and accompanying photos). The 45° angle is used to obtain a proper reflection. Light reflecting from the grooves forms the plot.

Banding on the test disc can also be checked right on the lathe, if a cutting studio is equipped with a special light mounted above the lathe. As with sunlight, the artificial light source is mounted at an angle of 45° from the plane of the test disc on the lathe turntable.

Bands from the test tones are compared to each other. Typically, 1 kHz is the reference tone and other tones are higher frequencies. The 1 kHz setting is popular because it is the crossover point on the RIAA disc playback curve. Also, the Buchmann-Meyer technique is ineffective because of problems with constant amplitude at frequencies lower than 1 kHz.

The expectation when comparing bands is that all will be the same width. If one or more bands are not the same width, the frequency response of the cutting head is uneven.

In most cases, the bands are compared by simple visual comparison (using one eye). The visual comparison is believed to be within ±0.5 dB accuracy.

If significant variation is noted between bandwidths, a caliper of some kind is used for measuring variations from the reference tone. The measurements can be used to discover the frequency response variation with a great deal of accuracy. The formula calculating variations is as follows:

$$dB = 20 \log A_1 / A_2$$

where

A_1 is the reference frequency (tone)

A_2 is any frequency of interest

As an example, the 1 kHz tone measures just over 40 mm at the standard reference level (a stylus velocity of 7 cm/sec peak for mono and 5 cm/peak for 45° stereo using the NAB standard). If the bandwidth of interest is 46 mm, compared to a 40 mm reference, using the formula indicates that the frequency of interest is at +1 dB variation.

It must be noted that bandwidths do not get smaller as groove diameter gets smaller. The reason is that as wavelengths become shorter when moving toward the center of a record, the modulation slope for a given frequency increases in the same proportion. Hence, both factors are self-cancelling.

The Buchmann-Meyer technique was widely used until dynamic feedback cutting heads were introduced. The new design cutting heads linearized frequency response and reduced distortion. As a result, cutting heads now remain calibrated with great accuracy, even after replacing styli, and so frequency response testing is not as critical. However, the principles that Buchmann and Meyer identified are applied to other disc-related tests.

Left: Buchmann-Meyer light pattern on JVC Test Record (TRS-1000), no RIAA equalization, 5.0 cm/sec., all same level. Right: The RIAA playback curve below 1 kHz is depicted on this test record. The equalization required by the RIAA curve is applied gradually, hence, the light plot takes a "Christmas Tree" form.

The Cover: Buchmann-Meyer light pattern showing frequency response of test cuts at half speed. Cuts are deliberately varied to demonstrate variations in level at different frequencies (100 to 30 kHz). As example, top 2 bands (innermost diameter) are same frequency (1 kHz) but differ by 6 dB. It can be seen that the louder is twice the width of the other.

Photos taken at the JVC Cutting Center, Hollywood. Special acknowledgements to Stan Ricker of the JVC Center, and Hugh Allen of Gotham Audio, Hollywood.

Chris Blair at EMI's Abbey Road Studios.

cutter to return them to the client with a request that they be re-recorded. This is extremely uncommon in North America and done only if there is severe, uncorrectable problems with master tapes.

A view typical of what is held by cutting engineers outside of North America was voiced by Werner Grimme, who masters for Polydor Records in Germany. "Our task," he said, "is to achieve a disc identical to a good tape."

Equalization and limiting may be introduced, but only if asked for or approved by a producer, Grimme said. Reverberation, on the other hand, is never added.

Two other disc engineers from outside North America expressed similar opinions. Toshio Kikuta of King Records in Tokyo, Japan, and Chris Blair of EMI-Abbey Road in London, England, said that limiting and compression are rarely introduced at the cutting stage. Such signal modifying effects are employed only in special cases or if specifically requested by a producer.

Flash Peaks And Disco

Because of improvements in modern playback equipment, Grundman feels that more flash peaks go through without limiting. The result, said the A&M cutting engineer, is that newer records have more "air" and are more "open" at the top end.

One trend noted by Golden is that more transient material is being recorded in studios as a result of close miking. Also, the "punch" of the disco sound is being worked into more types of pop music. These factors combined mean that wider grooves are needed to transfer program material to disc. There is less land area — the surface area between grooves — as a result.

In some instances, grooves may even be cut into one another, which is called overcutting. This is possible because a playback stylus rests in the lower one-third of a groove. Spacing grooves so they cut into one another is risky because skips will occur if the pressings are of poor or mediocre quality. Also, loud program material — especially if it involves flash peaks — modulates the playback stylus and could create enough momentum to cause skips.

"With more of that, you have to find *something* to control it," said Golden, speaking of the punch in popular music. "Sometimes I may use a small amount of compression just to hold the kick drum

A. Makino (left) and Toshio Kikuta (right), manager recording & studio, King Records, Tokyo.

down, but if it's not necessary, I don't use it. About 75 per cent of the product I get needs something and I use the PDM made by EMT for compression."

The complexities of mastering certain kinds of music aside, Grundman feels that the services of a good cutting engineer is essential for a producer seeking a specific sound.

"That's what a good mastering engineer is good for," he explained. "He gets to see a lot of product. He sees what everyone else is doing around town and from that standpoint, he's one of the most objective people the producer can come to. He's gone through four or five different projects in the last few days, so he's flexible; he's not locked into any one sound or way of doing things . . . Most producers are right here with us when we cut."

Test Records Of Program Material

One important part of the disc mast-

erer/producer communication process is preparing a reference cut prior to final mastering, according to Grundman.

"I have done it the other way but I let the client know the risk he's taking because disc, being a completely different medium from tape, gives you no guarantee you'll get what you want," he said. "There are so many things that can go wrong, you don't know until you play it. The client should then take the reference cut home and play it on a system he is familiar with so as to judge it more accurately."

"If a producer is after a certain sound, he may be willing to pay a little extra to get it," explained Grundman. "He may be back three or four times to get it right before it comes out."

The importance of a reference disc is a point of disagreement, though. Only about 30 per cent of clients at EMI-Abbey Road ask for a reference disc, said Blair, though producer and artist are often present during mastering. Grimme and Kikuta said that the demand for reference discs is small and clients are seldom present for mastering.

When a customer asks for unusual equalization changes, Golden will prepare two reference cuts. One will conform with the client's request and the other will be what Golden recommends. The client can then compare and choose.

"We usually insist that they get a reference disc before they get masters," added Golden. "As far as mail-in work, they want it to sound like the current number one hit, even though it may have a high school marching band background. In the event they don't want a ref, *I'll* cut one and listen to it."

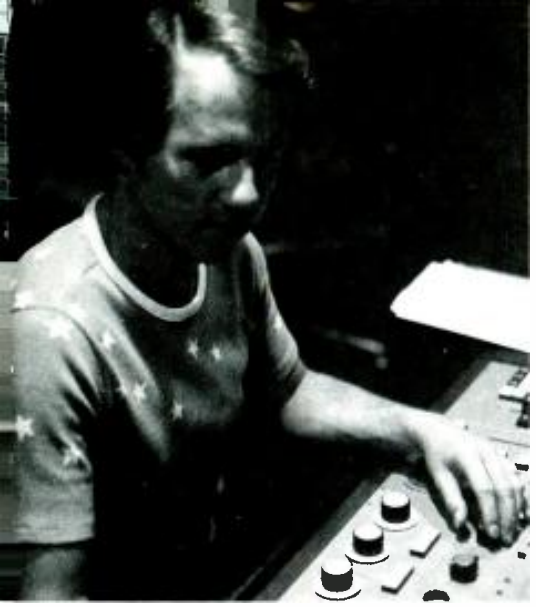
Lacquer Quality Criticized

When the mastering process begins the question of which recording blank (or lacquer disc) to use faces the cutting engineer. Masterdisk stocks blanks from all three major manufacturers — Transco, Pyral and Audio — because, as Ludwig explained, "at some time you're going to get a bad batch from someone — there's a lack of consistency."

"It seems almost impossible to pick out the best one from each of the said three," agreed Kikuta. "The quality of each brand varies on imports by lots from time-to-time."

"When they're at their best, the Audio blanks are the best blank in the world, as far as being quiet and free of defects," said Ludwig. "I would say Pyral has the highest level of consistency. I do a lot of classical cutting and I have some pressing plants that just *demand* that I send them Pyral blanks."

Golden feels that Pyral discs, which are made in France, are the best because the product has the least orange peel — areas which have high background noise — and blisters. "But they're about $16.00 for a 14-inch lacquer, which we have to pass on to the consumer," he added. "And as long as the consumer pulls records out of the sleeve with his fingers and stacks them on record players, it's almost a waste. Basically, though, the quality of all blanks is not where



John Golden at Kendun Recorders, Burbank. Photo by Howard Cummings.

we'd like it to be."

Golden was one of 15 Los Angeles-area disc engineers who toured the Audiodisc plant in Winchester, Virginia recently. The inspection was informative.

"They have to approve so many discs per day just to meet orders that it creates problems," Golden said. "While I was there, they rejected about 80 per cent. Then, when I got the good discs [at Kendun Recorders], I'd reject 20 out of 25 before I'd cut on them."

"It becomes even more crucial when I find out what we pay for them," he continued. "I have to ask myself why aren't they prefect? The time involved inspecting these blanks is incredible! When you have two rooms cutting with double-lathe systems and you have to take 10 minutes inspecting each blank, it really adds up. Then you have to package the defects and take care of the paperwork to get credit on the defects . . . I think Audio and Transco are neck-and-neck at the moment; they're equally bad."

Vibrations resulting from uneven lacquer coatings that a Westrex advance-ball head transfers to discs are an occasional problem Grundman experiences at A&M Records. It should be noted that much of the equipment Grundman operates is many generations older than equipment in general usage today. A&M Records' mastering operation was designed and partially equipped by Holzer Audio Engineering Corporation (better known as HAECO), which is now defunct. HAECO had been closely associated with A&M Records. The disc mastering community in Hollywood recognizes that Grundman is one of few cutting engineers who could use the dated HAECO equipment successfully in today's competitive market.

Because of problems associated with his cutting head, Grundman prefers Transco blanks because, he said, the lacquer is smoothest. He added that he does use all three brands from time-to-time.

"Psychologically, the Transcos always looked better under the microscope — they looked shinier and cleaner in color — whereas Audio was always 'black,'" Grundman said. "The Pyrals are dark but they're *real* shiny. They're more consistantly perfect. We have a much lower rejection rate with them. But overall, I think I'm getting better results with Transcos."

Cutting Heads and Amps

The preoccupation by many persons with the power of amps driving cutting heads is the source of many "misconceptions", according to Grundman. Noting that power amps of 600 watts per channel are available, he said that too much emphasis is placed on raw power. A more relevant concern is the efficiency of cutting heads because excessive power is not needed by efficient heads. Inefficient heads, he noted, simply waste excessive power.

"It is so rare that we exceed the power of our amplifier that I don't know why we'd need more power," Grundman said. "We use 150 watts per channel. Most of our amps are Crown 300's that HAECO and A&M designed to work with the cutting head."

King Records is equipped with a Neumann cutting head and four Neumann amps, with one amp modified by the firm's staff. The custom unit is of tube design with 250 watt output. Kikuta explained it "has been further modified over the past two

A&M's Bernie Grundman. Photo by Howard Cummings.

years to achieve a so-called 'natural sound' we have strived for. We are completely satisfied with this sound."

Golden, like Kikuta, works with a SX 74 Neumann cutting head. The system is powered by a 600 watt per channel Neumann amp.

Grimme has both a Neumann SX 74 head and Ortofon DSS 731 at Polydor Records. The Neumann head is powered by a Neumann amp that delivers 600 watts per channel while a 500 watt per channel Ortofon amp powers the Ortofon.

Five of six cutting rooms at EMI-Abbey Road are equipped with Neumann cutting heads and amps. Blair said that the sixth has an Ortofon DSS 732 cutter with amp.

"Ortofon is the only other head comparable to Neumann," commented Ludwig, "in response and phase characteristics."

Neumann Lathes Widely Used

Though cutting engineers usually have no option except to use whatever lathe equipment their companies operate, they are not reluctant to introduce modifications. Lathes of Neumann manufacture are most widely used by the cutting engineers interviewed. It is estimated that up to 80 per cent of lathes operating worldwide are of Neumann manufacture. Grimme, Blair and Golden use Neumann exclusively. Both Neumann and Scully lathes are used by Kikuta, Ludwig and Evans.

"We have four Neumanns and one Scully lathe, except for video disc cutting lathes," said Kikuta. "We have made improvements in one Neumann especially for half-speed cutting and, as a result, we have gained such merits as the reduction of mechanical noise and wow and flutter in low-speed cutting."

Ludwig and Evans use Capps accessories in conjunction with their lathes. The Capps unit is an add-on electronic accessory for Scully lathes that controls pitch and depth of cuts.

Golden has also modified his lathe, which is of Neumann manufacture.

"Instead of having four knobs on the high-frequency limiters, we now have two for sibilance problem areas," he explained. "We've also modified the programmers so it will cut a ten-inch 33 rather than a 12-inch disc, or a seven-inch 33 or a 12-inch 45 with a flip of a switch."

The programmers are plug-in modules that contain circuits for cutting discs in various formats. The program material directs the lathe to execute the proper sequence of events for the desired speed —

usually 1:1 or half-speed — and the appropriate disc size.

At A&M Records, Grundman has Scully lathes. "We have to fight with our systems a little," he said, referring to the older lathe hardware. Though he would like the opportunity to work with Neumanns, he said he would not necessarily wish to replace his existing equipment. He noted that other cutting engineers with Neumanns have imitated the sound A&M Records achieves with the Scullys. Two factors are largely responsible for creating the sound, he feels.

"Part of it is the people that run the equipment, but part of it is the coloration of each system," he said. "None of them is perfect. The cutting head is a miniature speaker and you're asking a mechanical device to reproduce the whole frequency spectrum."

The Scully lathes have been retrofitted with Lyrec motors found in Neumann units, enabling direct drive of the turntable.

"I see a lot of Neumann cuts and the lathe is doing its job, but the system hasn't really been 'pushed,'" he observed. "Nowadays, if you want a competitive disc, you have to know how much you can cut into another groove and be safe. If you have one groove cutting into another groove, but both of those grooves are five mils [wide], the actual distance from the walls that are cutting into each other from the center line could still be three mils [wide] and the stylus is only three-quarters mil. The stylus would go right past it without any hassle. But if you do a lot of over-cutting, it's harder to plate. You're cutting deeper than you have to and you run into problems of 'unfill' when you press."

The reference to a plate relates to electroforming a pressing master from the lacquer disc a cutting engineer prepares. When a polyvinylchloride record does not match the mold of the electro-formed master in places, it is said to be deficient because of unfill, which is also referred to as non-fill.

Evaluating Master Discs

Once a lacquer has been cut, some masterers feel that it is important to check it against a tape in a side-by-side comparison, referred to as an A-B test. In these instances, two discs are cut simultaneously — a test lacquer for listening and a master, which would remain unplayed.

"We're primarily concerned with the comparison on the *inner diameter* to see *how much* we're losing," said Grundman. "Usually, I have to add in the top end, the 10, 12, 15 k area, to open it up on the inner diameter even though the pressing won't have as much top as the lacquer."

Blair, Grimme and Kikuta also A-B tape against disc. Such a comparison, however, is rarely done by Golden.

"I think the disc should be looked on as a separate entity unto itself and people should not necessarily try to compare it to the two track," explained Golden. "It's a different format completely."

When cutting a disc, Blair, Grimme and Kikuta said they usually make a flat transfer (or 1:1 transfer) of program material to disc. Introducing no modifications to program material during the cutting process is, of course, the dominant practice of cutting engineers outside of North America.

On the other hand, Golden at Kendun Recorders — operating under a different philosophy — may find it necessary to make so many modifications to program material that he'll prepare a second generation working master tape. All equalization, limiting, compression and other signal modifications will be introduced by the cutting engineer when preparing the working master. The mastering engineer can then make a flat transfer of the working master (with all equalization) to the lacquer.

"I'll make 1:1 transfers when there are so many moves to make within a short time that I don't want to become a basket-case over the course of 18 sides," explained Golden. "The consistency will also be better with 1:1."

Using such 1:1 transfers with a working master saves lacquers, in many instances. Without a working master, many lacquers could be ruined when a complicated equalization routine is not performed correctly by the mastering engineer on each lacquer.

The working master tape also has another purpose in the industry. It can be used by other cutting engineers to produce master discs when a large first pressing of a record is required. The masterer who

makes the first disc and duplicate tape will usually be credited for all master discs. In most instances, though, only pressings from his master disc will be sent to reviewers and broadcast outlets because the quality of masters from other cutting engineers will always vary.

Tape Transports

Most cutters interviewed use tape transports of Studer manufacture. "European machines, as a whole, had motion-sensing in the '50's that Ampex is just now putting on their machines," said Ludwig. Ludwig, Evans, Blair and Golden use the Swiss-made tape transports.

"The down-time is maybe eight or 10 hours per year, if that," said Golden of his Studers. "They just run forever. That's a serious item [down time] with a preview machine. You can't pull in another two track; it's just not the same. The tape path [of Studers] is superior and it tends to really handle the tape very nicely. I can say I've never lost a master on a machine."

Studer A-80 advance-ball head machines are used at all six of EMI-Abbey Road's cutting facilities. Blair said that the ease of maintenance and simple alignment procedure are two advantages to using the Swiss-made equipment.

"The Studer preview machine," added Ludwig, "has far and away the best transport and has an extremely low wow and flutter."

Besides Studers, Grimme also has Telefunken equipment, which he feels is also excellent. Kikuta uses four Telefunken machines and a Scully unit. "I think Telefunken is the best," Kikuta said, "in mechanical stability and tape passing."

Grundman operates a Scully tape transport at A&M which he said is durable and easy to use. "I would speculate that the Studers are better than a Scully," he added. "They look great."

Customizing Consoles

Several cutters said that modifying console equipment gives them better results. One example is the console Golden uses at Kendun Recorders, which was designed internally by Carl Yanchar and built by Sphere.

"I think the board is the best you can get; there's things you can do with it that I haven't even figured out yet," Golden explained. "The board EQ is very good. It will cover virtually every combination with the parametrics."

At Masterfonics, Evans said that the circuitry of his Neumann SP272 console has been re-worked extensively. "We feel this has given us a one or two per cent edge over some other similar consoles," he said. "It's not a drastic thing, but in this industry, we're not dealing with drastics, we're dealing with one and two per cents."

The SP272 is not as flexible as newer models, Evans noted, because it does not have a double board system (two sets of controls facilitating instant change-over to pre-set settings).

Ludwig's Neumann console has Neumann selectable band equalizers "which are quite flexible," the Masterdisk cutting engineer noted. "We also use parametric Sontec's, which are very good, having a Class A amp type pre-amp."

"Neumann has come a long way in flexibility," he added. "They originally felt the tape comes fully prepared and you transfer 1:1. I mean, what else would you want to do?" he concluded.

Ludwig's tongue-in-cheek statement referred to the traditional European philosophy that cutting engineers transfer program material to disc as literally as possible. Neumann equipment is now engineered with signal modifying capabilities as this attitude is changing.

Blair gave a comprehensive description of his console, outlining its features. The EMI TG 12410 has level changes, balance controls, switchable NAB/IEC, replay Dolbys, comprehensive tone control for program and advance-head channels. Other features are SQ quadraphonic decoder, limiters, compressors, high and low pass filters, test oscillator, vertical amplitude limiters, a high level output unit, remote controls for tape machine and lathe, integral calibrated disc playback system (can be re-injected through console), overall program faders, comprehensive monitor, VU switching and tape copying capability.

The equipment Grundman uses at A&M Records is, again, older than hardware his counterparts operate.

"We have to scramble like mad in a 'spread' [band spacing between program selections] sometimes and run around pushing Dolby's and equalizers in and out," he said. "I've had as many as 19 different moves in a spread and a double system would have helped. But we have never let it get in our way . . . whether it takes us two or three lacquers to do it. But otherwise, it's a very simple system."

Program material that needs radically different equalization, limiting, compression and other modification from selection to selection is not uncommon. In such instances, the dynamic characteristics of each selection varies for one or more reasons. Recordings were made at different studios; generation loss affected selections with overdubbing; different engineers were used on each selection; recording equipment varied; different types of tapes were used. Another common occurance is for the mixing engineer to become fatigued when preparing master tapes. Treble equalizers are gradually turned up as the mixer loses hearing sensitivity during all-night work sessions.

Monitor Amp Output

The performance of monitor amps is something that varies noticeably from manufacturer to manufacturer. Grundman, who uses McIntosh 250's, had tried another "that was checked out to be the most phenomenal thing on earth, but it was impossible to listen to!" he said. "It sounded

very dry and brittle — hard as nails. I've always thought that some sort of measurement should be devised that would tell you about an amp when it's tied to a speaker. Our shop feels that the amp under test may change its characteristics when checking it on a bench connected to a dummy load."

The GRF Tannoy monitor speakers that Grundman uses were not adjusted and have no equalizers. No tone controls are on the back of the speakers either. Because he is so familiar with the monitor system, he easily works around its shortcomings. Clients who are familiar with many other studios tell him the monitors are excellent, Grundman added.

"I listen at an average listening level that works for me," he said. "I EQ at that level and if someone asks me to turn it up, I don't know where I am. I feel my speakers are very representative of what *most* speakers sound like in the home. Now I've got so many of my clients tuned in to them, they run over here with mixes to check them out. These monitors are not excessive in any area and they're one of the smoothest speakers on the top end."

The Hartley speakers that Ludwig uses at Masterdisk have a very high damping factor and he is satisfied with the Marantz 500 unit and 500 watts per channel that drives them. A pair of stacked Quads and Pioneer ribbon tweeters, which are tri-amped by Mark Levinson crossovers, are other major components of Ludwig's system, that also includes some JBL 100's. He listens to the speakers at 95 dB SPL.

"The ribbon tweeters in the system are crossed over at 7 k and put a silky top on everything," he said. "I love the system; I can listen to it all day and never get tired of it. Once your ear gets used to the transient response and low distortion you hear in electro-static speakers, you don't like anything else."

Ludwig noted that there are several philosophies for room acoustics. One, advanced by Tom Hidley, suggests a room be symetrically balanced so it can handle any set of speakers.

"It's a valid philosophy but I can't go along with it because of the type of speakers I like to listen to," he said. "My electro-statics like to radiate from the front and back plus they're set into the room so I go with that living room environment. I've done a little tuning to compensate."

Altec 604-8G monitors are the most popular speakers at King Records, according to Kikuta. When playing 45's, Auratone 5C's are used as sub-monitors. Kikuta added that no modifications have been made to the speakers nor is an equalization system used in the monitoring room.

The room curve at Masterfonics is the result of extensive research. Many listening tests were conducted using outstanding phonographic records cut by leading mastering engineers in determining its design.

"It has a gentle roll off; it's down 2 at 10 k, 3

at 12 k and 4 at 16 k," explained Evans. "On the low end, it's flat to 20 Hz in both rooms. High-end flatness becomes harsh and hard to work with. Low-end flatness does not bother me in the least and *I would like to hear rumble if it exists.* I want to know if there is something there."

Evans continued, "John W. Gardener, Inc., tunes our room with a B&K third-octave filter set attached to a standard B&K SPL meter with pink noise. We have a bass-trap in the rear of each room, but with only draping on the side walls, followed by cork, followed by stone, followed by heavy-wall construction around the monitor cabinets."

Originally, Evans used 4320's "because it was the 'standard speaker of Nashville' at the time," he explained. "I quickly found I needed something better to eliminate the 'lieing' and to have a better environment. I think a monitor system can 'lie' to you."

Westlake TM-1 "splinter lips", bi-amped speakers using a crossover between the horn and tweeter, are used by Evans now. The system has all JBL components with White filters for tuning and White crossovers. Auratones are often used as a reference for small speakers.

Need For Longer Alignment Tones

Working with tapes from various clients presents many problems, but the mastering engineers seem to agree on one point. Alignment tones, which are often lacking, should be of durations of 30-seconds or more.

"What bothers me most is when some guy sends a tape in and aligns his two track *while* he records his tones," said Golden. "As soon as he's done aligning, you're *lucky* to get 10-seconds of steady tone, if that. When that happens, you might as well not have tones at all, so I just put up my alignment tape and go with that, unless its Dolby or dbx."

Working at A&M, Grundman said he is used to dealing with what might be described as "the major Hollywood product." The main alignment tone he wants is in the center frequency, 10 k or 12 k, and 50 or 100 Hz.

"Dolby is all right, but they don't have to," he said. "If the Dolby is set up right, it should be close enough to the 700 or 1 k. I use an oscilloscope for azimuth; the left channel goes on one axis and the right on the other to see when it's right on. I use the 12 kHz for high end EQ and azimuth.

"I would prefer 1 k really," he continued. "We think, in discs, of 1 k a lot because it's the crossover for RIAA. Fifty Hz is nice to have because of the slope of the machine. If the music is a bit bass heavy, I just use the 50 Hz and turn it down — sometimes I do that. In the end, it's what comes off the monitors."

There was nearly unanimous disagreement with Grundman's statement that Dolby alignment tones are not needed, however. As Blair said, "I feel Dolby is important. In addition, I like 16 k, azimuth band, 100 Hz, 1 k and 10 k."

"For the low end, I have been using 70 Hz because it's between 50 and 100," said Golden. "For duration, no less than 30-seconds. If it's shorter, I find myself rewinding a million times."

Ludwig and Evans feel that 40, 100, 700 or 1 k, 10 k and 15 k alignment tones are a good practice. He emphasized that alignment tones at both extremes are most useful.

When disc masterers say they prefer three basic tones, their comments are often misconstrued by others in the recording industry. The reason for this centers around tape transports. Cutting engineers have only three gain adjustments on tape transport units — high, midrange and low. Hence, tones in these areas are useful while others are extraneous to adjusting the tape transport.

However, at the console, cutting engineers have a full complement of controls to process material. Though opinions vary, many disc masterers like a wider selection of test tones at the console because they feel circuitry in tape playback machines is not perfectly accurate. Permutations at localized frequencies can be detected with additional alignment tones; allowing the cutting engineer to correct program material.

Incompatible Noise Reduction Equipment

"dbx, contrary to their advertising, needs most alignment," said Ludwig. "It's not level sensitive but everything else is so frequency response sentitive that you need as many tones as you can get."

"I don't care what it is, recorded where or under what circumstances," added Evans. "It is an obvious standard engineering practice. Anyone that ignores tones because dbx says, 'No reference level tone necessary', is not an engineer."

Golden added that he often gets tapes recorded on semi-professional dbx equipment and it is not compatible with his professional dbx hardware. The semi-pro dbx units, the 120 Series, filter tape hiss but do not process the bass signal. Noise is treated over the full spectrum by professional dbx units, the 150 and 150/180 Series.

"I had one situation where a guy came in and I had to transfer off his tape recorder onto mine," recalled Golden of problems with tapes recorded on semi-pro dbx equipment.

IM distortion on master tapes has been an increasing problem that Ludwig and Evans noted.

"Many engineers will pile level onto a tape without realizing that a threshold effect takes place whereby there's a build-up of distortion when you try to transfer it to disc, especially on inner diameters," said Ludwig.

"I cut a record for Dick Burwen through one of his crystal-clear sound systems with 110 dB of dynamic range or whatever," he continued. "The tape was *super clean — really clean.* We put levels on inner diameters that *I know* would be pure hash on most normal recordings, that were playing back cleanly at that kind of inner

diameter. All I attribute it to was a clean tape."

Transferring the build-up of distortion is difficult and the result on a master disc is not always predictable, added Evans. "It's subject to the way the power or cutter reacts to it and the tracking of the sylus I use for playback," he explained.

The idea of transferring distortion may seem ludicrous to some. After all, who would willingly want to transfer distortion? However, when master tapes have distortion that cannot be processed out without damaging program material, the cutting engineer has no choice — short of having master tapes re-recorded. The distortion is transferred as "cleanly" as possible in an effort to prevent multiplying the problem in making another generation — the master disc.

Bright Studio Monitors

Problems with alignment tones, noise reduction systems and distortion aside, monitoring systems in studios are the source of other difficulties.

"I have tapes that come in which sound so dull because the studio monitors are so bright," said Ludwig, summing up the opinion expressed by others. "It sounds like they recorded it through the tape backing."

He continued, "Let's take a situation where you have a room that's flat at the console — which is a very unnatural act because it doesn't happen in nature. If you put a speaker in a corner 20 feet away, some studios will equalize it so it's flat up to 20 k. If you put a flute player through it, the high end of it should be rolled off naturally. I believe in having speakers flat out to the source and then letting things happen as they will, or build into your monitoring system a pre-determined roll off of 6 dB/octave — something reasonable like that. I also feel that any good engineer can work with any monitoring system if he knows it."

Another problem with program materical disc masterers receive was outlined by Grundman. Many 30 ips tapes have low end problems because engineers use recorders designed for 15 ips speeds. It is not always possible to bring up the low end when making the lacquer, especially if the recorder was set up poorly when the master tapes were made, said Grundman.

Engineering problems aside, the cutters also run into difficulties with written instructions from the sender of master tapes. This is most frustrating because it is simply the result of carelessness and is time-consuming to correct.

"Poor labeling happens about 50 per cent of the time," observed Golden. "Most of the time, people don't write the timings in correctly. They'll write the times down when they do the mix, then go back and edit and not adjust the legend."

He noted, "An interesting conclusion I've come to is that when a box comes in scribbled or messy with a haphazard legend, it has program material with sloppy splices, mis-timings, and so forth." ■ ■ ■

New Products

OTARI INTRODUCES FULL-FUNCTION ONE—INCH EIGHT-TRACK

A new one-inch eight-track recorder, said by the manufacturer to be the first full function eight-track machine, was shown by Otari for the first time at the Audio Engineering Show in Los Angeles. Designated the MX-7800, it is said to sell at a price considerably lower than competing units and to incorporate several operating and convenience features that should prove to be of real value to the multi-channel recording studio.

For example, all functions and operating modes can now be controlled remotely on an optional remote control unit, including selective reproduce and varispeed. This means that overdubbing on any one or a combination of the eight channels can be controlled from inside the studio by the musicians, for instance, instead of from the control room. As for varispeed, both coarse and fine controls are incorporated in the remote control, to permit changing pitch or precisely matching selection length.

As a complement to the remote control, Otari is also offering a remote tape timer with an easy-to-read LED readout and a return-to-zero feature, the latter extremely useful in mix down.

Other features include freedom from clicks or pops when punching into record, automatic monitor switching to properly match input or tape to record, reproduce, or sync mode, constant tension system for better tape handling and timing, dynamic braking for smooth stops, a direct drive DC capstan servo with 30 and 15 ips speeds, built-in 700 and 15,000 Hz test oscillator, plus easy accessilbility to electronics and transport assemblies.

Price of the MX-7800 is $8,695.00, including floor console.

OTARI CORPORATION
981 INDUSTRIAL ROAD
SAN CARLOS, CA 94070
(415) 593-1648

for additional information circle no. 45

CROWN REAL-TIME ANALYZER MEETS NEED FOR A LOW-COST, RUGGED, AUDIO BAND ANALYZER

The Crown RTA-2, real-time audio analyzer, is a new tool designed for fast, accurate, on site equalization and analysis of sound systems. The 32 filters included in the RTA-2 provide a dynamic range for the unit of 60 dB and a bandwidth of 16 Hz to 20 kHz. The range and flexibility assure quick on site system equalization checks as well as speeding up the basic equalizing process.

The RTA-2 includes a built-in 5-inch scope with a lighted graticule for photography or for viewing in dim light. The built-in pseudorandom pink noise generator contributes to accurate equalization.

The RTA-2 front panel has both balanced line/mike and unbalanced line/mike outputs for pink noise and both unbalanced line/mike and balanced line/mike inputs. Scope displays are switchable to full or 1/3 octave and can be set for 10 dB or 5 dB per division on the scope. Integration time on the filter circuits can be fast (normal) or slow. The slow setting averages the spectrum when needed for measuring system response. Speed selection is separate for the 16 Hz to 630 Hz filters and for the 800 Hz to 20 kHz filters.

The Crown RTA-2 uses precision, full-

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this dbx 216 comes with pre-assembled cables and connectors and a free spare plug-in module

something to think about if you've ever wired in a Dolby M16

dbx noise elimination

dbx, Incorporated
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Waltham, MA 02154

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R-e/p 71

wave detectors for an accurate display on each frequency band.

The RTA-2 weighs 22 pounds and measures 17¼-inches deep. The front panel is configured for EIA 19-inch rack mount with a 7-inch panel height. Provision is included on the RTA-2 to hook up auxiliary units to expand the utility of the unit. Two pairs of external inputs may be X-Y displayed, useful for on site check-out of component distortion or for establishing system headroom. Rear panel gain controls are provided for each input. External display outputs can be connected to a storage scope or to a larger display.

Front panel controls include pink noise output level control (including on/off) and 40 dB attenuation switch; an input level control (which includes "Calibrate" settings with precise 20 dB difference); fast/slow integration time switching for high and low frequencies; range selector; and full to 1/3 octave band switch. In addition, standard scope controls are provided for positioning, gain, brightness and focus.

The RTA-2 lists for $2,595.00.

CROWN INTERNATIONAL, INC.
1718 W. MISHAWAKA ROAD
ELKHART, IN 46514
(219) 294-5571

for additional information circle no. 50

SCAMP S24
TIME SHAPE MODULE

ADR's S24 Effects Package is the result of a carefully considered development program that has reportedly resulted in an exceptional unit at a competitive price. It's unique feature is the use of a limiter on input to prevent overload of the delay line. Not only does this ensure that continuous optimum modulation and noise parameters are maintained effortlessly, but also opens up a whole new range of effects possibilities. Used with 100% feedback around the delay line, the limiter controls the level and creates a sustained signal that can be further modified by another input signal with the varied delay. The unit is divided into two sections: audio frequency chain and controls and delay section and controls.

The audio section provides an input attenuator which contols program level into the limiter and through the audio chain, The Spin control is situated in the feedback path and allows feedback information to enter the limiter. One-hundred percent feedback is possible withour fear of overload as the limiter clamps and sustains the signal at its threshold level of +6 dBm without degradation.

The auxiliary input is an alternate input allowing a signal mix into the main audio path. This may be desired when cross linking signal between two units to create 'stereo' reverb, or when adding externally processed signal. [e.g. equalized, gated, etc.]

The flange control integrates direct signal in feed-forward manner in either positive or negative phase relationship. This gives maximum flexibility for phasing effects and is normally used in the short delay [I] mode period. Incorporating a degree of Spin when flanging will enhance the effect, while increasing the delay and Spin will create a hollow characteristic.

Maximum ADT effect is achieved with the longest delay [II] and the flange control set fully to '+' or '-' dependent on the effect required. Alternatively when real-time signal is required to distinctly predominate, the delayed signal from the S24 unit can be routed via the Scamp mother-board for mixing externally in the real-time signal path.

The delay section incorporates a delay pot, with manual sweeping operation in two ranges. [1.2 mS-11 mS (I) and 11 mS-45 mS (II)] dependent on the range switch. A constant visual indication is given of delay setting by two green LED's above the control, whereby maximum delay is indicated when the lefthand LED is fully off and the righthand LED fully on.

The EF [envelope follower] control signal is derived from the main audio signal level. It increases the delay [manually established]

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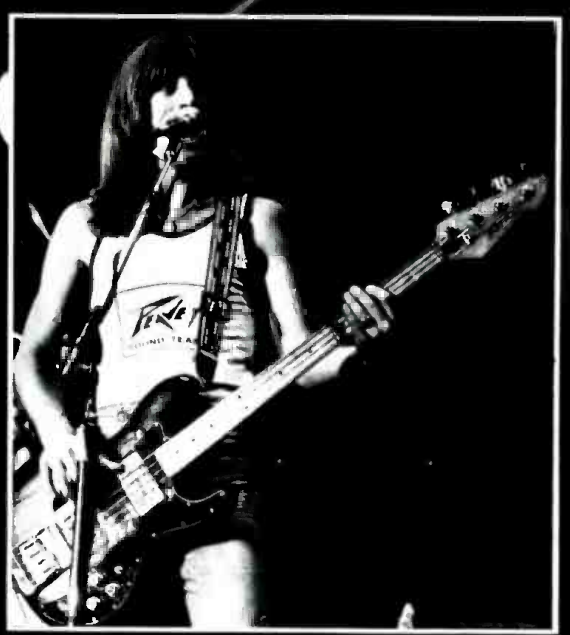

Ross Valory

Steve Perry

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Meridian, Mississippi 39301 ©78

for additional information circle no. 51

proportional to the program modulation.

The modulation control effectively varies the swing about a predetermined delay time. [e.g. with delay pot set mid-way, maximum modulation will give swing over the full range of delay time, Range I or II.] The frequency control determines the rate of swing from 0.1 to 10 Hz. The red LED is used to indicate limiter function operating and below threshold. A green LED shows signal present but not at optimum level.

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P. O. BOX 23047
HONOLULU, HI 96822

for additional information circle no. 54

NEUMANN VMS 80 GROOVE SPACE COMPUTER LATHE

The 59th AES Convention in Hamburg saw the premiere of the Neumann Company's most revolutionary development: the VMS 80. It is their greatest visual and technical design change since 1957 when Neumann added pitch and depth control to its 1931 originated line of disc mastering lathes.

A crystal time base is used to control both the DC servo turntable drive and lead screw drive motors. A hydro oil bearing, a development inherited from the videodisc technology at Neumann, coupled with through-the-bearing vacuum chuck air feed, provides minimum rumble, eccentricity and

dynamic wow. Microscope illumination uses fiber optics and an optional CCTV camera mounts on the scope for monitor display of the grooves. The entire lathe assembly is air cushion suspended within the cabinet, making for efficient isolation from ambient rumble and touching by the operator.

Many innovations have been included in the VMS 80 design: stylus use hour meter, integral banding unit, automatic groove echo suppression, digital indication of percentage of available radius used, automatic run-up of stylus heat from outside to inside of the disc, elimination of the pitch control knob and the introduction of a *land* meter and a control permitting easy setting of both groove width and land width and indication of the resulting pitch in lines/inch.

The Groove Space Computer, for the first time, provides an analysis 16 times each revolution of the phase and amplitude relationship of the adjacent excursions of the next successive grooves to be cut. This is accomplished by means of several digital delay lines in the preview system, likewise timed from the crystal time base. The resultant control signal permits grooves to "snuggle" into each other, something never before possible. The computer can even command the lead screw to stop momentarily when very loud modulation is followed by very soft modulation and the grooves close up quickly.

The VMS 80 will be delivered starting in the Fall of 1978.

GOTHAM AUDIO CORP.
741 WASHINGTON STREET
NEW YORK, NY 10014
(212) 741-7411

for additional information circle no. 55

UNI-SYNC MODEL 1003 MIKE SPLITTER

The Model 1003 is a 10 x 3 microphone splitter that is specially constructed for sound reinforcement as well as recording and broadcast applications. The 19-inch rack-mountable unit has ten female XLR connectors for its microphone inputs. From there you can go three ways from each input: Direct output for phantom powering from main console for condenser micro-

THE NEW TAD* DRIVER, IT GIVES YOU MORE BY GIVING YOU LESS.

The new one-inch TAD driver is truly unique. There is nothing else like it. Use it with your favorite horn and you'll get a frequency response from 800 to 22,000 Hz. So one speaker does the same job it used to take both a tweeter and super-tweeter to do. Saves weight. And money.

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The quality of both parts and workmanship, plus the same care in assembly given a fine watch, makes the TAD driver a new standard for the entire industry. It allows the driver to reproduce frequencies up to 22,000 Hz without any major drop-off in response and permits it to withstand high input power.

If your job involves professional sound reproduction — on stage, in concert halls, in clubs or studios — you have an obligation to yourself to hear this remarkable driver.

With the arrival of the TAD driver the state of the art just took a quantum leap.

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*TAD is an abbrev
Technical Audio
the professional
U.S. Pioneer Electron

for additional information circle no. 56

R-e/p 75

phones; and splitter outputs consisting of two bridged outputs with ground lift switches on each.

One of the unique features of the 1003 is that it can be rack mounted. The rugged 14 gauge steel chassis is tough enough for the road or studio use where splitters take plenty of wear and tear. The transformers are dual Faraday shielded, therefore eliminating hum and buzzes. This maintains super low distortion with no ringing and exceptional isolation.

. . . in reverent quest of the last dB

John Joseph Boyle

December 20, 1947 — August 9, 1978

For those of us lucky enough to have known John Boyle, his passing from this physical world is a time of tremendous sadness, yet it is also a time of great strength. John was able to see the future as it related to the music, the equipment and most importantly, the people involved in pro audio. It was his great foresight and energy that inspired so many to follow his visions and his ideas. His accomplishments, through his involvements with Altec, TEAC/Tascam, Express Sound, Sound Workshop, and so many others are numerous, but they are far surpassed by his inspiration to those he touched. In a competitive industry such as ours, John was always able to convey the importance of the music and the people. The gear was John's vehicle to what he cherished most, bringing friends and music together. We will miss John dearly, but he will live on in everything we do.

— From Johns' friends in the industry who loved him dearly.

The Model 1003 microphone splitter retails for $840.00.

UNI-SYNC, INC.
742 HAMPSHIRE ROAD
WESTLAKE VILLAGE, CA 91361
(805) 497-0766

for additional information circle no. 59

PHANTOM POWER MODULES FROM ELECTRO-VOICE

The Electro-Voice Model AC24M is a remote AC power supply designed for use with condenser microphones. Inserted in the microphone line between the microphone and the mixer, the AC24M provides 24 volts DC via the phantom method. The AC24M will power two microphones directly and with the use of the AC24S expander modules, will power approximately ten microphones, depending upon current required for each microphone.

The AC24S expander module is designed for use with the AC24M. Utilizing a mechanical nesting concept, the AC24S mates with the AC24M to provide a rugged mechanical package. The AC24S draws the power it requires from the AC24M power supply and distributes it to four additional sets of microphone connectors. There is a connector on the top of the expander module that will accept additional AC24S expander modules. The stacking of additional expander modules increases the total number of microphones that the AC24M is capable of powering. Note that the AC24S must be used in conjunction with the AC24M.

The AC24M is ready for use as it comes in the box. The power supply requires 105 to 120 volts AC, 50 to 60 Hz, for proper operation. The power supply may be inserted anywhere in the microphone line between the microphone and the mixer input.

Suggested price for the AC24M is $96.00 and $81.00 for AC24S. Prices are slightly higher on the West Coast.

ELECTRO-VOICE, INC.
600 CECIL STREET
BUCHANA, MI 49107
(616) 695-6831

for additional information circle no. 60

QUANTUM AUDIO LABS PROFESSIONAL RECORDING CONSOLE

Just introduced by Quantum Audio Labs, the Model QM-8B is an 8-input x 4-buss console. The unit incorporates all the features of the QM-8A, its predecessor, including an 8-track monitor section, cue system, built-in talkback and a genuine VU meter for each buss. In addition, the QM-8B offers several new features as standard equipment.

Each input has a solo button, a smooth conductive-plastic fader, a switchable 15 dB pad for the mike preamp, a deluxe 3-knob/6-frequency equalizer with In/Out switch, 3 special effects sends (cue, Echo 1 and Echo 2), stereo panning, and 4 output assignment switches. There is a Pan In/Out switch to select direct or panned buss assignment. Remote mike powering ("phantom power") and direct channel outputs are available as options.

With the monitor section features, an 8-track tape machine (16-track optional) can be mixed to stereo and monitored without disturbing the console's input channel

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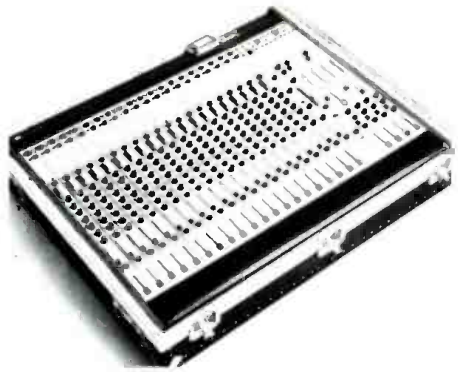

setting. Additionally, two echo return channels are provided in the monitor section, each of which can be assigned to any combination of the four mixing busses.

The output section includes buss trim controls, a board master fader and a VU meter on each buss. XL connectors accommodate the inputs and outputs, and a separate pair of multi-pin connectors facilitates interface to an optional patch bay. An 8-input expander can be added to the system at any time, increasing its capacity to 16 inputs. (A 12-input version of this console is also available, the Model QM-12B.)

High quality transformer-balanced mike inputs, wide dynamic range mike preamps and electronically balanced line inputs assure quiet operation in actual recording studio conditions (88 dB signal-to-noise ratio). For instance, the console measures -70 dB output noise when its controls are set to yield +18 dBm output level from a +4 dBm nominal input. The QM-8B's total harmonic distortion is typically 0.05%. Its high slew rate (greater than 10 volts/microsecond) is fast enough to assure good transient response. Quantum provides a one-year warranty on parts and labor.

QUANTUM AUDIO LABS, INC.
1909 RIVERSIDE DRIVE
GLENDALE, CA 91201
(213) 841-0970

for additional information circle no. 64

A&H's NEW 20 CHANNEL MIXING CONSOLE AVAILABLE FROM AUDIOMARKETING

A new live concert and theater mixing console, the SR 20, is now available from Audiomarketing, Ltd., exclusive U. S. distributor for Allen and Heath. The sophisticated SR 20 is a fully modular mixer with totally expandable format which allows up to 20 input channels to be fitted.

Its fully modular construction enables rapid 'in field' servicing and parts replacement as well as a greater degree of flexibility and fidelity — qualities not found in standard mixers. The grouping of each channel into twelve mix busses greatly eliminates a sound engineer's mechanical tasks, allowing him to concentrate on the creative aspect of his work.

Along with the routing to Subgroups, stereo masters, auxiliary masters, auxiliary sends and the PFL system, each input channel offers a transformer balanced, low noise, input stage with low distortion and high headroom. Mike and line signals may be permanently connected without crosstalk. Standard on the SR 20 input channel modules are a variable gain preamp with input pad on mike and line and switchable high pass filter; three bank equalization with parametric mid-band; three auxiliary sends may be pre-selected to either pre or post fader by an undermodule link; and an input insertion point for limiting or special effects.

The output modules give control of left and right master outputs. Facilities they provide include four subgroups all panable to the main output faders; two master faders with solo; a comprehensive meter system for either the four subgroups or the program selected on the monitor system; two auxiliary masters are provided with pre-fade monitoring; and patch points on each subgroup and master for additional external equipment. The Master Control Module of the SR 20 allows the engineer to monitor all

signals with the console without affecting the main mix.

Technical specifications on the SR 20 include equivalent input noise of -126 dB. Also, sensitivity: -80 dB. Maximum output: 18 dBm. Noise: better than -75 dB overall. Frequency response: 30 Hz to 20 kHz ±1 dB. Output operating level: 0 dBm including insertion points. Equalization: ±16 dB at 10 kHz, ±16 dB at 100 Hz, and ±18 dB at 1.8 kHz to 7.5 kHz continuously variable.

Price of the SR 20 is $6,250.00. Also available is a 28 input version, the SR 28, for $8,400.00.

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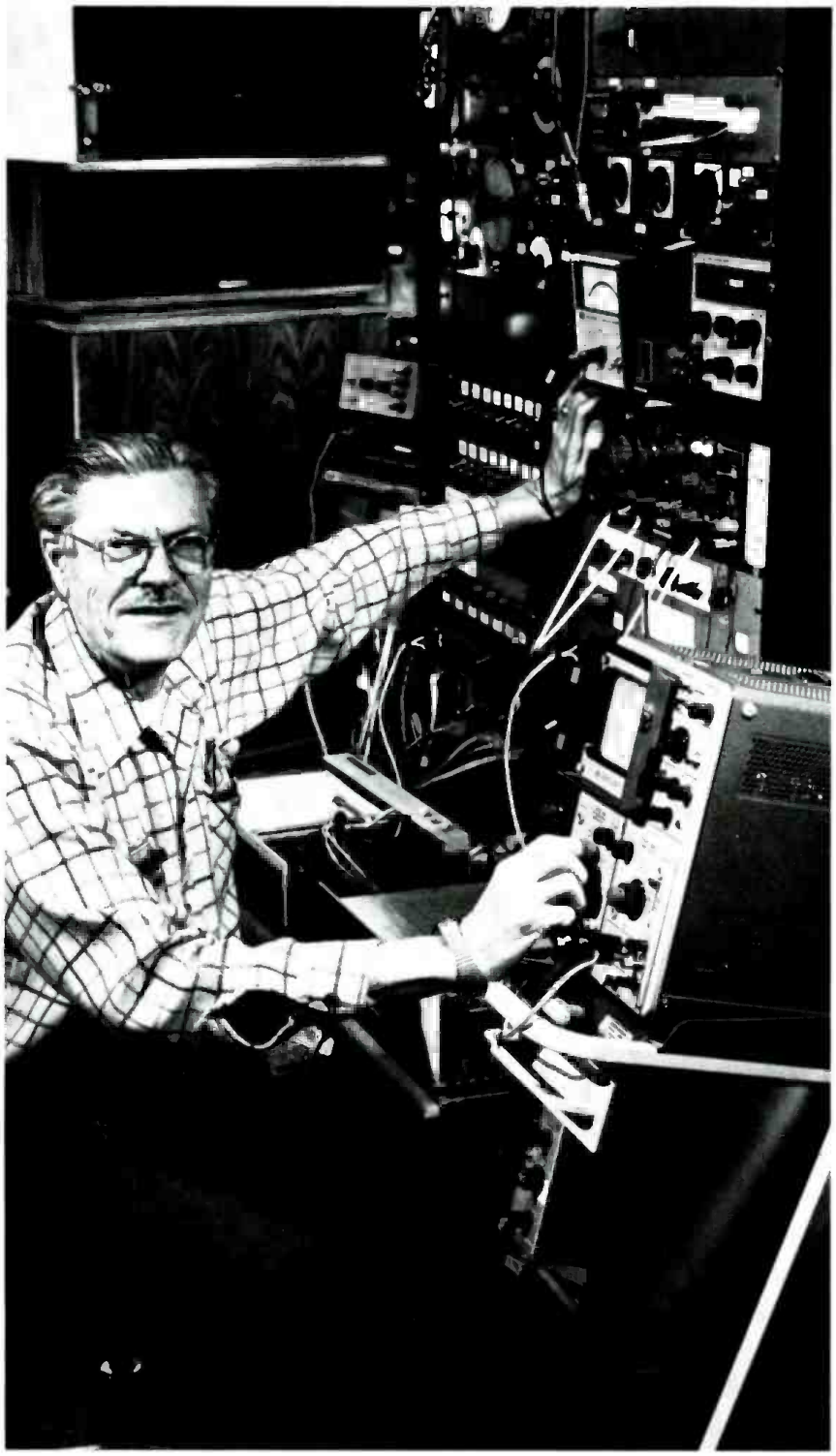
for additional information circle no. 65

JBL ANNOUNCES ITS NEW FAMILY OF PROFESSIONAL POWER AMPLIFIERS — THE 6000 SERIES

Six amplifiers are included in the 6000 Series. The 6007 and 6008 deliver a minimum of 60 watts; the 6011 and 6012 deliver a minimum of 100 watts; and the 6021 and 6022 deliver a minimum of 200 watts. Each pair includes a model with an audio output transformer (the 6007, 6011 and 6021) and without a transformer (the 6008, 6012 and 6022).

One outstanding feature of the 6000 Series is modular construction. With the exception of the power supply and output

LISTEN.



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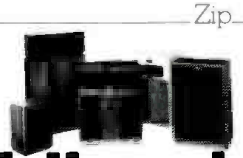

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transformer, the entire amplifier circuit is mounted on a single board, which can be removed from the rear of the unit with the mainframe still mounted in a rack. This unique "field interchangeable unit" offers professional sound engineers swiftness and ease of servicing previously unavailable.

Performance reliability of the 6000 Series is ensured by an advanced protection circuit, which senses true dissipation of the output devices even under extreme conditions of load impedance and line voltage. Cooling is accomplished by convection over a generous heat sink area. No transients are produced by turning the unit on or off.

The audio output transformers available in the 60-watt 6007, the 100-watt 6011 and the 200-watt 6021 have been designed for minimum distortion and power loss. The transformers allow full power operation, 35 Hz - 20 kHz, into an 8-ohm, 16-ohm or 70.7 V load, with less than 0.2 per cent total harmonic distortion.

The 6008, 6012 and 6022 amplifiers allow full power operation, 20 Hz - 20 kHz, into a 4-ohm load, and less than 0.2 per cent total harmonic distortion.

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8500 BALBOA BOULEVARD
NORTHRIDGE, CA 91329
(213) 893-8411

for additional information circle no. 68

SOLID STATE LOGIC SSL4000 AUTOMATED CONSOLES

Solid State Logic Limited of Oxford, England, has introduced their SSL4000 — 40 channel automated recording consoles. Already in use in several studios throughout Europe, the SSL consoles offer the artist, producer and engineer complete freedom from operational details, allowing full concentration on musical creativity.

Every input module of the SSL4000 includes an instrument quality compressor/noise-gate/expander and a four band variable-cue parametric equalizer. Full tape machine remotes are included within each channel. The unique super-cue logic automatically provides artists with correct fold-back sources, even during complex punch-ins.

The SSL4000 automation system is composed of a mini-computer with floppy-disc storage as well as an alphanumeric keyboard and CRT display. Also included is a SMPTE time code generator/reader and fast learning intelligent auto locator. In addition to level, mute and grouping memory, the SSL automation also provides

full record-keeping of track assignment, song titles, dates and comments, as well as presettable punch-in timing and editing of stored mixes. All commands are entered into the keyboard in simple English.

Sierra Audio Corporation has been appointed exclusive representation of SSL for the entire Western Hemisphere including Asia. A complete operational system will be on display at the November AES convention.

SOLID STATE LOGIC, LTD.
CHURCH ROAD, STONESFIELD
OXFORD OX7 2PD, ENGLAND

SIERRA AUDIO CORPORATION
621 S. GLENWOOD PLACE
BURBANK, CA 91506
(213) 843-8115

for additional information circle no. 69

INTERFACE HIGH PERFORMANCE EIGHT INPUT MIXER—SERIES 400

The Series 400 mixer is said to achieve high performance, reliability, and ease of operation with low cost and is suitable for mono or stereo recording, small sound systems, or any application requiring up to eight inputs and one or two outputs plus echo and cue. The eight inputs are suitable for balanced 150-600 ohm signal sources at levels from -50 dBm to zero dBm; internal pad switch protects the normal 20 dB headroom at all levels and each input is fitted with an LED overload danger indicator to aid in setting input gain.

Three 12 dB equalizers and a low frequency rolloff provide for full professional equalizing; the mid frequency equalizer can be switched to 400, 1,000, 2,000 or 4,000 Hz, and the low frequency rolloff can be switched for flat or 12 dB/octave at 50, 100 or 200 Hz. Echo Send can be used for effects such as reverb requiring a postslider send, and an echo return is provided. Cue send can be used for cueing or monitoring, and can listen to any one input solo or any combination of inputs, preslider. Slider masters and VU meters provide output control. Construction is entirely modular and plug-in and utilizes new high slew rate plug-in integrated circuits with blow-out protection. Good design and shielding provide immunity from stray fields or inteference. These mixers are also available on special order with 12 inputs.

Specifications include flat response within 1 dB from 20 to 20,000 Hz with 12 dB boost or cut at specified frequencies with the equalizers, distortion under .05% at 400 Hz almost to the clip level, normal 1 volt output into 600 ohms (unbalanced) at zero VU with approximately 20 dB headroom, and extremely low noise levels. Inputs are XLR-3 type, outputs are phone plug. The eight input version measures 15" x 17" x 5" and weighs 16 lbs. List price is $1,300.00.

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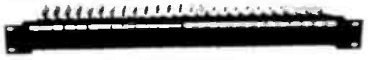
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continued from page 16 —

Reply from Ken Fause

currents in an existing installation to a tolerable level if wide dynamic range is not essential. For new installations we agree that it is simpler and cheaper to do it right the first time.

To address Mr. Kramer's specific questions:

In the scheme of Figure 4, conventional (U. L. listed) receptacles are used — by code, these are bonded to the conduit at the outlet box. For instance, see National Electric Code Article 250-74: "An equipment bonding jumper shall be used to connect the grounding terminal of a grounding-type receptacle to a grounded box." The additional green wire run in parallel with the raceway ground is used to insure low impedance to ground whether required by Code or not. As an example, NEC Article 350-5 requires a parallel grounding conductor when 20 ampere branch circuits run more than six feet in Flexible Metal Conduit. Mr. Kramer quite correctly observes the DC loop thus created.

If the conduit is steel, (and I should have been specific on this point) the "green wire ground" is enclosed within a magnetic shield. Provided some caution is observed regarding lead dress at outlet boxes, the enclosed loop area available to be threaded by a magnetic flux is virtually nil, and so the induced noise current is extremely small, if any. Use of steel receptacle dress plates in lieu of plastic will minimize magnetic shield openings.

The isolated Ground Receptacles discussed earlier and shown in the

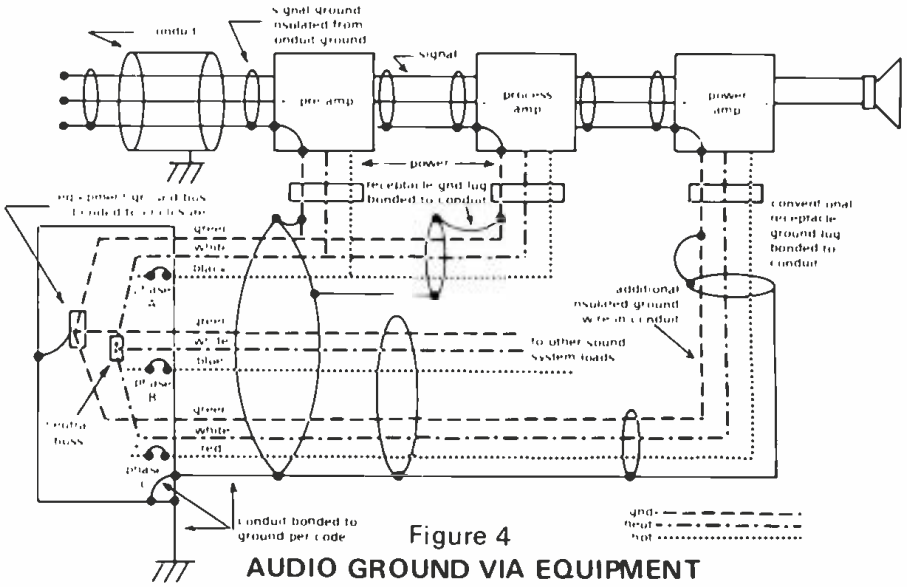

Figure 4
AUDIO GROUND VIA EQUIPMENT SAFETY GROUND

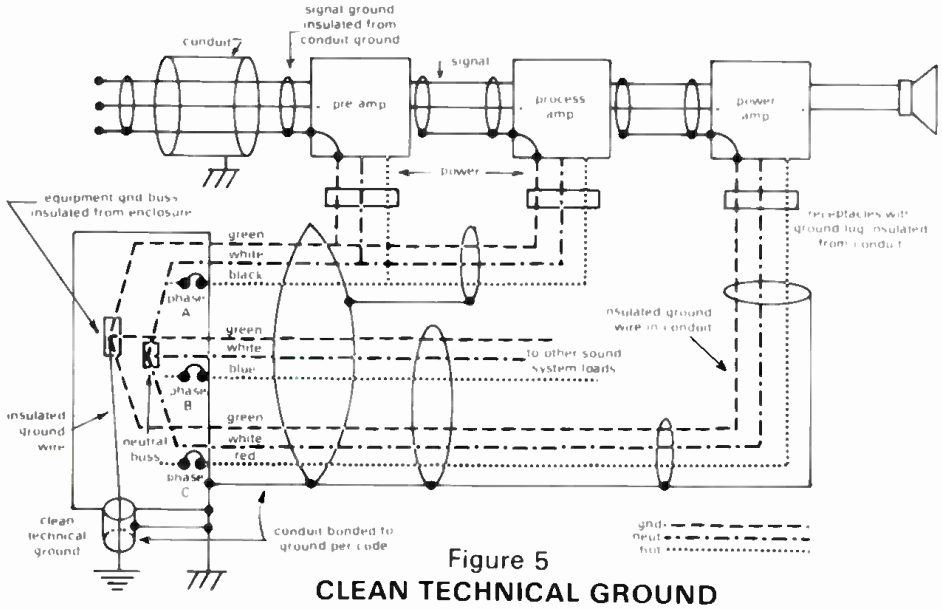

Figure 5
CLEAN TECHNICAL GROUND

corrected Figure 5 do break the DC loop where Mr. Kramer suggests.

The panelboards shown in Figures 4 and 5 are intended to represent local distribution panelboards, not the service entrance equipment, thus the bonding of neutral to ground is not shown. The connection is made at the service entrance to prevent a flow of neutral current over grounding conductors or grounding paths established via bonded raceways (NEC Articles 250-21 and 250-23).

Testing polarity of receptacles is mainly a nod to the existence of some AC-DC equipment where the neutral side of the line is connected to the chassis. Two wire line cords on such equipment *are* polarized — the neutral pin is slightly wider than that for the hot side. The U. S. standard receptacles for 115 volt branch circuits (NEMA 5-15R configuration) are all polarized in this fashion. It is faster and safer to test polarity with a commercial plug-in outlet tester ($6 to $10 at your local electric supply house) than it is to disassemble each receptacle and look. If one intends to look, *remember to shut off the branch circuit power first.* If in doubt, the green ground jumper goes to the green hex shaped screw, the white neutral wire goes to the chrome plated screw, and the black, blue, red or other color hot conductor runs to the brass screw of the receptacle. Local ordinances and insurance requirements may dictate that corrections be performed by a suitably licensed electrical contractor.

I hope this clears up any confusion I may have inadvertently caused. ■■■

Late News

SENNHEISER ANNOUNCES WEST COAST MICROPHONE REPAIR/SERVICE FACILITY

Effective May 1, 1978, Audio Services Company will be performing all repairs, both in and out of warranty, on all Sennheiser microphones, it was announced recently.

In sending repairs to Audio Services, it is suggested that information describing the defect or malfunction be included, and if the unit is still in warranty, some proof of the

(continued)

date of purchase.

Rolls Electronics will continue to service all Sennheiser headphones.

For microphone repair contact Mr. Dick Topham.

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SYNERGETIC AUDIO CONCEPTS (SYN-AUD-CON) SEMINAR SCHEDULE ANNOUNCED

Synergetic Audio Concepts (Syn-Aud-Con) has a new six-page brochure which describes its 3-day nationwide sound engineering seminars. The brochure includes a full schedule for the balance of 1978 through May 1979 in ten different cities.

Chicago, September 13-15, 1978; Washington, D. C., September 26-28; New York City, October 4-6; Atlanta, October 17-19; Orlando, October 31-November 2; Anaheim, February 27-March 1, 1979; San Francisco, March 13-15; Salt Lake City, March 21-23; San Diego, April 10-12; Los Angeles, May 22-24.

This schedule does not include the many in-house seminars conducted within the audio, military and entertainment industries.

To receive a free brochure and further information, contact Don Davis.

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AVAILABILITY OF THE ENGLISH TRANSLATION OF "MICROPHONES" ANNOUNCED

This 74-page pocket book on Microphone Technology is being made available by Gotham Audio Corporation after two years in translation. "Microphones", for the first time, gives an easy-to-understand overview of the often misunderstood workings of the most important transducer in the recording, broadcasting and public address equipment chain. Authored by the chief physicist of the venerable Neumann Company of West Germany, Dr. Gerhart Bore, the booklet covers all of the basic transducer types, and discusses and illustrates microphones of many manufacturers in addition to those made by Neumann.

This booklet is a must for anyone who comes in contact with microphones both from the operating as well as the artistic point of view. It keeps the formulas and calculations down to bare essentials while concentrating on useful application information. For example, it clearly shows why the use of an omni-directional microphone for the distant pickup of an orchestra can only be recommended under very special circumstances; but never as a general practice!

It is available in any quantity on receipt of one dollar ($1.00) to cover postage and handling.

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—continued from page 32

Bill Szymczyk

Bill: Up until the point that it's into the board. I trust him so explicitly. I don't even go out into the studio anymore. When we even go into a brand new studio like here, we're working at a place called One Step Up, we'll just bring our microphones and I know that Ed's going to set it up the way that we set it up. I know I don't even have to go out there.

Tom: "Life In The Fast Lane" has a very unusual vocal quality. What microphones did you use?

Bill: 87's . . . yeah. I think the unusual quality came from the effects in the mix. It was a certain amount of DDL in it; it's limited pretty much, too.

Tom: How do you feel about automated mixing?

Bill: I hate it. [Laughter]

Tom: Why?

Bill: I don't need it because I started out, like I said before, two mono machines and ten generations — sometimes 15 generations. And after you do about three years of that, you know what the hell you're doing. The people that need automated mixing are the people whose first machine they saw was a 16-track. They never learn how to record the right way. They learn to throw it on the machine and sweat it later. Where I come from, if you've got to sweat it, you do it now.

When I bought my new board, I bought the new 500 Series MCI Board, with automation, but basically for outside clients. It isn't for me. If you're going to be state-of-the-art as a studio, you've got to have it; the

hardware manufacturers are driving me wild.

Tom: What are you going to do about digital tape recorders?
Bill: Hopefully sell my studio and get out of the business by then. [Laughter]

Tom: Pushing straight ahead . . . What microphone do you use on a kick drum?
Ed: Well, we've been using a Sony C55P on the kick. Sometimes we go to a RE20, but that C55P usually wins out.

Tom: What about your snare?
Ed: When we were at Criteria we used the 546 and now we use 57's, 56's — basically a Shure mike. He never used either until he came to Criteria.

Bill: Yes, those are two mikes that I picked up at Criteria and the high hat mike.

Tom: Anything under the snare?
Ed: No. Very seldom.

Bill: Once in a great while, I'll stick something under there. I just don't like that sound. There's a raucus, raunchy sound that's happening underneath the snare drum.

Tom: How high do you put your overhead?
Bill: Maybe six inches to a foot away from the cymbals and six feet apart.

Tom: Do you take most of your electronic keyboard instruments direct?
Bill: Most of the time.

Tom: What about guitar?
Bill: Very seldom — I never take guitars direct. You're cutting away half of what he wants to do.

I record bass on two tracks, one direct and one through an amp. And I usually try to get a real clean bottom sound on the direct track and then a top-ier, or a different sound, on the amp track. Then you can use as much as you want or all of one or none of the other when you mix.

Tom: What mikes do you use for guitar?
Bill: We use 87's; acoustics, we use 84's.

Ed: AKG 414's we like a lot. They're good mikes.

Tom: On Jay Ferguson's THUNDER ISLAND, there's an incredible amount of presence on the slide guitar.
Bill: Probably went up three or four more steps on the equalizer, 4.3. Lots of compression.

Tom: There's also a sound there that I swear must be you hitting on the side of an EMT.
Bill: Exactly. I got that from a group called Brick. You remember a tune called "Dazz"? It's subtle and way in there. As soon as I heard that on their album, I said, "Wait a minute, I know what that is. Somebody's hitting on the EMT. Wow!" So we did it too. We call them "Next Valley Mortars" because they sound like mortars going off in the next valley.

Tom: Do you do any treatment to the drums?
Bill: I never limit drums. Never. I don't Keypex them; I don't do anything.

Tom: When you do a tune, how much editing do you do before you actually release it?
Bill: Once in a great while we're doing overdubs or lead vocals or guitar solos or something, we'll realize that, whoops, this is too long and we shouldn't be doing 16 bars of guitar here; we should only be doing eight. At that point we'll lop out, say, eight bars. But by the time I mix them, that's it. The only time I'll edit after that is when we're editing for a single after the fact — after the record is out.

Tom: Did you use an 87 on Jay's voice?
Bill: Yeah.

Tom: In cardiod?
Bill: Yep.

Tom: Do you feel that the sound changes much with the pad in?
Ed: We don't use the pad.

Bill: It does change a lot — yeah. I'd rather not use it with the pad. The only thing we will do is put a wind screen on it.

Tom: Joe, that lead guitar on "Happy Birthday Baby", is that some sort of a unit that has automatic panning back or what?
Joe Walsh: It's a Leslie miked in stereo.

Tom: It doesn't sound like a Leslie.
Bill: Well, first it goes into an Echoplex and then the Leslie, so it's being repeated. It's going over and over and then it's going side to side. And if you limit both sides, it just sort of undulates as opposed to the usual Leslie sound.

Joe is the most unique person I've heard as far as this setup goes. It's like his signature on some of these things. On Jay's album, on Eagle albums, that same sound is in there for just a second. Of course, it helps when you're working with the best.

Tom: On "Losing Control" the last word descends in pitch while the rest of the track stays the same.
Bill: I wanted to tell you about that because I was real proud of that. It starts naturally. It's a continuation of a natural vocal and all of a sudden just goes completely to Darth Vadar in the cellar. It's quite simple. We did the whole vocal up to that line — and the line is "losin' control". I put the machine — the 24-track — in variable speed and then A/B'd it and made sure it was running exactly at 15 ips.

So after we did the vocal, I said, "Jay, I'm going to punch in this line and I want you to hit that note, 'losin' control', and hold it as long as you can. No matter what happens in your headphones, hold that note." So I punched it in, "losin' control", and then I took the VSO and I cranked it way up as fast as I could. And after a few trials and errors, I had it so it was rhythmical, so it f-e-e-l-l-l-l-l all the way to the bottom and then we tripled it. [Laughter] Yeah, there was three of them on that line. Right in the center.

Tom: Do you dance?
Ed: No, sir.

Joe Walsh: No, I never learned to dance because I was always in the band. [Laughter]
Bill: I think we dance as it is. I think if you're into what you do, you're moving constantly. Actually my whole body gets moving. When we're in the middle of cutting a track and the band is looking in the control window, I've got some kind of dance going whatever, depending on what tune it is, and they know that the harder I'm dancing the better the take is. If I'm up out of my seat, they know we've got it! It's cool.

Tom: How long did it take you to do Joe's record?
Bill: That was an on-going period of about 16 months from the time that we first went to the boat to do demo tracks to the time the record came out. Actually, the time in the studio was very minimum. It went fast. But the delays due to Joe's schedule and my schedule were months at a time. There was one period there where we didn't work on it for five months.

Joe Walsh: I had a chance to get really into basic tracks and that helped put it together later in the least amount of time.

Tom: On SERIOUSLY FOLKS, *Joe's vocal was a compilation of tracks. Right?*
Bill: Yeah.

Tom: The high guitar on "Indian Summer" seems to sing.
Joe Walsh: That's a Martin Tripolo 18. It's a real strong three-quarter size Martin almost for children. I restrung it in A — it's called a Nashville tuning. But the third string, a G string, is actually higher than on a regular guitar and then it starts from there. Your fourth, fifth and sixth string are an octave higher than on a regular guitar.

Bill: On the basic, he played a Martin 35. And the high string was done on an overdub and we overdubbed what he had done on the basic guitar exactly.

Tom: The phasing effect used in "Life In The Fast Lane" was intriguing. What equipment did you use to create it?
Bill: The effect was achieved with a number of tape machines rather than a solid-state phasing device. Solid-state devices, of course, are simple to use and easy to set up. For a small studio that doesn't have two or three additional two-tracks, the phasing device is the only answer. However, good as they are, the phasing devices still don't create the unique phasing quality achieved by using four two-track tape machines.

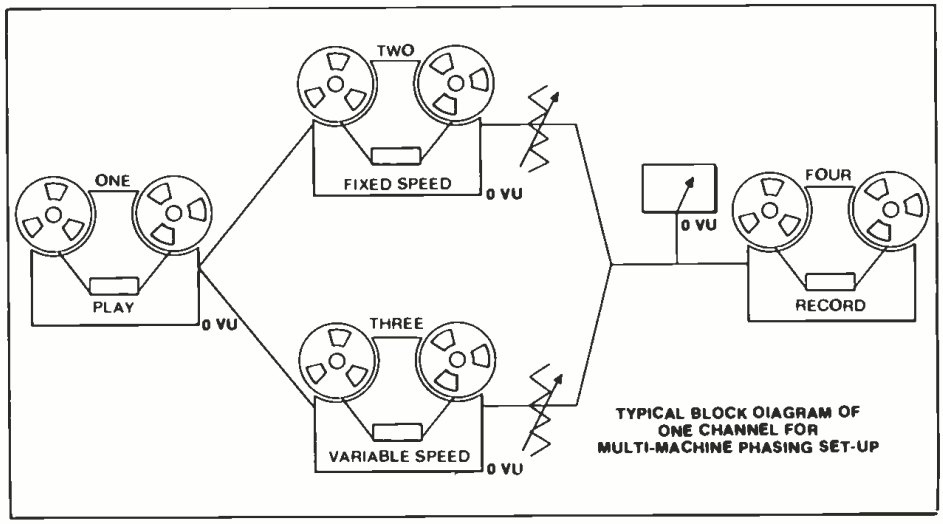
Tom: Since multi-machine phasing is rarely attempted these days, could you describe the process?
Bill: First of all, all four machines must be perfectly matched. Testing is necessary to confirm that their properties are identical. This is important because the effect is like making exact copies from one machine to another.

A master tape is placed on machine number one, which is the play machine. The number one machine output is fed directly to the input of machines two and three. Machine two runs at the standard 15 ips, but machine three is connected to a VSO which will vary its speed.

The output of two and three are brought up through the board. The outputs of each machine are combined equally — left two with left three and right two with right three. This combined board output is adjusted to match the output level of machine one. The fourth machine is used to record the board output. Once everything is checked out and the levels matched, the master tape is played on machine one while machine two, three and four record. The speed of machine three is varied ever so slightly from just a bit faster to just a bit slower than the standard 15 ips tape speed.

Tom: What happens?
Bill: While the distance between the record head and the playback head of the two machines is the same, the amount of time it takes the signal to travel from the record head to the playback head will be different. This is because of the variable speed of machine three. The difference in time constant will result in the two programs being slightly out of phase with one another. Hence, when the two outputs are combined, they not only sum but phase-cancel at certain frequencies.

If the speed of machine three is not continuously varied the summing and



TYPICAL BLOCK DIAGRAM OF ONE CHANNEL FOR MULTI-MACHINE PHASING SET-UP

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DATAWEST has applied its digital computer know how to bring the stability and precision of digital technology to the high fidelity audio field. The same advanced techniques that make the DATAWEST high resolution analog-to-digital and digital-to-analog converters industry leaders, have been employed to produce studio-quality audio delay systems. The DATAWEST digital delay systems provide up to 450 milliseconds of delay to two independent audio signals. These systems allow more effective use of program material by permitting analysis and/or modification prior to recording. For example, in disc recording applications control of groove density will provide the maximum playing time consistent with good signal quality.

THAT'S **sound sense** *FROM*

DATAWEST CORPORATION ™

For further information regarding DATAWEST's standard audio delay system or to obtain assistance with your custom requirements, contact **AUDIO DIVISION**, David Long, Director of Technical Marketing.

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Specifications: Dual channel; selectable delays from 15 milliseconds to 300 milliseconds standard, optional to 450 milliseconds; **frequency response** - dc to 20,000 Hz; **dynamic range** - 90 db; **signal-to-noise ratio** - 70 db; **intermodulation distortion** - 0.1%

cancelling, or phasing, will not sweep the frequency range but stay static. The broadrange phasing effect is achieved by continuously varying the speed of three ever so slightly. By the way, if the machine is too fast or too slow the effect will sound more like doubling than phasing.

Tom: What kind of adjustments and tuning is involved?
Bill: Once you get this thing all set up, you determine how fast you have to vary the speed and where you want the effect. The effect is most pronounced on high frequency. It's unlikely you're going to want to phase the whole tune, so once you've got the effect the way you want it and where you want it, you cut it into the master you've been playing: This is why you have to be so careful about the levels matching. If you've been careful with the levels, the phased section and the master should intercut.

Tom: Do you experience problems picking up noise somewhere in the chain?
Bill: The only generation loss occurs in the phased section and the phasing masks whatever additional hiss there may be. If you aren't satisfied with this, noise reduction could be used in two and three regardless of whether noise reduction was used on the master. You might want to keep the phased outtakes in case anyone has second thoughts. The pieces of the master that the phased section replaced should *always* be saved. You never know when someone will change their mind.

Tom: What could you use if you didn't have a VSO?
Bill: Before VSO's, the engineer would take his thumb and apply additional hold-back tension to the feed reel of number three machine slowing it down. This was called *flanging*.

Tom: How much studio time did creating the effect involve?
Bill: It takes about an hour to set that up.

Ed: You have to be so accurate.
Bill: A/B it with tones and all that stuff. They had a little MXR gizmo and the Eventide phasing.

Ed: But the sound is not the same.
Joe Walsh: It ain't nowhere near it.

Tom: Was "Life In The Fast Lane" the first tune Joe did as a member of the Eagles?
Bill: The first tune he did as a member of that group was a tune called, "Try and Love Again." The first tune he *wrote* as an Eagle was "Life In The Fast Lane."

Tom: What sort of a tape delay do you use?
Joe: Well, we used the Echoplex for a long time. It was an old tube model Echoplex which was the old standard. They haven't changed since the 50's. When they went solid state they lost the sound. But we've been getting into some of the digital stuff now.

Bill: You've got a new Roland.

Joe: Yeah, and MXR makes a nice round sound. They're a lot less noisy but they still don't have enough delay. The delay time isn't long enough for me.

Bill: Yeah, I like a lot of tape. I put my delay in my EMT's on max and then I'll delay the send to that through the tape machine. I'll use that for my main echo.

Tom: Creating an envelope around your voice.
Bill: Right. I like to echo what happens that split second after the signal — the main signal. That makes it just about long enough.

Tom: Have you tried the gold foil?
Bill: Yeah, I got one. It's a little too clean. I like the old one. The mono send and a sort of stereo return. I love that. I don't like it direct left and direct right. I want the echo to just be there — it should be basically a bi-mono or bi-aural sound, you know. Slightly different left and right, but not where you can pinpoint it.

Tom: Have you worked with many live chambers?
Bill: Yes, Regent had a great live chamber when I was in New York. It had a killer live chamber.

Tom: "At The Station." I'd like you guys just to talk about that tune.
Joe: Well, that was co-written with Joe Vitale who was the drummer and an old friend of mine from Ohio. Musically we just put it together in kind of an A/B, A/B situation because he had that one part but he didn't ever quite do anything with it. I had the other part and we just worked together. And I had about a verse of words and I brought it in to Bill.

Bill: That was one of the tunes we rehearsed on the boat, one of the initial five tracks. One comment I'll make about it is that Joe's guitar sound is the best I've ever gotten. That's our usual Leslie, but this time, we had off center a regular amplifier plus he had it into the Leslie. So I put the direct tape sound in the middle — the Leslie sound on both sides. That's the most killer guitar sound I've ever gotten.

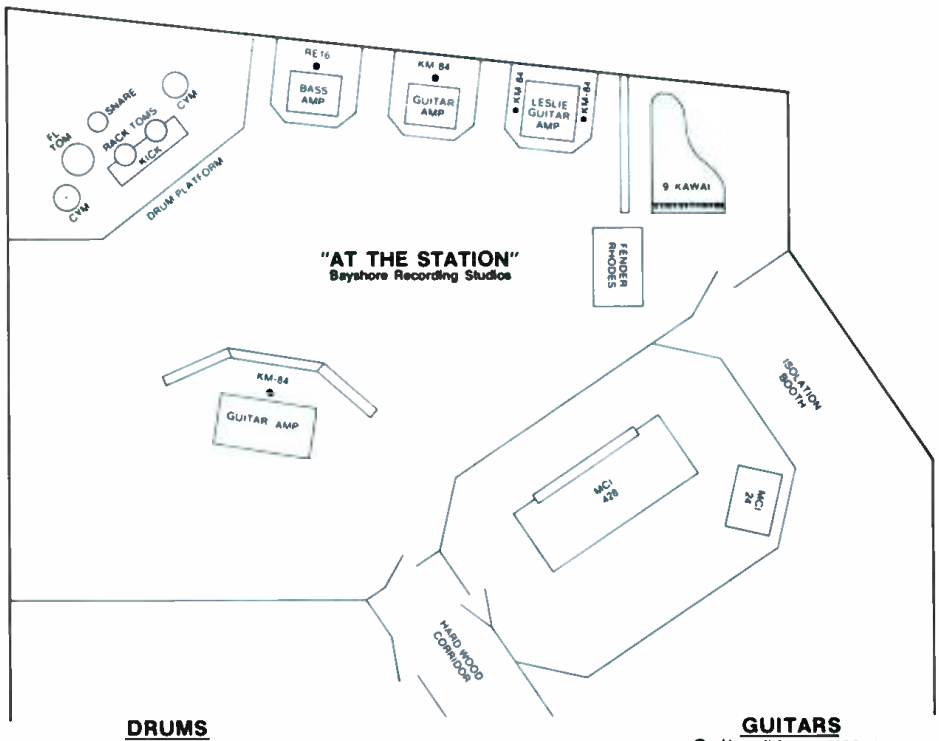
Tom: Yeah, it sounds loud.
Bill: It's a little speaker.

Joe: A Fender Champ.
Bill: And the Leslie cabinet.

Tom: What did you use for microphones?
Ed: The mike on Leslie was a 451. The mike on the amp was an 84.

Bill: Yeah. Limited the hell out of those! [Laughter] That's cool. I love that sound.

Watching Joe and I punch in guitar parts is cosmic to an outsider, because the communication is so defined between him and I in the studio now. We'll just stop in the middle after 12 hours of working on



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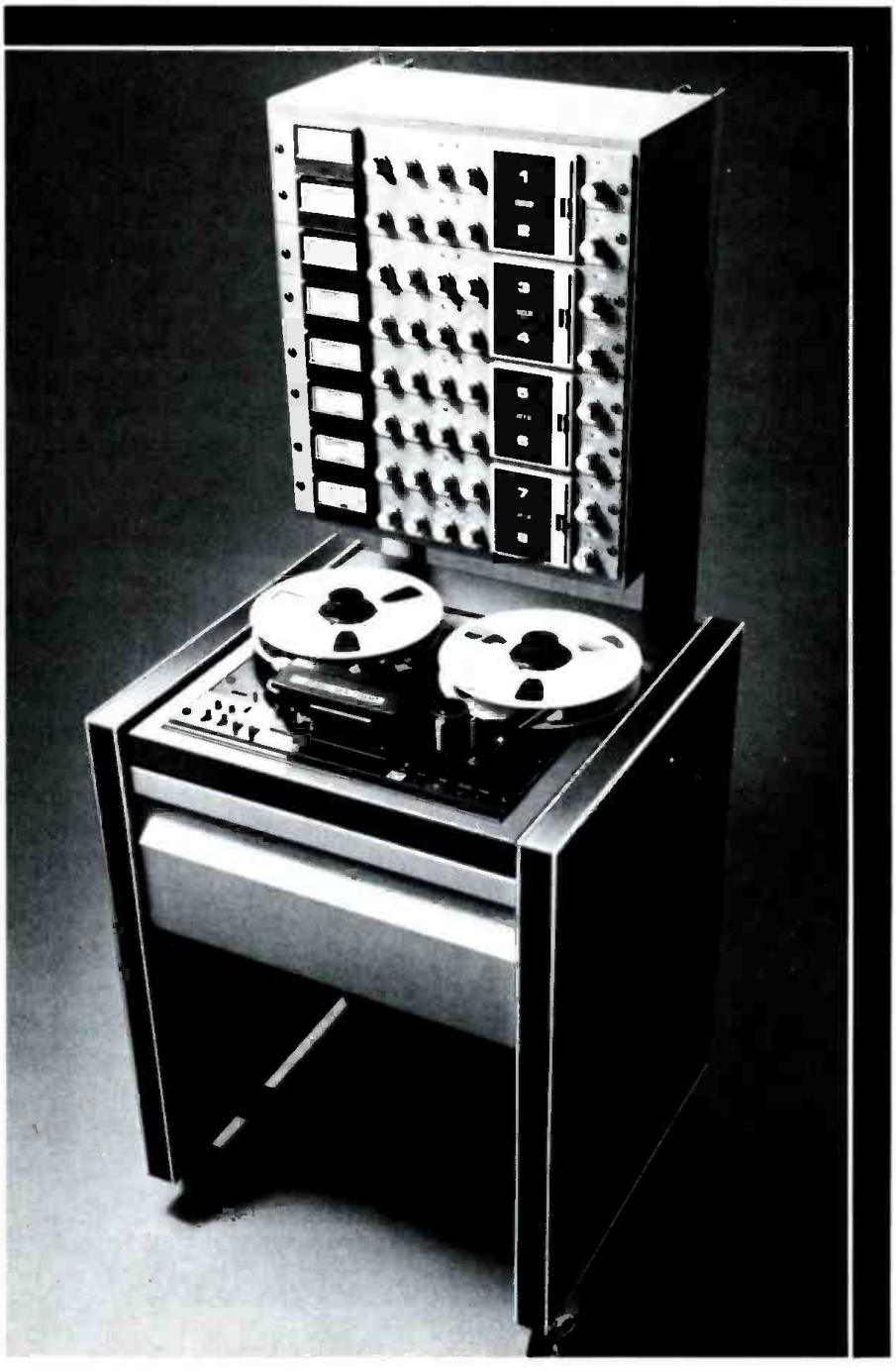

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something and he'll go — and I'll go, yeah. No words go down. It's just, you know, I go to the right spot, he goes there and then whang! We're into it and it just goes down like that.

Tom: Is this in the control room?
Bill: Oh yeah. Oh, hell yeah! I got to have him sit right next to me.

Joe: You know almost all were overdubbed except for vocals done with me in the control room.

Tom: Is there an organ in there?
Bill: Yeah.

Tom: It sounds big.
Bill: It's a regular Hammond B-3 with Leslie.

Ed: Tell him our church organ technique.
Bill: When we want to get a huge organ sound, we mike it from 12- to 15-feet. We get two 87's about 30-feet apart and there's a Leslie in the middle. Then we turn it up as loud as it will go and then limit that quite a bit. You can get a real nice churchy sound to that.

Tom: Do you do a lot of doubling of guitars or do it electronically?
Bill: A lot of times it's done electronically, but on "At The Station" tune, both Joe and Felder doubled the lead. So the leads are four guitars with the guys doubling everything.

Tom: Moving to another topic, what do you think is realistic length to put on a record?
Bill: Realistic? I don't want to get over 20 minutes a side. Preferably, I like 18. At 17 to 18 you can get maximum volume. If you're below 17, I feel you're cheating the buyer. So I say 17 to 18 is ideal. 17:30 is just ideal. You can get ten tons of volume on the record and that would help overcome the rotten pressing.

Joe: Revolution! When the revolution comes, everybody is going to have tape players. [Laughter] Ain't gonna be no records!

Tom: Do you think records are the way it's going to be for awhile?
Bill: I hope not. If they don't make them better, I hope they just discontinue them and everybody has tape recorders.

Tom: Cassettes or something like that?
Bill: Yeah. A cassette is the obvious way, to me, to reproduce in quantity recorded music and get quality. I mean a 99th generation cassette from the master is going to sound better than the best press CBS is giving us out of Santa Maria right now. Do you follow what I mean? If they go from Dolby A system in the studio to cassettes Dolby B, it's going to sound better than an average pressing that you get today.

Tom: I think everyone is waiting for some new developments in this area. What do you see developing in the future for you personally, Bill?
Bill: I see about another three or four years of making records and then I don't know what goes down after that. I've been through 16 years in studios and have never really had a purpose. One thing has developed into another and I just fell into this.

When I first settled in what I call the "B" list — I mean when Joe and I were making our records and they were going and hitting the Top 20 and I was making Giels records and they were hitting the Top 20 and I was working Derringer, B. B. King and all of that — I figured that's cool, but I wasn't, I didn't consider myself or my acts, the stature of, say, Glyn Johns and the Rolling Stones — the "A" list of the select five or six acts and producers in the world. And then with the advent — through weird circumstances —

Joe meeting Irving Azoff and then through him meeting the Eagles and then he becomes an Eagle and I wind up producing the Eagles and the Eagles wind up being the biggest band, you know, all of a sudden I'm on the "A" list. But for the five-year period I was on the "B" list I thought, this is it. I'll never get there.

I wasn't particularly uptight about it, but it was just there. This is a hell of a lot better than putting fenders on Vegas. It's a damn sight more fun than that. And then when we broke through, it's all of a sudden, "Wow! This is it, huh?" So I don't know. I'm going to let the future take care of itself. I don't have any big plans.

Tom: It would seem to me the Eagles are going to be around for a long time. They're very yeoman-like about what they do.
Bill: They are and perfectionists in the studio. They have driven me to heights that I never thought I'd go to in pushing me in my job — and depths that I never thought I'd sink to! [Laughter] We have hills and valleys. You must learn to love the hills and accept the valleys. [All laughing]

They've also done a helluva lot for Joe, too, especially his vocal. Joe Walsh will be the first to admit he was never the world's greatest vocalist, but spending a year or two in that band with those singers whipped his butt in shape and he is great now. He's gotten to the point where he can say with a straight face, "I like my own vocals now." This solo album of his is the best thing he's ever done. That's because of the Eagles and because of being in that band.

Tom: Are you working on another album?
Joe: Oh, no.

Bill: Yeah, it's called the next Eagle's record.
Joe: My whole album was worked around their schedule.

Tom: Joe, what do you do if that's a really big album and it stands a good chance of being a big one?
Bill: Nothing. He's already in a good band. They're going out on tour. The Joe Walsh fans who love that album will come and see the Eagles on tour and, more than likely, one or two tunes from that album will be played within an Eagles concert.

Joe: It doesn't necessarily follow that I would go to a solo career; I just put out a solo album.
Bill: We've done a lot of live recordings since Joe has joined the band. We've got miles of tape of live stuff and there are some *killer* versions. In the eventual live Eagles album in about a year-and-a-half or two years, there are going to be about three Joe Walsh tunes in the Eagles — as the Eagles. And they are the best definitive versions of those tunes ever.

Tom: What are you going to do?
Ed: Just a lot.

Bill: I have a plan for him. I've got more of a plan for him than I do for myself, to be honest with you. We're about ready to start our first co-production where I'm elevating him, if you will, from the status of engineer to the status of producer-engineer with the act that he found. We've signed a deal with Asylum and he and I are going, for the first few projects, to work on them together until he gets his feet wet — until he gets comfortable within that role, being not only the technical boss, but like you said.

Before you wanted me to define my job and I can define it strictly as saying Henry Kissinger. You have to take these five, six or seven people and make it happen. You've got to take it out of their heads, through their fingers, through all the electronics, onto the tape, onto the disk and make everybody be happy with each other when it's all done. There's nothing to it! And to me, that's the producer's greatest asset — diplomacy. You have to have the act's respect. But at the same time, the act has to know that they can override you. It's got to be give and take.

I'm not an authoritative figure; I'm not a dictator in the studio in the working context. I'm a clearing house; I'm the court of last resort; I'm the speaker of the house, you know, the vice president. I don't vote unless there's a tie. I'll let those guys hear it out and I'll just give a little direction here and there and then change a word here and there. Just keep on top of it, that's all.

■ ■ ■

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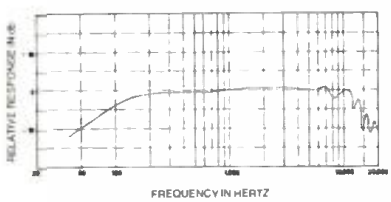
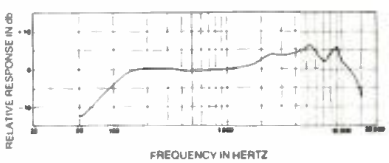


...some like a "presence" peak.



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