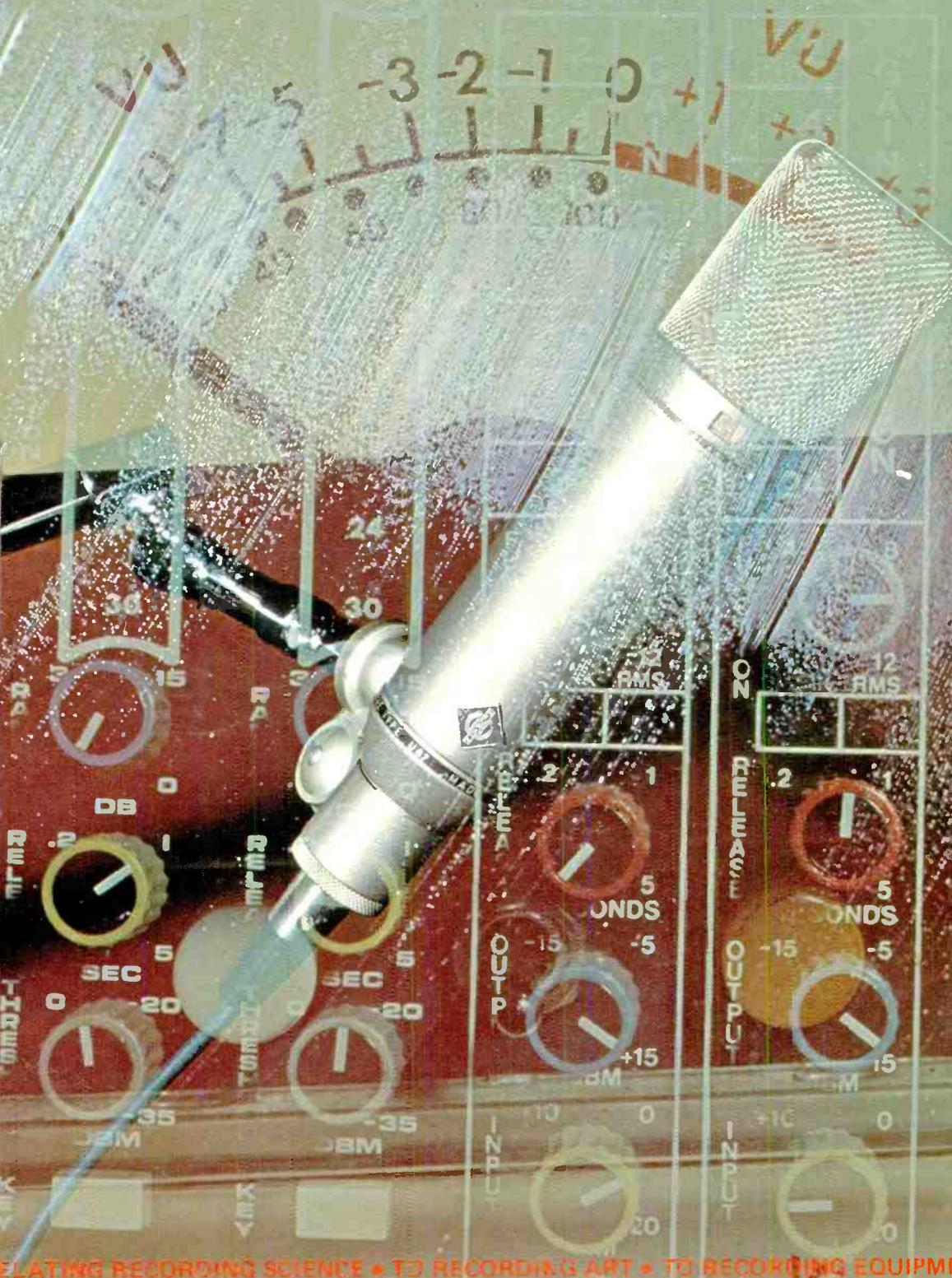


Recording engineer producer

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OCTOBER
MAGAZINE 5 NUMBER

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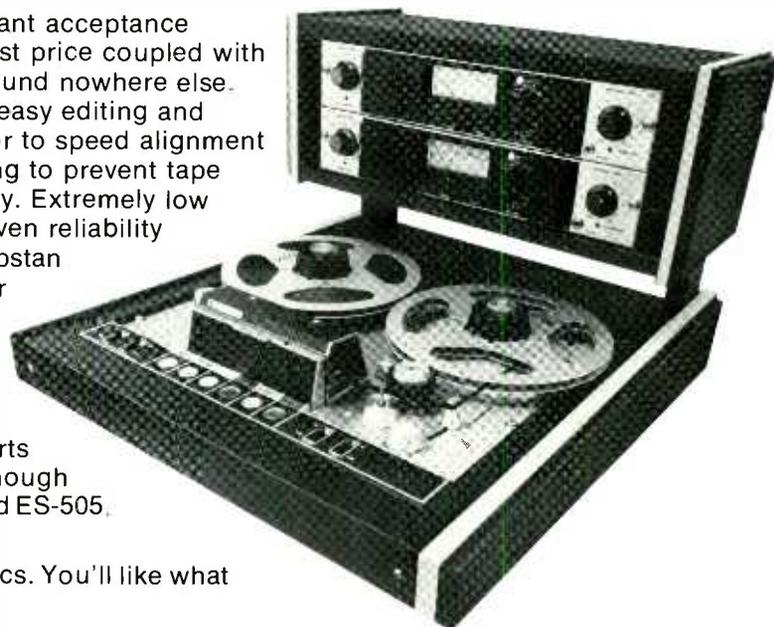
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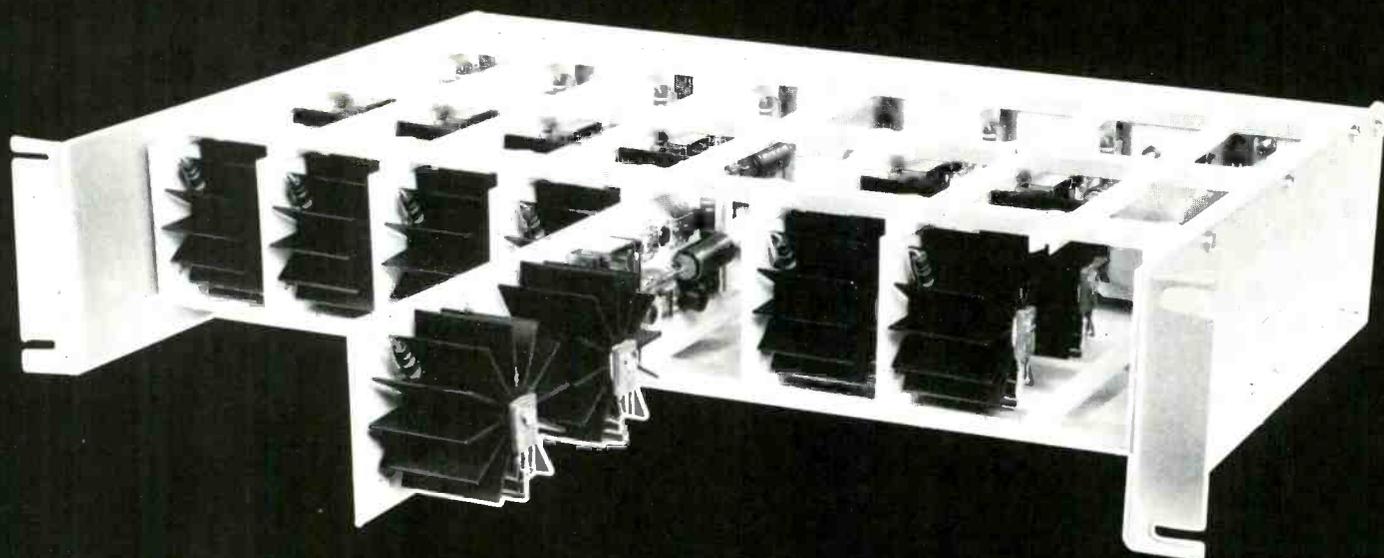
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The Cover: A combination of double exposures: the U-87 over a brilliantly lighted pressing, and the VU meters over a rack of Kepex by GARY DAVIS creates the cover montage.

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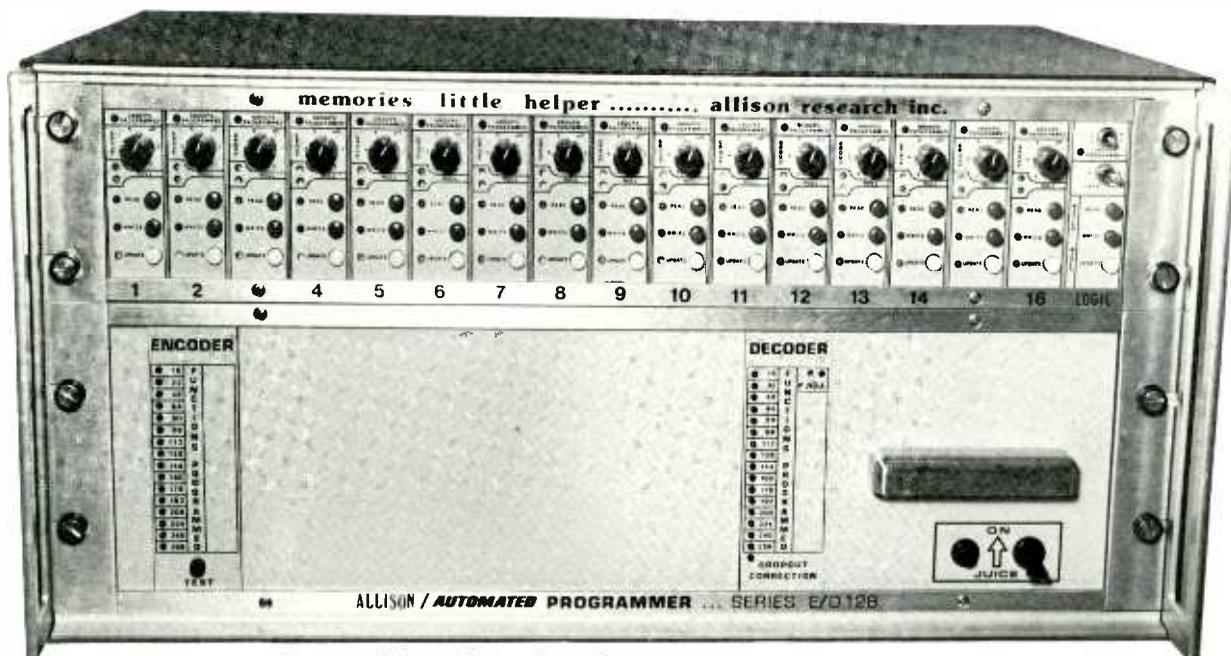
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have it your way,

OK. LOOK. TAKE OUT THE STRINGS ON THE SECOND EIGHT OF THE FIRST VERSE, RAISE THE HORNS ON THE "DO DUM DUMS," BRING UP THE VOCAL GROUP ON THE "LA-LA'S" BUT KEEP THEM DOWN ON THE "LU-LU'S". THE LEAD VOICE IS FLAT ON THE FIRST EIGHT OF THE SECOND VERSE, SO TAKE HIM OUT AND BRING UP THE FLUGEL HORN. THE BRIDGE IS WEAK SO LET'S RE-STRUCTURE THE WHOLE MIX AT THE SECOND EIGHTH NOTE OF BAR TWO. YOU KNOW, BASS, GUITAR AND DRUMS UP, STRINGS AND HORNS OUT, AND START PANNING EVERYTHING ELSE IN CIRCLES, BUT WATCH THE "LA-LA'S" AND "LU-LU'S". BY THE WAY, IF YOU DON'T GET IT RIGHT THIS TIME I'M GOING TO HIT YOU WITH THIS WRENCH!!!



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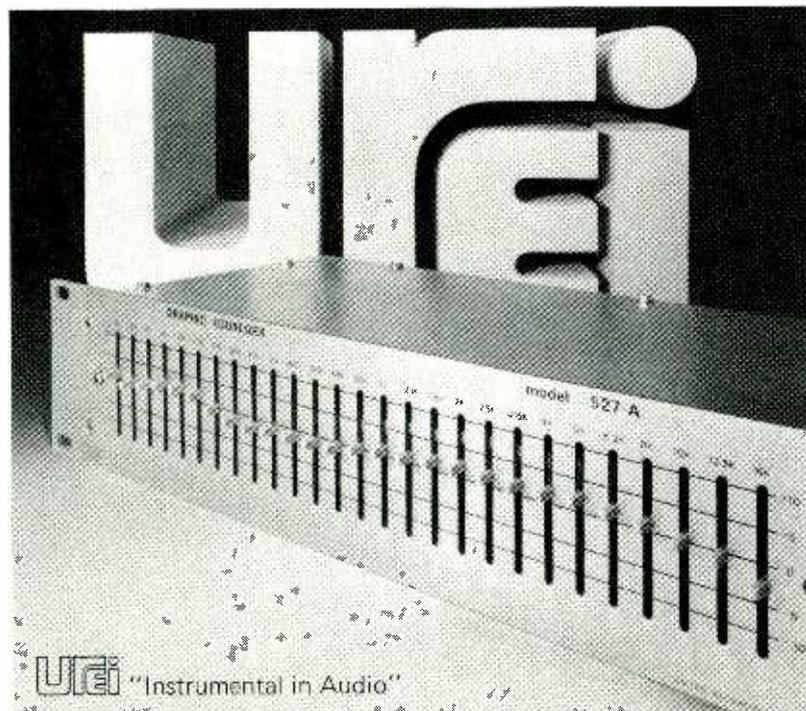
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Letters &

Late News

From: HAM H. BROSIOS
PRESIDENT
AUDIOTECHNIQUES, INC.
142 HAMILTON AVENUE
STAMFORD, CONN. 06902

We appreciate, very much, the opportunity R-e/p has offered for AUDIO-TECHNIQUES, as another of the major studio builders, to present an *Eastern* approach to studio acoustics and design as practiced by our company. In order to establish a good approach to this project we analyzed the excellent articles R-e/p has recently published on the topic, beginning with . . .

GEORGE AUGSPURGER's informative piece on his design work at Village Recorders . . . then on to TOM HIDLEY's fine job on the historical background of Westlake's current acoustic practices . . . and most recently, DAVE HARRISON's common sense studio construction article that is loaded with valuable tips.

Well, after considerable reading, re-reading, studying and comparing the articles by these three experts (and, believe me, we mean experts . . . these guys are really tops in the field!), we began to realize that for the most part we were sitting there nodding our heads and agreeing with them . . . (and not only that, they seemed to agree pretty much among themselves). And, we were well on the way to writing a "me too" article. Let us point out just a few examples and maybe you can see the problem.

(1) A symmetrical control room is a must!

Augspurger . . . "make the left and right halves of the room identical."

Hidley . . . "The slightest departure from room symmetry can detract from uniform acoustic performance."

(2) Control room ceilings should be false!

Harrison . . . "a trapped false ceiling is installed approximately 8 feet above the platform to totally attenuate the vertical mode of the room."

Augspurger . . . "the false ceiling is low, right over the console . . . that's part of the basic approach."

(3) Control room ceilings should be "V" shaped.

Hidley . . . "the ceiling would slope down toward the mixer . . . and slope up just ahead of him, behind him or right overhead. This was effective and helped break up the floor to ceiling standing waves."

Augspurger . . . "The angled ceiling does double duty . . . the area above it becomes a bass trap and the geometry of the angle is designed to break up the floor to ceiling standing waves."

(4) Carpet is good!

Hidley . . . "A floor with dense carpet will attenuate these sounds sufficiently..."

Harrison . . . "An absorbent carpet on the floor is beneficial . . ."

(5) Control Room Monitor equalization is primarily for correction of monitor deviations.

Augspurger . . . "accidental overloads, horrendous operating levels . . . these things (monitors) will shift dramatically over two to three months."

Hidley . . . "the primary reason (for eq.) is to correct for drift when loudspeakers begin to deviate . . ."

(6) Traps, resonators, absorbers can go almost anywhere . . . but the back of the control room is a good place to start!

Harrison . . . "the control room rear wall is trapped to the extent necessary to properly control the front to back room mode . . ."

Hidley . . . "placing broad band traps behind the mixer did a fine job of keeping the low frequencies from bouncing around the room."

Augspurger . . . "The rear wall is usually made as absorptive as possible down to the low frequency region."

Our point is that these gentlemen are truly representative of the current thinking in studio design and we are sure R-e/p isn't looking for us to write a piece that in some devilishly clever way manages to say in some different manner the same thing our friends have already written. (Who needs that?)

And, speaking of studio design, if anyone reading this is about to get a studio project under way, the six items compared previously are a pretty good initial check list. (or call George, or Tom, or Dave . . . or me) . . .

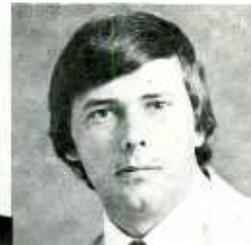
'EVERYTHING AUDIO' BOWS

As announced by founder BRIAN CORNFIELD the new studio design, construction and service organization will headquarter at 14045 SHERMAN WAY, VAN NUYS, CA. 91405. Telephone: (213) 873-4447.

Cornfield, well known in studio circles, had previously been associated with Westlake Audio and Custom Fidelity in Los Angeles. He will be assisted by longtime associate Annette Saldana, who had also been with Westlake and Custom Fidelity.

ALTEC REALIGNMENT OF PROFESSIONAL SOUND PRODUCTS RESPONSIBILITIES ANNOUNCED

As announced by W. F. Gannon, corporate vice president, operations, of Altec Corp., a number of new assignments, of interest to the professional audio market,



have been announced.

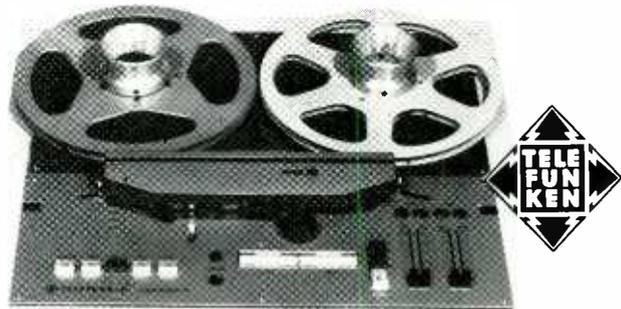
Charles E. VanLiew has been appointed as vice president-general manager of the Sound Products Division.

Robert Rufkahr, promoted to vice president, marketing, for the Sound Pro-

ducts Division.

Mark Engbretson, promoted to director of new product development, Sound Products Division. Succeeding Engbretson as marketing manager, Professional Products, is Jerry Hogerson.

Gotham Audio takes a progressive step backward.



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tension over the entire length of the tape. It also eliminates the need for brake solenoids. Typical weighted peak flutter: $\pm 0.02\%$.

Telefunken's recently developed ferrite heads and sintered ruby tape guides are so rugged that they are guaranteed for 15 years.

Take a progressive step backward to Telefunken. You'll get the benefits that can come only from the experience of the world's first tape recorder manufacturer. And you'll get these benefits at just about the same cost that you pay for domestic professional recorders.

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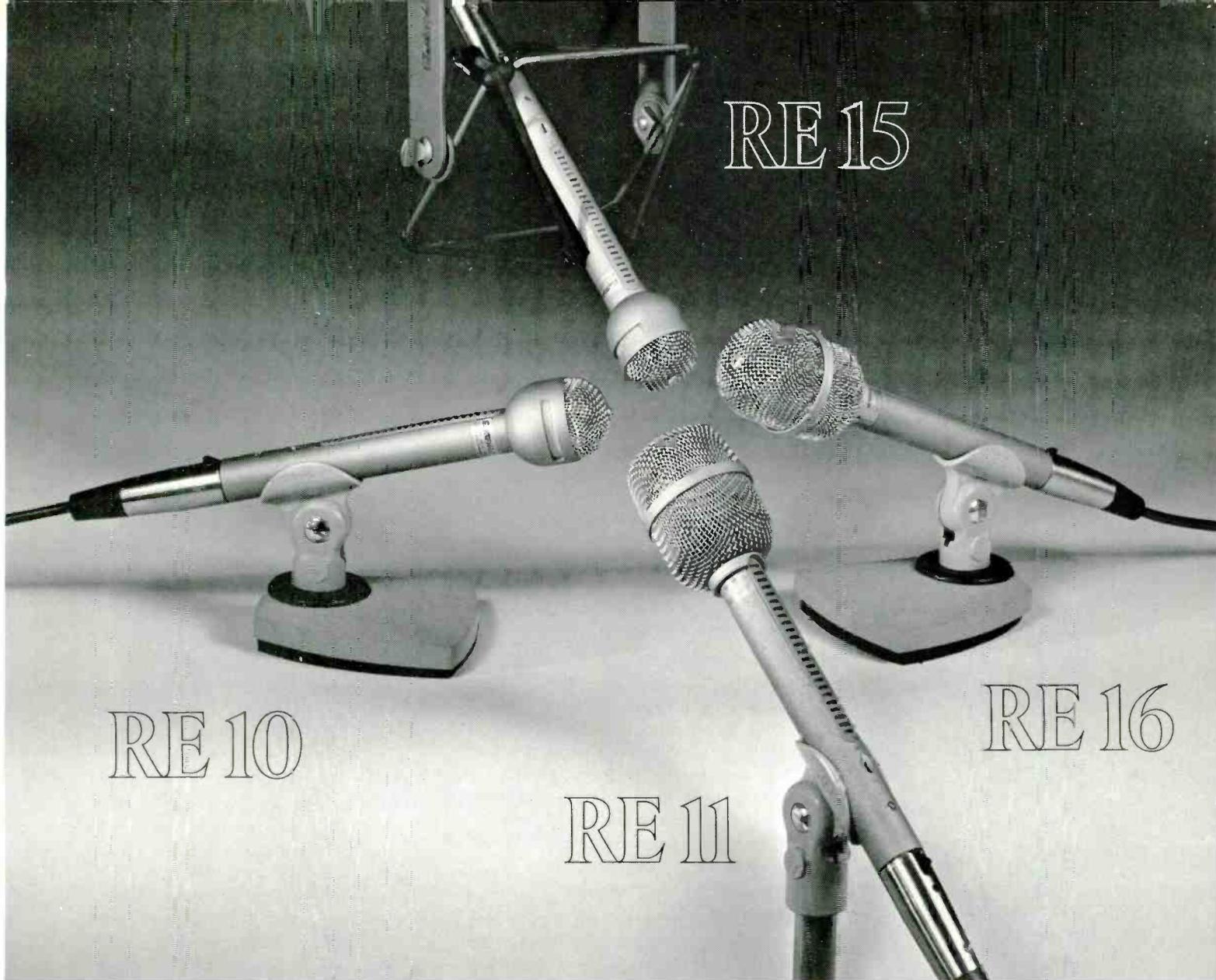
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RE 10

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These four great cardioid microphones give you new freedom to head off sound problems before they start. Your E-V microphone headquarters has them waiting. Choose today.

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Electro-Voice manufactures quality audio equipment for broadcast, recording, and sound reinforcement including all types of microphones, audio studio monitors, speakers and enclosures, sound systems and stands.

For years, I knew Jimmy Miller only through album credits. "Why is it," I wondered, "that I've never read one thing about him, or even seen a photo of him? Could it be that there really is no Jimmy Miller?" Perhaps it was a pseudonym for someone else, who wished his true identity kept secret. Maybe it was a cover for some sort of production company, composed of a half-dozen efficient but otherwise drab technical experts. I could not rule out the possibility that "Jimmy Miller" was a wholly fictitious person — the Stones playing a little joke on us all by conjuring up an imaginary associate (a la their early co-writer "Nanker Phelge").

Three years ago, I met and ultimately came to know the man behind the myths. To most, though, he remains a mystery. This is because he shies away from publicity, preferring to eschew the notoriety and self-aggrandizement potential of his position for the artistry of his craft. Still, this unorthodoxy hasn't prevented him from being one of the decade's most successful record producers. Since his first release back in 1966¹, he has gone on to produce some of the era's pre-eminent acts (among them being Traffic, Spooky Tooth, Blind Faith, Delaney & Bonnie, and the Rolling Stones), garnering 11 gold records in the process.

The most recent Rolling Stones album, "Goats Head Soup," is maybe their most controversial ever. Alternately celebrated and damned, it nevertheless managed to attain and hold down "Billboard"'s No. 1 position for four weeks during October/November of 1973.

"Soup" stands in notable contrast to the Stones' previous effort, "Exile On Main St.," in its "sound," arrangements, and mixes. "Soup" has maybe the richest sound of any Rolling Stones album — especially apparent in the piano, drums, and strings. "Exile," on the other hand, has maybe the thinnest sound of all their stereo LP's. Still, (in the tried-and-true Rolling Stones tradition) they both have what is commonly referred to as a "dirty" sound.

This was achieved on each record by totally different means, however. "Exile" is dirty because it has so many tracks per song and not much

"depth," resulting in a curious "one-dimensional" quality reminiscent of early stereo recordings. "Soup," however, has a very contemporary type of dirty sound, achieved through the use of studio ambience, leakage, tape delays and stereo miking/mixing.

Arrangement-wise, "Goats Head Soup" harkens back to earlier days. Most obviously, there is less brass, with longtime Stones sidemen Keys, Price, et al appearing on fewer cuts, usually with a much less prominent mix. Also, there is not the female chorus that was so evident on the previous album. Two of the songs even feature strings, an instrumentation not used since "Sticky Fingers" (1971).

On "Goats Head Soup," Mick Jagger debuts on piano, and even sings some up-front harmonies to his lead vocal (again a technique not used for many years). Keith Richard, that all-important rhythm guitar, is back to playing Gibsons after a brief romance with Fenders on the previous album. On "Soup," lead guitarist Mick Taylor unveils his latest style, using wah-wah, phase shifting, and Leslie.

As far as mixing goes, "Goats Head Soup" is a much more dynamic and visual record than its predecessor. Because of its sparser instrumentation, there was more room to experiment with stereo miking/mixing and tape delays, creating a lot of "omnipresent" tracks whose placement within the stereophonic spectrum is difficult to ascertain. The album's vocals, though sometimes buried, are often clearly audible. The bass guitar, a lost casualty on "Exile," has been brought back up, occasionally being a tune's most "up-front" track. The drums are more prominent as well, with Charlie Watts receiving perhaps his widest stereo spread (the overall effect of which he tends to minimize by not moving around much). Of interest is the album's greater use of dynamic panning, which occurs on five of "Soup"'s 10 songs. Also reminiscent of earlier days ("Satanic Majesties" in particular), there are some laterally-placed background vocals.

P.L.

album production analysis:

GOATS HEAD SOUP

an indepth interview with

Rolling Stones

producer

JIMMY MILLER

by

Paul Laurence



PAUL LAURENCE: What were the circumstances surrounding the making of "Goats Head Soup?"

JIMMY MILLER: It was done in two segments — late winter '72 and spring of '73. We chose to do it in Jamaica for a number of reasons, one being that the Stones couldn't record in Britain, as they're supposed to live and work out of the country for a couple of years.

When you get right down to it, there aren't too many countries where you can get top notch recording facilities. Germany has pretty good studios, so does Japan. When you start to get into the other countries, you find that only the major label (like RCA or CBS) has adequate studios, and then they're usually pretty booked up. We prefer to use block book-

ing, where you can have the studio day and night — any time you fancy going in, you can. Dynamic Studios in Kingston was very willing to do such a block booking for us. Also, it's a nice climate and area — a very musical country to begin with. There just always seemed to be music about. Jamaica has hundreds of record shops — there are probably more per capita than in any other country. If there are two in one block, for example, they try to drown each other out with their loudspeakers, just blasting reggae music out into the streets. As you walk along, one starts to take over before the other dissipates. It doesn't much matter because the records are so similar. When I was down there, the No. 1 song had been No. 1 six times — the same basic track slightly reworked!

¹. "Gimme Some Lovin'"/"Blues In F" (United Artists 50108) by the Spencer Davis Group, released December 1966.



LAURENCE

MILLER

at ABC-DUNHILL STUDIOS

PAUL LAURENCE: *Were there any basic concepts or ideas you wanted to realize with "Goats Head Soup," or was it just another album?*

JIMMY MILLER: The first night I arrived in Jamaica, I remember Mick and I sat down and talked into the night about the album, and kind of reflected on the last one ("Exile on Main St."), which had been a lot of trouble. The only thing we were really shooting for was stronger material, which we all agreed was somewhat lacking with "Exile."

PAUL LAURENCE: *What were some of the problems with "Exile?"*

JIMMY MILLER: Well, first of all, it was recorded in a basement – the bottom of Keith's house in the south of France. We used the Stones' mobile truck, which is really a great truck.

PL: *Is that the same one that was in Britain?*

JM: Yes, the same one that was at Stargroves – that's Mick's house. The only thing about the truck is that its equipment is fine, but you can't make it sound better than the place you're using. Stargroves, for example, was lovely for recording. That great hall with all of its wood and that big bay window from floor to ceiling . . .

PL: *What tunes came out of that set-up?*

JM: "Bitch" was done at Stargroves, "Sway" – a good portion of "Sticky Fingers." Also "Bent Green Needles," which later became . . . "Sweet Black Angel." Anyway, in France we had problems with not finding an adequate place to record, finally settling on Keith's basement. It was very hot and humid, and not at all conducive to good sound. Another minus factor was that it didn't let the band play together as a unit. We were all spread out in different rooms – it wasn't one big basement, but several different rooms in fact. We ended up with Nicky (Hopkins) in the "Piano Room," a "Horn Room" with Jim (Price) and Bobby (Keys), etc. The way we had it set up,

Bill (Wyman) had to stand out in the hall! This of course prevented them from playing off each other visually, you know, feeling the other players. The sound was really pretty bad, but what can you do? I think we were there from May till November, taking our time recording. We really worked to get the best sound out of the place we possibly could, but we were still aware that it wasn't what we were after or what we particularly liked.

PL: *I'm surprised that this situation, of all the others, would be the one to have generated a double album.*

JM: Yeah, it does seem a bit strange. I can tell you why, though. It was the first time that we ever had a situation where there was unlimited time – there were no deadlines. It was also the first time that we were all living that close together for that long a period of time. Charlie (Watts) was the farthest away – it was about a two-hour drive – but he used to stay at Keith's during the week and go home on weekends. Everyone else was within 15 minutes. You can see where the basic situation lent itself to a lot of tapes being done, despite all the sound problems.

Personally, there aren't that many double albums that I'm fond of. I think that most could have made great single albums if only the best half had been used. I feel that way about "Exile on Main St." too. You know, someone will say, "Have you heard such-and-such a cut?" and you'll say, "Which one is that?" – Oh yes, that's that one on side four. I haven't gotten there yet." It's hard to make a double album a living, breathing entity. Even with it being a double album, we had a lot of material left over.

PL: *Did any of those tunes appear on "Goats Head Soup?"*

JM: Surprisingly enough, no. I expected that when we went to Jamaica, we would be taking along some of those unused things and re-doing them or overdubbing them. We didn't because Mick and Keith had written some new songs, and were more keen on them. The left-over tracks

were just thought of as being the weaker ones – better to go and get on with something new that you're excited about, rather than re-hash some old things.

PL: *What about the brass players – were they there for the basic tracks, or did they come in for two weeks of overdubbing? For my tastes, "Exile" has far too much brass.*

JM: Well basically it was because they were there. You know, we'll run through a tune and they'll be coming up with a horn line that's nice. Maybe the song *doesn't* need it, and you probably wouldn't use horns if you'd thought about it beforehand. But it's like playing in a ball game when you're a kid – you don't want to have to tell someone they have to sit this one out, 'cause they want to play too. You're aware that the horns are superfluous, but at the same time, it's all part of the atmosphere. I look at that album as the summer of '71. Somehow it was a long hot summer.

PL: *It seems to me that the Stones have fallen prey to a kind of "musical levelling" as far as their instrumentation goes. They used to really build their tracks from the ground up – "Lady Jane" for example had acoustic guitar, dulcimer, and harpsichord. Nowadays, there's almost always two guitars and piano, to where a lot of their songs begin to sound the same.*

JM: That's true, especially with "Exile." Much of this was because we were in France and we couldn't get the people who could play those other instruments. If you're recording in London or California, for example, and you want a steel guitar, you ask who's around and you can get a really good steel player. When you're in France, though, you've got to do it yourself. You're right, though – we fell into the trap of being locked into the same instrumentation instead of treating each song as a separate entity and developing it along those lines.

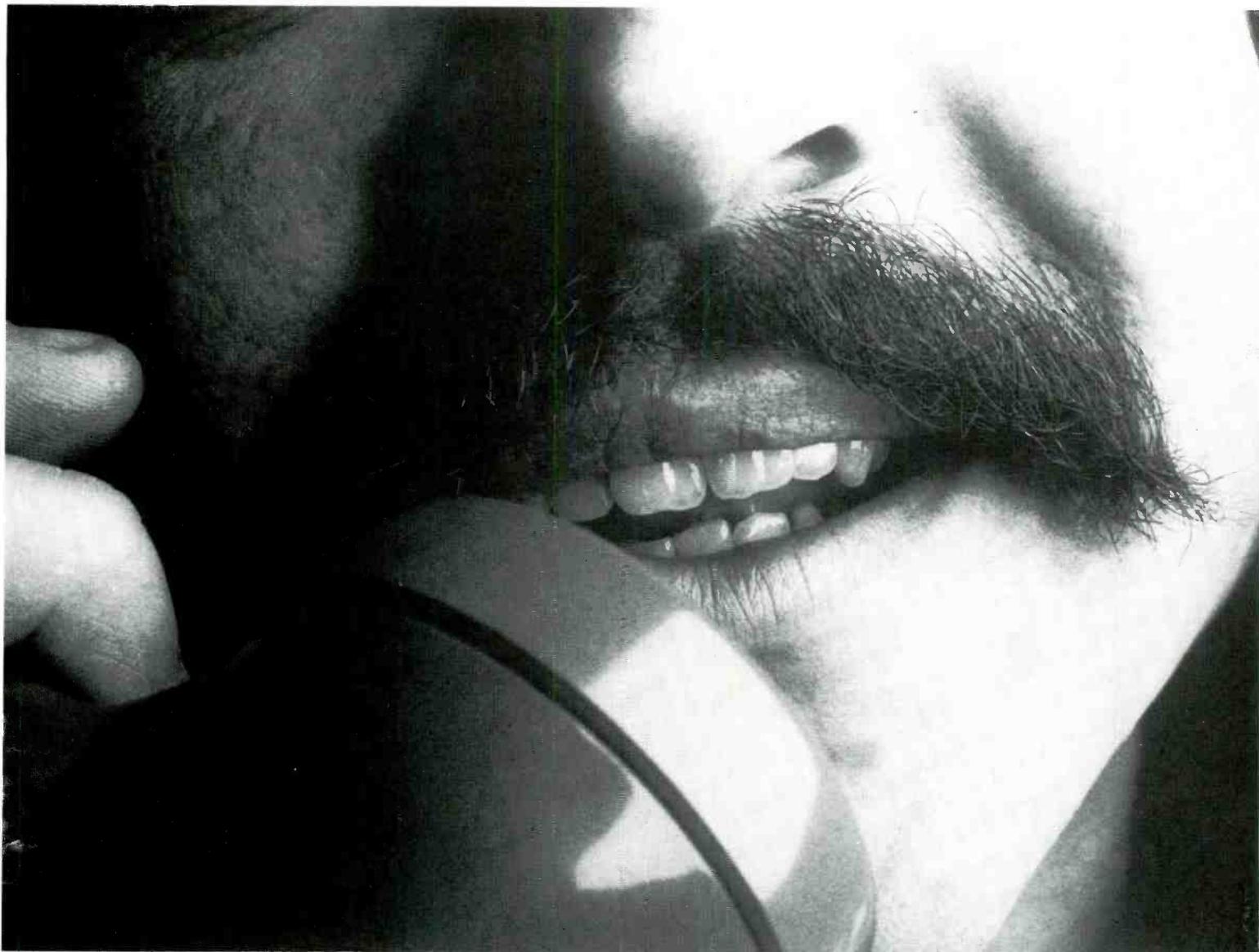
PL: *I guess the fact that Nicky Hopkins can play a good part to almost any song is also a contributing factor. Brian Jones, on the other hand, was much more limited as a keyboardist.*

JM: Yeah, when Nicky starts playing, your song immediately starts to sound like a polished, professional track.

PL: *I've always felt that the Stones let some "turkeys" out on "Exile." With the Beatles' double album also – you could tell that they really racked their brains to put something down.*

JM: It's true. We really had no material ready for "Exile." We recorded every night without having any definite songs – most of them were half blows that evolved into songs. That was another consistent problem with that album.

continued



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(at this point, the "blindfold test" was initiated and "Goats Head Soup" was put on)

"DANCING WITH MR. D"

JM: Back to Jamaica! That's Keith on rhythm. The double tracked lead is Mick Taylor, playing through a Leslie.

PL: The Stones really don't feature lead guitar, except for maybe three or four solos per album. Mick Taylor seems to always be in the background or at the end, snaking around. Myself, I think that's a stronger basic concept — a rhythm guitar band versus a lead guitar band.

How did you get so much depth on this album? Was that the intent — to have a lot of leakage — or did it just happen?

JM: Our studio set-up, I guess, had a lot to do with it. We didn't put up a lot of baffling and stuff — the band pretty much set up like it was a live show. I might add that the baffles we did use weren't even real baffles — they were just homemade cushions or pieces of foam that we kind of threw around the amps. As a result, there was a lot of leakage, but it was the kind of leakage that helps their sound.

PL: Is that Mick doing those screams?

JM: No — I was hoping you'd ask that, though. Originally, we planned to have a chick come in and do that part. Instead,

Mick got a hold of this tape from Hammer Films. It was of a chick who was auditioning to do some screaming for them. It was so funny, 'cause it had all these different kinds of screams on it — a whole production of screams! You'd hear the director say, "Okay, dear, are you ready?" and she'd say, "Yes," and he'd say, "All right, we're rolling," and then she'd let out this bloodcurdling scream. It was so funny, she even started laughing at one point.

"100 YEARS AGO"

JM: "100 Years Ago" was one of those tracks that didn't mix well. Needless to say, it was the track I was most sick of hearing by the time we were all finished. Also, this was the one where the bass was so out of tune. We must have done the bass 20 times on this track, in Jamaica, at Village, back in England . . .

PL: From the chording, I would guess that this is primarily Mick's song. Is that right?

JM: Yeah.

PL: To what extent do Mick and Keith collaborate on each other's songs?

JM: They don't really "collaborate" in the traditional sense of the word. They independently write songs, or bits of songs, which they put down on cassettes. When they get together, each will help the other finish or polish up the other's tunes. For example, Keith will bring in a

song where he's got the story and the refrain figured out, but needs some of Mick's really nice visual lyrics for the verses. Mick quite often writes on piano rather than guitar, but when he plays it for Keith, Keith'll come up with a riff or a hook that will really help the song — give it something that it didn't have as just a piano demo. This is how most of their tunes are written, at least since I've known them. It's really kind of a refining process, rather than them starting from scratch together.

PL: As far as lead guitarists go, I would imagine that Mick Taylor is one of the hardest to mix, because he's always changing his volume and his circuits. You can tell that he's been "mixed" when his guitar is at the same level but the distortion level has changed.

JM: Yes. He's always being told to turn down, but he never really does.

PL: Were there any cuts between the three segments of this song?

JM: No, we did them all in the same take. We said, "We could add them, but that's kind of cheating," so all the tempo changes were done live like this.

PL: Do you remember who's on bass here?

JM: Keith, I think.

PL: Why did the guitarists play so much

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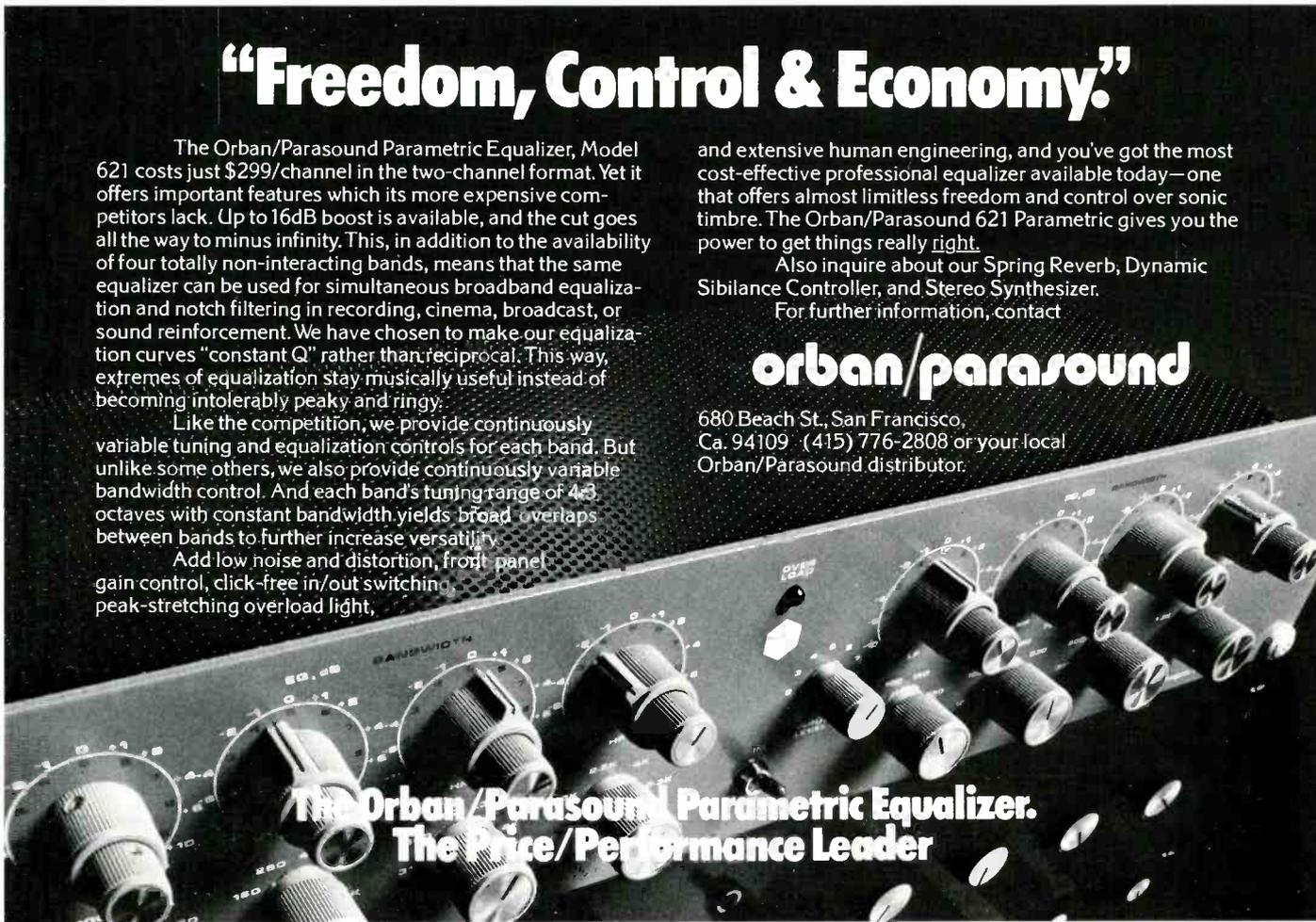
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bass on this album?

JM: Bill was a few days late to Jamaica — a couple of the tracks he's not on are because of this. Also, occasionally Keith will sometimes almost write something with a bass, like "Live With Me," and say, "I'd like to play bass on this one because I know exactly what I'm after."

Billy (Preston) was a great help on this album. He picks up so quickly on things — you know, Mick'll play him a song one time and he'll go over to the piano or the clavinet and have it all figured out. His time, his groove is always so good.

"COMING DOWN AGAIN"

JM: That's me on scraper.

PL: What's that instrument really called?

JM: A guida? Gouda? I've also heard it called an oard. We used it in "Gimme Shelter" too.

PL: That piano is all over. Do you have a lot of delays going?

JM: Yes, I'm sure we do. Still, the real problem was that we were picking up so much guitar and drums over the piano mikes. We had the lid down as far as it could go, with the mikes stuck inside.

PL: Do you do your delays at the time of recording?

JM: Usually all types of echo are done afterwards. We may do it for monitoring,

but it's not on the tape. Once it's on tape, you can never take it away if you change your mind.

PL: When you're cutting a basic track, does Keith sing live?

JM: No, because he's trying to concentrate on his playing. Lots of times Mick will sing for the cans even though Keith will be doing the final vocal.

PL: After years of resisting, I've really come to love Keith's singing.

JM: Me too. There's a funny story behind how he started singing lead. Mick was in Australia making "Ned Kelly," and I was finishing mixing "Let It Bleed" with Glyn (Johns). We wanted to backward echo a bottleneck guitar track — you do this by turning the tape over and recording your echo on an open track. When you play the tape right-side-up, the echo is backwards. Glyn forgot that when you turn the tape upside down, the track order is reversed, and accidentally erased Mick's lead vocal. As Mick couldn't get away, Keith went in and sang it. The song was "You Got The Silver" — it worked out great in the end, really a very fortunate accident.

PL: Aren't the saxes here at (placement) points 2 and 4?

JM: They could very well be. With the Stones, we rarely send something to one

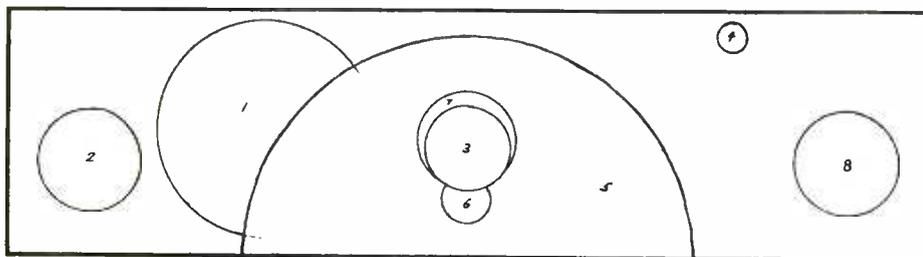


Fig. 2. Visual schema of "100 Years Ago" (first segment), illustrating the Rolling Stones' "wall of sound without the holes." (The numbers indicate the entrance order of the various tracks.)

- | | | |
|----------------------|-----------------------------|---------------------|
| 1. CLAVINET (stereo) | 4. TAPE DELAY OF LEAD VOCAL | 6. BASS |
| 2. PIANO | 5. DRUMS (stereo) | 7. BACKGROUND VOCAL |
| 3. LEAD VOCAL | | 8. GUITAR |

side only. They don't like a real stereo stereo — they like more of a wall of sound without the holes. So many of their things actually sound better in mono.

PL: *Charlie's really good here. A funny thing about him — he's nowhere near the best technically, but at times he sounds like the best drummer in the world. He's got a definite power, which is more than the sum total of his time and his riffs and his concepts.*

JM: It's true. I've worked with a lot of drummers — a lot of great drummers — but no one is better for the Stones than Charlie. I just can't see them with anyone else. He's got a very distinctive style. Some of his breaks are so funny because he almost doesn't make it. Somehow though, he does. He just can't believe he's where he is. If he had more confidence in himself . . . then he wouldn't really be Charlie, I guess.

**"DOO DOO DOO DOO DOO
(HEARTBREAKER)"**

PL: *One of the amazing things about this tune, something I've really only heard on*

Stones' records, is that you manage to give the brass a demonic, scary sound.

JM: That goes for "Bitch" also.

PL: *What effects did Mick Taylor use for the solo?*

JM: I think we did that in the mix, really. Maybe a bit of phasing.

PL: *About how many backing vocals are here?*

JM: Mick and Keith probably overdubbed three or four times — maybe eight voices in all.

PL: *In the last two albums, they seem to favor what I call the "angry mob" approach with the backing vocals. They don't make it sound like individual voices as much as a group of people standing around a microphone. "Sweet Virginia" had this too.*

"ANGIE"

JM: This was originally Keith's song, believe it or not. It was "Anita, I need ya." Mick's voice was sped up a little on this track.

DISCOGRAPHY

BLIND FAITH

BLIND FAITH (Atco SD 33-304), Jimmy Miller, July 1969

- Do What You Like (Ginger Baker)
- Had To Cry Today (Steve Winwood)
- Presence Of The Lord (Eric Clapton)
- Sea Of Joy (Steve Winwood)

THE ROLLING STONES

AFTERMATH (London PS 476), Andrew Loog Oldham, May 1966

Lady Jane (Mick Jagger; Keith Richard)

BEGGARS BANQUET (London PS 539), Jimmy Miller, November 1968

- Street Fighting Man (Mick Jagger; Keith Richard)
- Sympathy For The Devil (Mick Jagger; Keith Richard)

EXILE ON MAIN ST. (Rolling Stones COC 2-2900), Jimmy Miller, May 1972

- Casino Boogie (Mick Jagger; Keith Richard)
- Happy (Mick Jagger; Keith Richard)
- Sweet Black Angel (Mick Jagger; Keith Richard)
- Sweet Virginia (Mick Jagger; Keith Richard)
- Tumbling Dice (Mick Jagger; Keith Richard)

LET IT BLEED (London NPS 4), Jimmy Miller, November 1969

- Gimme Shelter (Mick Jagger; Keith Richard)
- Live With Me (Mick Jagger; Keith Richard)
- Monkey Man (Mick Jagger; Keith Richard)
- You Can't Always Get What You Want (Mick Jagger; Keith Richard)
- You Got The Silver (Mick Jagger; Keith Richard)

STICKY FINGERS (Rolling Stones COC 59100), Jimmy Miller, April 1971

- Bitch (Mick Jagger; Keith Richard)
- Sister Morphine (Mick Jagger; Keith Richard)
- Sway (Mick Jagger; Keith Richard)
- You Got To Move (Fred McDowell)

THEIR SATANIC MAJESTIES REQUEST (London NPS 2),

The Rolling Stones, December 1967

THROUGH THE PAST, DARKLY (BIG HITS VOL. 2) (London NPS 3), Andrew Loog Oldham, Jimmy Miller, and The Rolling Stones, August 1969

- Honky Tonk Women (Mick Jagger; Keith Richard)
- Jumpin' Jack Flash (Mick Jagger; Keith Richard)

TRAFFIC

MR. FANTASY (United Artists UAS 6651), Jimmy Miller, March 1968

Hole In My Shoe (Dave Mason)

ARTIST

**ALBUM (Label and Code Number), Producer, American Release Date
Song (Author)**



I said, "How about Mick Taylor?" and Mick said, "Oh, he's terrible!" . . .

It turned out to be a completely different Mick Taylor!

PL: *Was that due to your slowing the track down so Mick could hit some of the high notes?*

JM: The key was a little high, yeah.

PL: *Why didn't you tune the guitars and bass down and have Mick sing to it in a slightly lower key? Then you could have VSO'ed it up to overdub the piano, and Mick's voice would have its normal timbre.*

JM: Because we didn't realize any of this until the track was finished and we got around of the vocal. Also, maybe because Keith was originally going to sing it, and it would have been all right for him.

PL: *I really like these strings — the way they creep in and out. Another interesting thing is that you heightened the emotional pitch by using a low instead of a high string part. Generally, how are the string part created — does Mick call up Paul Buckmaster or Nicky Harrison and say, "Write me an arrangement for this song," or does he try to work a specific idea out with them?*

JM: Closer to the latter. He likes to get together with them and hum or sing some lines that he can hear the strings doing. For some parts though, he'll say, "Do whatever you feel" — he gives them some leeway as well.

PL: *Who's on bass here?*

JM: I think it's Bill but I'm not sure. Often, one of the guitarists will play the bass live, and Bill will come in later and re-do it. To further complicate things, he'll occasionally pick up on some of the riffs that Keith or Mick Taylor played, so the bass track is often a real "group effort."

"SILVER TRAIN"

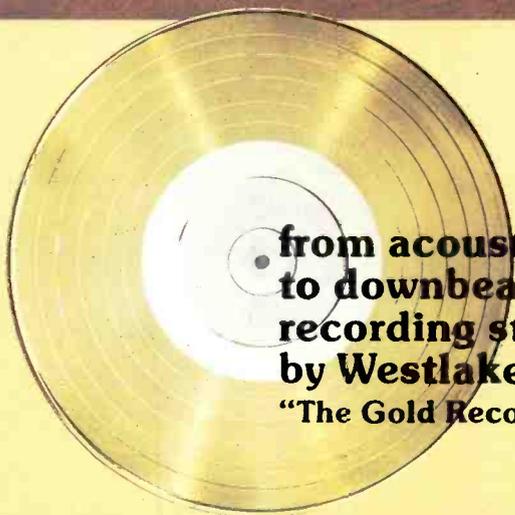
JM: This tune was written originally for Johnny Winter, as Mick promised him a song. They cut a rough demo for him, which turned out so good that they decided to do the song on their own album. As a matter of fact, this is that demo.

PL: *Offhand, I can't think of any artist who's had a bigger hit with a Jagger/Richard tune than the Stones.*

"HIDE YOUR LOVE"

JM: This was the one track that wasn't done in Jamaica — it was done at Olympic.

continued on page 25



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... Mick
doesn't like
to use
a booth—
He prefers
to be
right
out
with the
band

using a hand-held mike!

PL: I noticed that in a couple of other places — “100 Years Ago” and “Angie.”

When and how were the strings done?

JM: We did them back in England, at Olympic. I think there were eight violins, four cellos, and two violas — something like that. Each part was doubled, for a total of about 28 actual instruments.

“CAN YOU HEAR THE MUSIC”

JM: Mick brought in that bit of tape, that “jungle music,” which we later faded into the song during the mixdown.

PL: I was hoping that the Stones would have embraced a little more of the local influences than they did on this album.

JM: I think it was because they had the songs ready this time. If it had been more like France, that probably would have happened.

PL: Did you get a chance to hear much of the local music?

JM: Not a whole lot, because we spent so much time in the studio. We'd usually go in twice a day. We'd get up around five in the afternoon, eat, go into the studio, come back before the kitchen closed at 11:00 to have dinner, and then go back in for more recording.

That organ is Leslie'd. We used a lot of VSO'ing on those background voices — up and down.

PL: To what per cent were they varied?

JM: Quite a bit, almost to the Mickey Mouse point on the high ones.

PL: At what point does it become “Mickey Mouse”?

JM: Well, it depends on the tempo of the song to begin with. Generally though, I'd say at around a step-and-a-half up.

“STAR STAR”

JM: After “Goats Head Soup” was finished, the label pulled an old London

Records trick on us and said that they didn't want to use this song, whose real title is “Starfucker.” They finally said that we *could* use it if we changed the title and remixed it and kept the voice down. We wanted to remix it anyway, because we weren't especially pleased with the original mix, but there was no real effort to put the voice any lower. It was taken back in and they said, “Oh, that's better.”

PL: Was this vocal done live?

JM: No. Mick always does a vocal live for reference — for the cans — but this particular vocal track was re-dubbed. He doesn't like to use a booth — he prefers to be right out with the band using a hand-held mike. That's how come you can sometimes hear the leakage from the original vocal.

PL: Is this Bill Wyman on bass?

JM: Yeah. He plays great Chuck Berry. The solo is Keith playing through a fuzz, with heavy limiting.

PL: What happens to the song right here? It sounds like a locomotive is driving through?

JM: A lot of sounds you hear, a lot of those weird things that happen are accidental. You can sometimes trace them to the echoes you're using — we often have quite a lot of tape loops running when we're doing a final mix. I really can't describe it too well, but it happens when you're feeding a bit too much and the signal starts ganging up on the repeater.

PL: Is this what happened on “Had To Cry Today”?

JM: Very possibly. I must tell you though, I was brought in at the 11th hour on that album (“Blind Faith”). Originally, they wanted to produce it all themselves. One day, Chris Blackwell called me up and said, “The album is just about finished, but the boys really feel now that they'd like to have somebody independent come in.” It turned out that the album had to go to New York in something like four days, because it had to be out to coincide with the tour and all that.

PL: So you spent four days without sleeping.

JM: Right. I went down to Olympic to hear what they'd done, and they brought up something like 38 boxes of tape, most of which was jams! Anyway, we quickly re-did a couple of things — “Presence Of The Lord,” “Sea of Joy,” “Do What You Like” — and did extensive editing on the rest. With two nights left, it was still unmixed. I mixed all of side one one night and all of side two the next night. After that ordeal, I was really numb. When I got a pressing, I remember putting it on the turntable, playing about 30 seconds and

thinking it was just horrible. I was very embarrassed about it, never played it in my home, and generally did my best to forget about the whole thing. A few months later, I got the biggest royalty check I had ever gotten! Still, I really don't like doing something this way. I was down on the “Blind Faith” record because I felt, knowing what was in the group, that I could have done a much better job had I been involved since the beginning. It was great to work with Eric, though — I always loved his playing. Even when everybody was raving about Hendrix, I always felt that Eric was really the better player. Under any circumstances, it's good to see him re-emerge. He's one of those people who seems to be doing about 1/10 of what you wish he was doing, or what you've always felt he had the ability to do. Steve (Winwood) is another one.

PL: He's certainly not short on talent.

JM: When he was 15 — when I first met him — I imagined he would be one of the all-time musical geniuses. He's gone through his share of changes though, like everyone else. With Traffic, there were always fights with Dave (Mason). Dave's philosophy was that when you're in the studio, you should utilize it, while Steve never wanted to do in the studio what he couldn't go out and play onstage — two very different schools of thought. Being a studio person myself, I'm inclined to agree with Dave. Still, I never wanted to take sides, but rather tried to let each understand the other's thinking. The compromise was usually that Dave would have final say with his tunes, and Steve with his.

PL: Getting back to the Stones, I've always felt that they've had some of the best and most diverse drum sounds ever recorded. Generally speaking, how do you set-up and mike the drumkit?

JM: Well first of all, we use a D-40 for the bass drum. Because it gets such a good bottom response, you can use it on all kinds of bass-y instruments like bass guitar or African drums. African drums tend to be kind of toppy, but there's also a bottom there if you can get it — that dead skin sound.

Overhead we use a stereo U-67 — it gives a nice even stereo pan. For the rest, we usually use M-160s or sometimes an AKG directional whose number escapes me at the moment.

PL: Do you dub the kit down after it's on tape, or do you record it as you'll be using it in the final mix?

JM: We usually have a track for the bass drum, and then left and right sides, so we've got our stereo at the time of recording. Occasionally, we'll take a high hat or a snare separately if we think we'll want to play with them later.

... Continued



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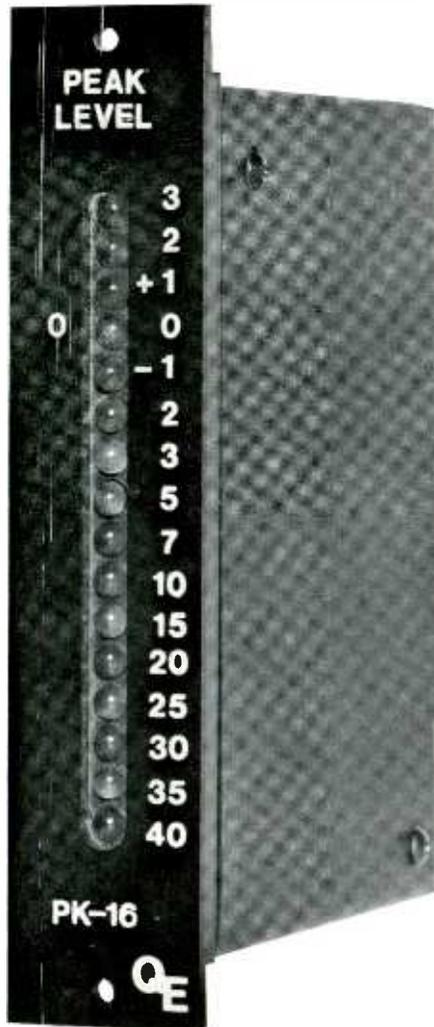
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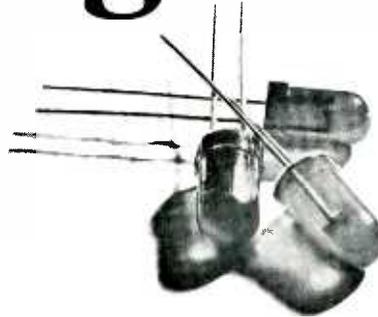
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PL: What kind of EQ do you use?

JM: A lot of midrange.

PL: What about baffling?

JM: We usually screen Charlie on three sides. Sometimes though, we take away the back baffle if the sound's too "closed."

PL: Let's talk about "Honky Tonk Women." It's the song I always think of when the subject of drum sounds comes up.

JM: I was playing cowbell on that one, so a lot of the sound in this case was Glyn.

PL: Was the cowbell done live? I've always wondered about that, 'cause Charlie kind of "falls" into that first drum hit - I've never been able to figure out how you two got together.

JM: Neither could we! It was one of those fluke things. That's what we were talking about earlier - that's Charlie. I started playing that figure, and when he came in I thought "That's wrong - he's got the time turned around completely," yet somehow it came together. I remember that night in particular - we just happened upon a great drum sound. I think we may have used a bit of compression too.

PL: Do the guitarists play through small amps in the studio?

JM: Yeah, they do usually. Sometimes Keith will even use something as small as a Champ.

PL: How about the bass?

JM: We usually take it amp and direct, each on a separate track. Bass sounds are funny. It seems to be the instrument whose sound is the least consistent in the studio. You can go in one night and have a great bass sound, and the next night - you haven't touched the set-up - it just isn't there. Then you've got to really work on it. Problems aside, you'll often need two channels of bass. Maybe with one you'll be getting a good bottom end but not much "punch," and vice versa with the other. Then you can combine them to get the best sound.

PL: Also, you should know how that particular instrument will sound direct - some just sound too rinky-dink without an amplified channel.

JM: Yeah. Sometimes we don't use the direct channel at all.

PL: How do you mike the piano?

JM: Lately we've been using M-160's. They're good because they're very directional - you can get just one side without picking up much of the other. Occasionally though, they'll make the sound too "small." When this happens, we switch to U-67s - big condenser mikes. They're primarily vocal mikes, but they get a nice rich sound with piano. They're not as



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directional as the M-160's — you can turn them all around and still get a pretty good sound. There were a couple of things on "Goats Head Soup" where we even ran the piano through an amp. The one track I can think of offhand where we did this was one we didn't use on the album — it was a calypso kind of thing.

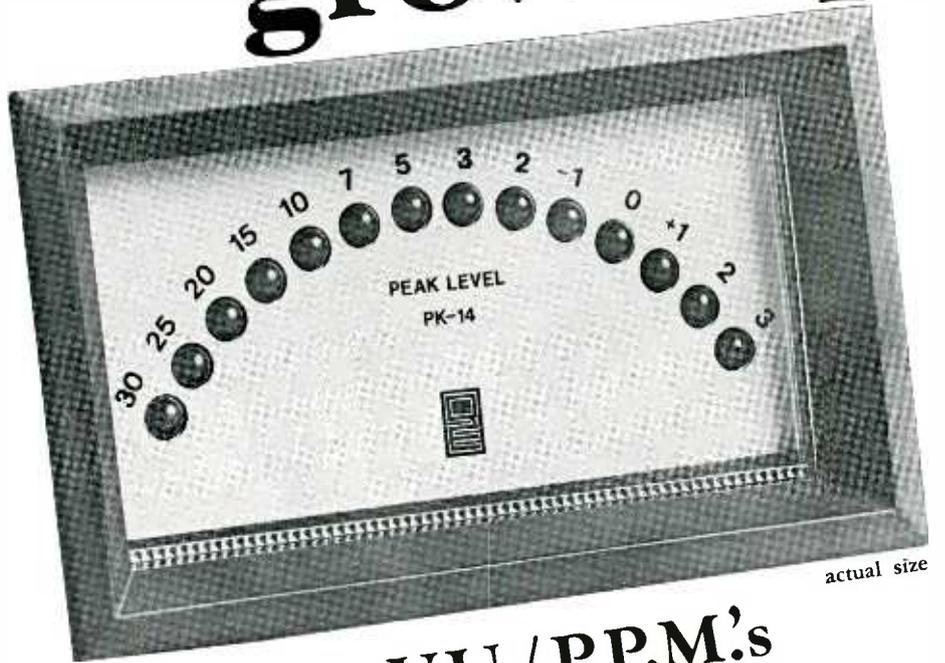
PL: How closely do you work with the engineer?

JM: Very. I think it's important to have a good working relationship with your engineers. One of the reasons I'm not more of a technically-oriented producer than I am is because I've always had the good fortune to work with such good engineers. Glyn had worked with the Stones long before I got involved. I often just leave the "sound" aspect up to him because he's got it so down. This is why I can't answer all your questions as to exactly what we did — you know, Glyn or Andy will come up with a good sound and I'll say, "Great, don't change anything!" without ever having really looked at the settings. This frees me to concentrate on the performance aspect. Because we *do* have such a good relationship, when I want something special, they'll really break their asses to make me happy. With Andy, it's reached the point where he says that I'm the only producer he can work with.

PL: Let's talk about the "Rolling Stones Sound," assuming there is such a thing.

JM: Okay. A lot of technical people might say that the Stones have a really bad sound. It's strange, but they wouldn't sound good if they had what is usually thought of as a "good" sound. Certainly, people who never let the needle touch the red could never really record the Stones properly. Andy and I have talked about this often. His general feeling is that with a rock and roll band, you should try to get as much level onto the tape as possible. Of course, you don't want to get *too* far into distort, 'cause then the sound starts going the other way — it starts getting thin again. You want your sound *fat*! Like drums for example. Sometimes, when you can't get a decent drum sound, if you take the main mike gain knob (which at Olympic is in steps of 10dB) and move it one notch over till the drums are just

the meter grows up.



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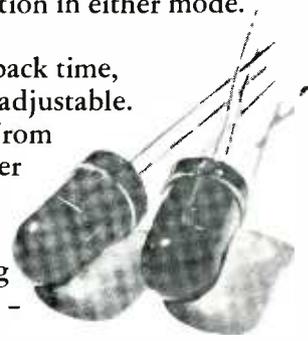
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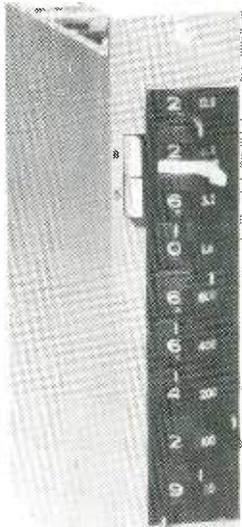
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about breaking up, it can make all the difference in the world.

PL: Do you use a lot of limiting?

JM: English engineers *do* use a lot of limiting. They'll automatically limit guitars, bass, piano — I'm always asking Andy not to limit the piano quite so much, so it doesn't sound so "boxy." I think possibly this is an outgrowth of the acoustics of many British studios. With an American studio, the group goes out, sets up and starts playing, and when you lift the faders you've got quite a decent sound. In England, they'll buy an old church or a pub — something that in the beginning had nothing to do with acoustical work — and then spend a lot of money on the electronics. With this kind of studio, when you lift the faders, the sound will be just horrible, in which case you really have to work on it. As a result, they've come to rely a lot more on EQ, compressors, and limiters to "create" the sound. In America, engineers will use a limiter on request. In England they do it as a matter of course.

PL: Do you have any pet limiters, or a certain brand that you favor?

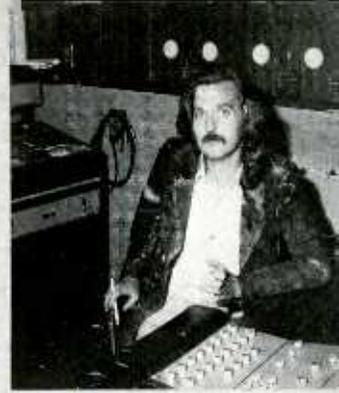
JM: Well no, not per se. There was one though, that I really loved — we used it on a lot of Traffic records. It was a small Pye limiter that lived in the desk at Olympic. It was so great because it was broken — when you really wound it up it would suck so much that you'd swear it was backward tape.

PL: Can you think of a particular tune you used it on?

JM: "Hole In My Shoe" — the bass drum. One day, I went into the studio and there was a big hole where the limiter used to be. "Oh we're finally getting it fixed. Wait till you hear it — you won't be able to hear it working at all." Hah! And they were right — you *couldn't* hear it working at all. It was totally useless after that. As a normal working limiter, it was nowhere near as good as a Universal, for example. When it was broken it was great — not as a "limiter" but as a "device."

You know, there was a lot of creativity coming out of Olympic around then. For example, George Chkiantz did a really incredible thing. He was working on the second Family album, and phoned me at 5:00 in the morning — got me out of bed — to come down and listen to something he had done. He had mixed a song where, at a certain point, the sound went to the outside, kept coming, went behind your head for a couple of bars, and then went back into the speakers. It did happen — it honestly did — a quad motion in stereo, probably from some phasing aberration. It drove him mad, because he could never cut it! He tried it every which way — over the same speakers — but could never get an acetate to do the same thing.

... certainly
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PL: Do you ever do any "studio miking" — just take a couple channels of room ambience?

JM: I have on a few odd occasions, like with Spooky Tooth, but I can't think of any Stones tracks where we did that.

PL: I remember reading somewhere that the basic track of "Street Fighting Man" was done on a cassette.

JM: It's true. Charlie played a toy kit of drums, and Keith acoustic guitar. We recorded it on a normal Phillips cassette at 1 7/8 ips, and then transferred it to the 4-track.

PL: Jimmy, how did you come to play the drums on "You Can't Always Get What You Want"?

JM: Mick felt that Charlie wasn't playing the right kind of thing on it, and asked me if I heard anything there. I heard what I thought would be a good drum part, but couldn't get Charlie to play it — you know, he just couldn't *feel* it. When you don't feel something, you can have someone explain it to you all night long and you still won't get it. Finally, out of frustration, Charlie handed me the sticks and said, "Here, you play it." By then, feeling that our getting the track depended on getting that drum part, I was very willing to take the sticks and play it myself. The funny thing is that the next night, Charlie came in and said, "Hey, Jimmy — look!" and played the part.

PL: Were you "out of shape" as far as your drumming went?

JM: If you're talking about practicing, I guess I'm always "out of shape." I never in my life even owned a drum set! Even when I was in college, working gigs on weekends to earn a little extra bread, I would go and rent a drumkit. Even without practice, I always seemed to be able to play reasonably well, as long as I kept it simple.

PL: How many takes with you drumming did it take to get the basic track down?

JM: As everyone else had been ready, once I started playing, it was just a matter of two or three takes as I remember.

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Charlie played a toy kit
of drums,
and
Keith —
an
acoustic
guitar!



PL: How about "Happy"?

JM: We did that one afternoon — Charlie wasn't even there. Bobby and I had gone over to Keith's house for lunch, and Keith said, "Shall we go down and play a little bit?" It was me on drums, Keith on bass, and Bobby on sax for the basic track. Then Keith overdubbed the guitars and the vocal. I think maybe we tried recording that song the previous night, but it didn't come off and Keith was trying to iron the bugs out before the others got there for the evening's recording.

PL: Are you guys real meticulous about tuning?

JM: Fairly meticulous, yeah. We always have a big tune-up at the beginning, but as the takes go along the instruments start to slip out of tune. It happens so slowly that there's never one point where suddenly you realize that you're clearly out. Sometimes you'll be into a groove and you won't want to stop to check your tuning, but when you hear that take the next day, you'll say, "Boy, that guitar is really out of tune."

PL: Knowing the Rolling Stones, you'd think there'd be lots of places on their records where they'd be out of tune.

JM: Well, you know, it sometimes just doesn't sound right if everyone's perfectly in tune. With the Stones especially this is true — that slight out-of-tuneness contributes to the "spread" of the sound.

Then there's that other kind of "out of tune," the kind that is annoying to the ear. When this happens, you've got to redo that instrument.

For some reason, the bass being out of tune is what bothers me the most. Bill sometimes plays a fretless bass, in which case it's his placement rather than the actual tuning which makes it a bit off.

PL: Especially if he's playing high up on the neck — the "frets" are smaller, which magnifies any placement error.

JM: He's got such little hands anyway. Sometimes I think it must be terribly difficult to hold down those strings.

PL: I've always felt that an important part of the Stones' sound was Bill on bass — a very solid bass line. As good as Mick Taylor is, I think he's often flashier

than a bass player should be.

JM: Yeah, most guitar players are that way. Keith's not — he usually plays something very tasty. As a rule, though, almost all guitar players play a bass that leans towards guitar.

PL: What was the most aggravating tune that you ever worked on?

JM: Oh God. I guess that would have to be "Tumbling Dice." We mixed it about a dozen different times at maybe six different studios. I remember one mix in particular. It was done at Sunset Sound, and afterwards we had them cut an acetate for us. At about 2:00 in the morning, Marshall Chess took us by one of the local FM stations — he knew the night jock — and asked if he would give it a play so we could hear what it sounded like over the radio. We then retired to the Cadillac in the parking lot to listen. When it came on, I was thinking, "Yeah, it sounds good." When it was over, Mick said, "Aw, it sounds awful!" Then we started re-overdubbing and remixing — it got to where everyone was sick of it.

PL: Was there anything in particular that made it hard to mix?

JM: I'd say there were a number of problems with "Tumbling Dice." First of all, it was done in that basement, so sound-wise it really couldn't compare with the best Stones tracks. And, it wasn't a real clear single selection. The best singles are the ones where you knew right from the beginning that it was single material, like "Jumpin' Jack Flash" or "Honky Tonk Women." I just think it didn't come off — that's the only way I can say it. You know, if you look at something as an album cut, that's one thing, but when you look at it and say, "This is going to be our single," you can't help but become very critical. Mick especially is very aware of this. People are waiting for the new Rolling Stones' single, and with only one (or at most two) a year, it should be well worth the wait. He doesn't want them to be disappointed.

PL: How long generally does it take to get a basic track? Do you shoot for one a night?

JM: Yeah, we're very happy if we can get one basic a night. It's hard to say just how many takes we go through because we roll the tape while the band is still working the song out. After about a dozen real takes, we start over with "retake No. 1," because psychologically it can get you down to hear, "Okay, take 32." If we're going to catch that song fresh the next night, it'll probably happen within four or five takes. Still, I can recall a few cases where we've really slugged it out and gotten it after 15 takes.

PL: With the Stones, do you find there's a point after which you won't get that

master take?

JM: I haven't found that as much as reaching the point where you really don't know if they're getting better or worse. Often you'll be surprised to hear how good some of those earlier takes were — ones you did maybe three hours ago. One of the reasons it's hard to evaluate just how you're doing after a lot of takes is that whatever has happened has happened so slowly. You'll begin to think, "Maybe there's nothing really wrong with these takes, maybe they're perfectly all right." What you mean when you say this is that the magic didn't happen, where everybody's jumping around saying, "That's the one, that's it!" This is what you're really looking for.

PL: On what songs did that happen?

JM: "Honky Tonk Women," "Sympathy," "Monkey Man" . . .

PL: There are two songs of yours in particular that have always stood out in my mind as being the zenith in dynamic record production. How did you create the effects you did on "Sister Morphine" and "Gimme Shelter"?

JM: "Sister Morphine" all happened in the mix — it was really pretty modest till then. Glyn and I did it when no one else was around, and I must say we really made it happen. That was the one time I ever played a mix for Mick where I wasn't worrying whether or not he'd like it. I was proud as could be, knowing he would love it. It was really a pleasant surprise, because nobody was really that keen on it — we almost weren't going to use it at all!

We made a real "sound trip" out of it, with all that backward echo and the way we rode the piano. We had one fader for just the echo of the piano. We started out with just the echo on its own, gradually mixing in the piano itself. Every verse was done differently — one was just straight piano, another almost all echo.

As far as "Gimme Shelter" goes, that intro happened pretty much by accident. Out of all the takes, it was the only one that built like that — everybody came in at exactly the right time.

A lot of the song's sound has to do with the fact that Keith was playing through a split lead. The left and right guitars are in fact the same guitar taken through two different amps.

PL: Didn't you use tremelo on them?

JM: On one, not on the other. Even though it was just one signal, we treated each "guitar" so differently that it sounds double-tracked.

You know, I've been asked many times what my favorite Stones track is. I usually end up by cheating a little and naming three or four, but I always include "Gimme Shelter." Its imagery is so powerful.

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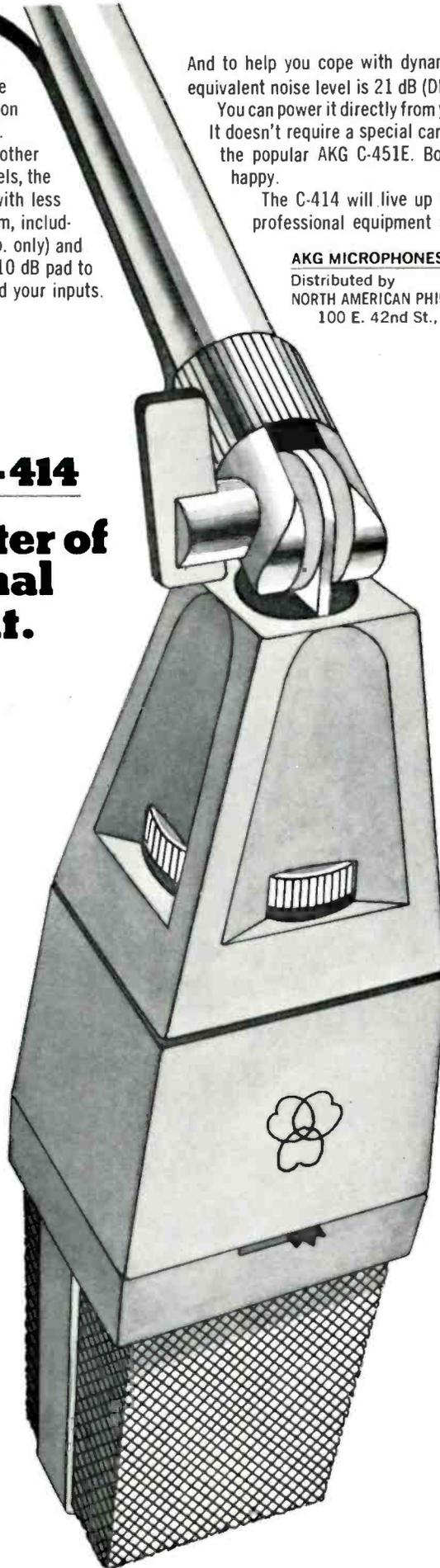
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BACKGROUND NOISE REDUCTION

. . . Practical aspects and some alternatives

by
Stan Polinsky

An audio purist might validly say that the signal-to-noise ratio of any recording system is primarily established by the initial gain stages in the system; microphone or tape-level pre-amps, for example. Assuming, as we have every right to expect as a function of our professionalism, that the mike pads are properly set according to program level, and the console faders, the sub-master and master controls are all set for *design point attenuation*, then the electronic recording system should produce the highest signal-to-noise ratio. Or said another way, will yield maximum headroom throughout the system . . . with minimum internal system noise at the output. Assuming this condition to be true in any system, practically speaking, most noise (and low level coloration) in recorded material is then the result of the additive effects of multi channel tape bias.

With the proliferation of recording tracks, the suppression of unwanted background noise has become a matter of critical concern to the recording industry. However, efforts to reduce or otherwise control background noise have traditionally and basically involved the use of only one or the other of two types of noise reduction systems. COMPLEMENTARY noise reduction (Burwen, DBX, Dolby) has in recent years somewhat overshadowed the application of other devices of the NON-COMPLEMENTARY type. The purpose of this discussion is to review the basics of both systems to provide an understanding of why and how the tandem use of more than one kind of noise reduction system (per channel) has enabled some studios to realize significantly wider dynamic ranges and thus a greater degree of noise reduction.

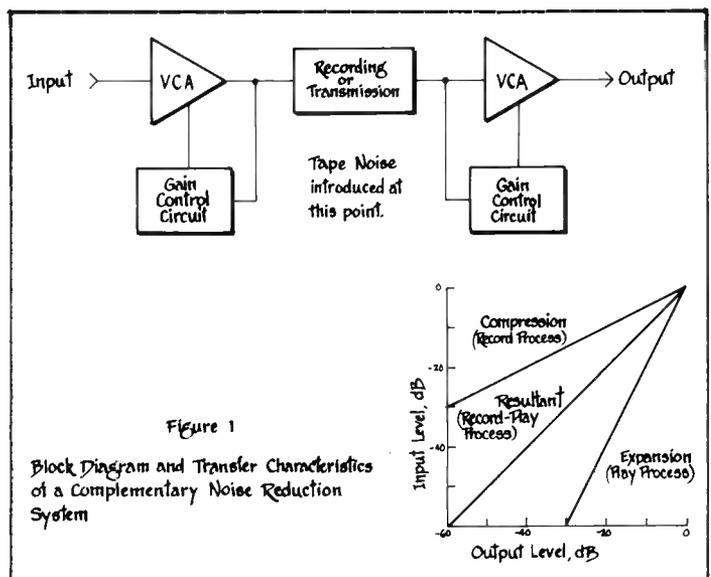
COMPLEMENTARY NOISE REDUCTION

As you know, a noise reduction system of the complementary type basically operates in the following manner: (Refer to Figure 1). All of these devices are designed on the theory that recording noise (hiss, hum, bias noise, etc.) only becomes audible during low level passages and is masked by the sound at higher levels of program. Using the masking effect as a basis, if one desires to eliminate the recording noise while not changing the dynamics of the program, one direction to take would be to make all low sound louder by a specific amount (during the recording), and leave the loud sound unchanged. Because this results in less dynamic range this process is called compression.

During the playback the dynamics of the original program are restored by use of an expander whose gain controlling information is an almost exact reciprocal of the gain controlling

information used to compress the signal during the recording process. The net result of this complementary system is a reduction of noise introduced by the recording process by an amount equal to the gain variation during the compression or expansion stages. This kind of noise reduction is easy to understand if you think of the expander section as a device that not only restores program dynamics very close to the original, but by virtue of its gain reducing characteristics, simultaneously attenuates noise by a variable amount, determined by program level and amount of expansion below threshold. It therefore becomes clear that if noise reduction systems of the complementary type are to be used with maximum effect, they will be of far greater value if they are used at downbeat of the first session — rather than adding noise reduction later during dubbing, sweetening and other post production operations.

There are those who claim they can hear when noise reduction is or isn't used — that they hear phase shift, breathing or pumping or whatever. But it should be remembered that, most likely, they are hearing it on a wide range monitor system, through a sophisticated console, in a near perfect listening situation and probably 20dB louder than 99% of the locations where home playback systems are used which cost probably two tenths of one percent of what that studio initially cost. If the recording



industry can offer the record-buying public anywhere from 10 to 35dB of wider range/less noise than what they had before, isn't that quite a gain?

Noise reduction systems based upon the masking theory as described are certainly not new concepts; companders have been tried for many years but because of poor tracking they have never been popular. What is new is the remarkable way the reciprocal control voltages track the program envelopes in the newer systems. This accurate tracking results in dynamic range restoration usually within 1/2dB — *providing of course the recording channel and its associated equipment has been properly maintained and proper line up procedure for each device has been followed.*

The use of low level (masking effect) noise reduction started back in the very early thirties in the motion picture industry during photographic sound recording with the use of the "squeeze track" which expanded the dynamic range capabilities of the motion picture sound track by using shutters to vary the width of the variable density sound track. The shutters were controlled by a manually operated foot pedal used by the mixer.

One could write a whole book (and many have) on photographic sound recording and the various methods used to improve it. With the new fast acting solid state devices now available it might be an interesting project someday to re-examine some of these methods to see if they might now apply in some modified manner.

NON-COMPLEMENTARY NOISE REDUCTION

The application of non-complementary noise reduction devices such as noise gates and expanders is slightly different in that *the program and noise are treated after they are mixed together on the recording.* An expander basically operates just like a compressor only opposite in function. As a matter of fact,

a compressor can be changed into an expander merely by reversing the direction of the gain controlling voltage (VCA "bias" if you will) so that instead of the gain being reduced during the loud program above a pre-determined level (or "threshold") the gain is reduced when gain falls below the pre-determined threshold. The adjustment of the threshold control allows the engineer to choose how much or how little expansion (and therefore low level background noise reduction) he desires.

When using an expander with an expansion ratio of 2:1 the background is reduced in a very soft, gentle way because the action of the expander is the opposite of a "soft" compressor. Even though this action is gentle to the ear the amount of noise reduction is still under the engineer's control by variance of the "threshold" control.

The proof of the pudding in using an expander instead of a noise gate for noise reduction is the fact that four dubbing stages at The Burbank Studios have a Dolby 361 installed in each console which is used for noise reduction (in the playback or expander mode only) in the dialogue channels. The mixers usually have to put back some presence with a graphic equalizer, boosting 2 or 3dB at 1600 and 3 or 4dB at 3200Hz after the Dolby, because of the band splits and de-emphasis. Once the presence is recovered, the Dolby reduces the background noise in a velvet smooth sort of way that is uncanny — considering that it was designed for another purpose.

In addition to the smooth and gentle way the Dolby sounds used like this, the mixers have the added bonus of automatic threshold control which allows for hands off operation.

When using noise gates it is sometimes necessary to manually ride the threshold control in order to avoid choppy effects. With the Dolby the action is smoother by virtue of the four separate expander sections which operate on different frequency ranges.

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Each section has a gain reduction threshold at about 20dB below system 100%. (See Figure 2B) If one were to add a bit of gain after the Dolby along with a ganged pot at the input and output which lowers the signal going in and raises the signal back coming out or vice-versa, the threshold of noise reduction could be varied for more or less effect. What happens is that the Dolby is fooled into thinking it should be expanding a low level signal when in reality it expands a medium level signal. The importance of the above unorthodox use of the Dolby cannot be emphasized enough, because expanders don't seem to be used quite as much as they could be, considering what an effective tool they are for smooth noise reduction.

Noise gates on the other hand are a most effective tool for cleaning out a track, completely sterilizing a track, or for special effects like modulating voices, etc. Noise gates can also be used to reduce leakage, cross-talk, or reverberation in certain types of tracks. In other types however, the gates are unusable because of the audible gate triggering.

Noise gates operate something like a sound operated switch, where the switch controls the passage of sound through an attenuator, the sensitivity of the switch is adjusted by a "threshold" control which can be set for a specific level, above which the switch is actuated. As long as the program level is above threshold, the switch passes the audio with no loss, but when the program drops below threshold the switch opens and the audio is attenuated. (See Figure 3)

One problem area that occurs with all noise gates is during low level passages below threshold. If this low level audio contains energy that has peak excursions which go above the threshold, the noise gate will switch each time threshold is crossed, causing an effect like relay chatter. As a matter of fact, that's what the description of the sound is during this condition.

One solution to "chatter" is a capacitor-resistor combination across the coil which would provide voltage to hold the relay when coil voltage is varying above and below threshold. This same solution may be applied to our noise gate relay by adding a variable time constant which allows the relay to delay its return from unity gain to the attenuated condition. Unfortunately, when the time constant (which we call release time) is lengthened it holds the gate in the unity gain state, reducing the effectiveness of the gate. So the solution to one problem (chatter) makes the gate ineffective to other conditions for which it was designed unless very minimal amounts of gating attenuation are selected — typically a maximum of 9dB, and release times of at least 1/2 second or more. (See Figure 4) These limitations impose restraint in applications such as background noise reduction in dialogue or vocal tracks. This is not to say that the noise gates are useless — for on the contrary, devices like Kepex and the Quad Eight Noise Gate are excellent tools that do things to sounds of certain types which has never been done before. They also can take a bite out of unwanted noise by as much as 60dB. So gates must be placed in our tool box (or "bag of tricks" if you are one of the miracle men of sound) along with expanders, graphic equalizers and other tools of the trade which are used to fix or modify sound. Keep in mind however, that good sound starts at the beginning of the project with proper microphone selection and placement and good recording techniques. The tools of the audio trade are pulled out of the tool box to fix or modify the sound for acoustic enhancement at the monitor — while remembering that in theory the best audio path from microphone to speaker is a straight wire with gain.

Considering the switching or chattering of noise gates in certain applications points out why the Dolby 361 used only in



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play mode (expansion) is so successful for background noise reduction. In view of this, insertion of an expander with variable threshold, variable release and variable expansion ratios from

1:1 (linear amplification), through 2:1 (soft expansion) to 10:1 (hard expansion or gate effects), into a record circuit or mix bus output, could, if handled with discretion improve the dynamic range of your recording by perhaps 10 or 20dB beyond what you now have – including the use of your complementary noise reduction systems. *The important point to remember is to be sure to monitor the device.* That is to insert it somewhere in front of where the feed to the monitor appears. The reason for this is that different types of program can use more or less expansion (noise reduction) than others. Therefore, each channel of your dub down should have its threshold set individually.

The gate is normally set for unity gain and inserted into the channel at a high level patch point typically +4dBm. As long as the gate is set for unity gain it can be placed in a lower level area, but, as the average signal level insertion point becomes lower, the internal noise generated by the gate comes more and more into the picture. The reason for this is that if the noise gate has an internal noise figure of -80dBm and is placed into a +4dBm patch point which has an overall noise figure of -73dBm, the added device would not add any of its own noise to the circuit. If the device were placed in a lower level patch point of the circuit say at -20dBm for example, then the equivalent internal noise figure of the device would be -56dBm (80dBm minus 24dBm of amplification to get back to +4dBm line level) which is certainly audible. The application of a gate in this type of console is not out of the question however, for there is a way to use most unity gain devices in a lower operating level patch point if that is the only point of insertion available. (See Figure 5.)

continued on page 43

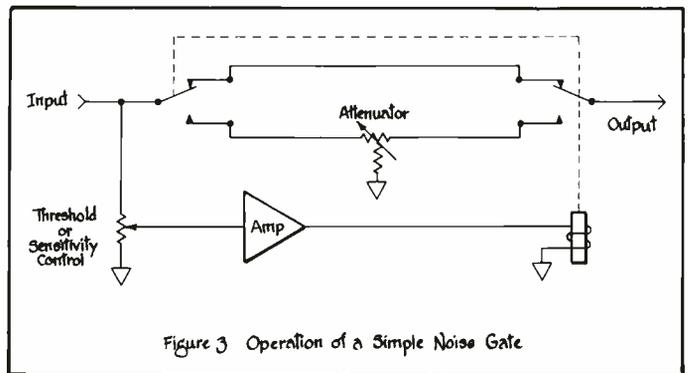


Figure 3 Operation of a Simple Noise Gate

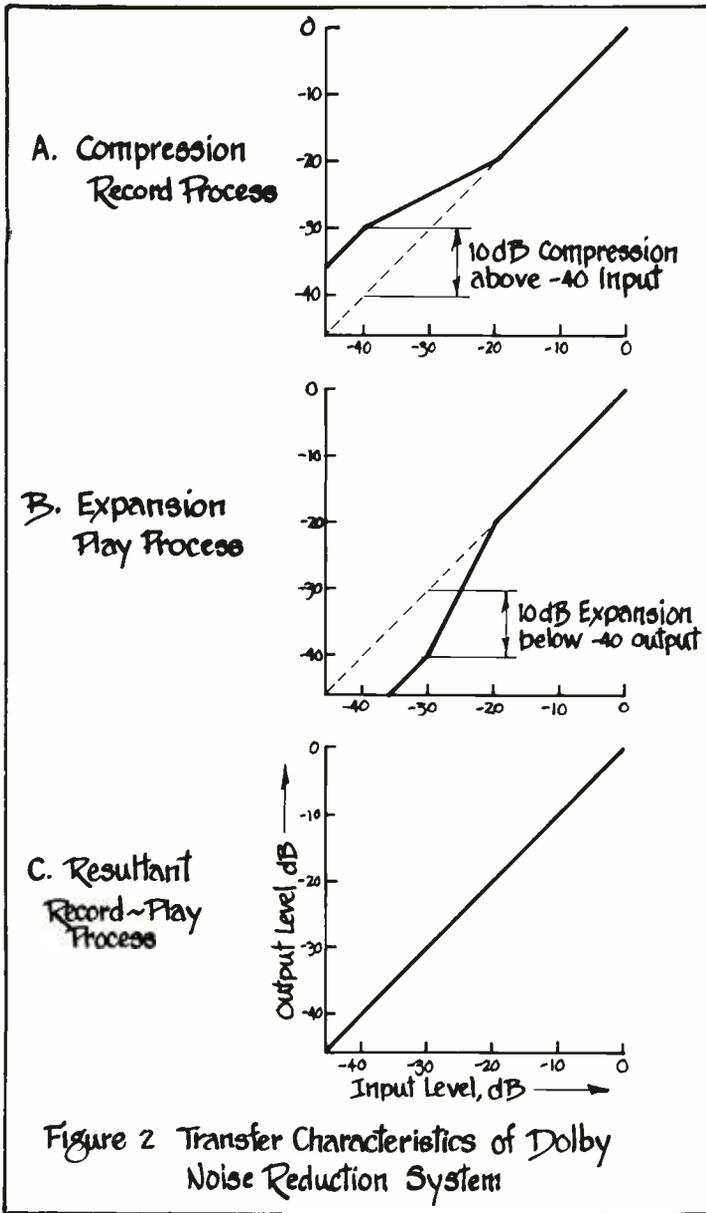


Figure 2 Transfer Characteristics of Dolby Noise Reduction System

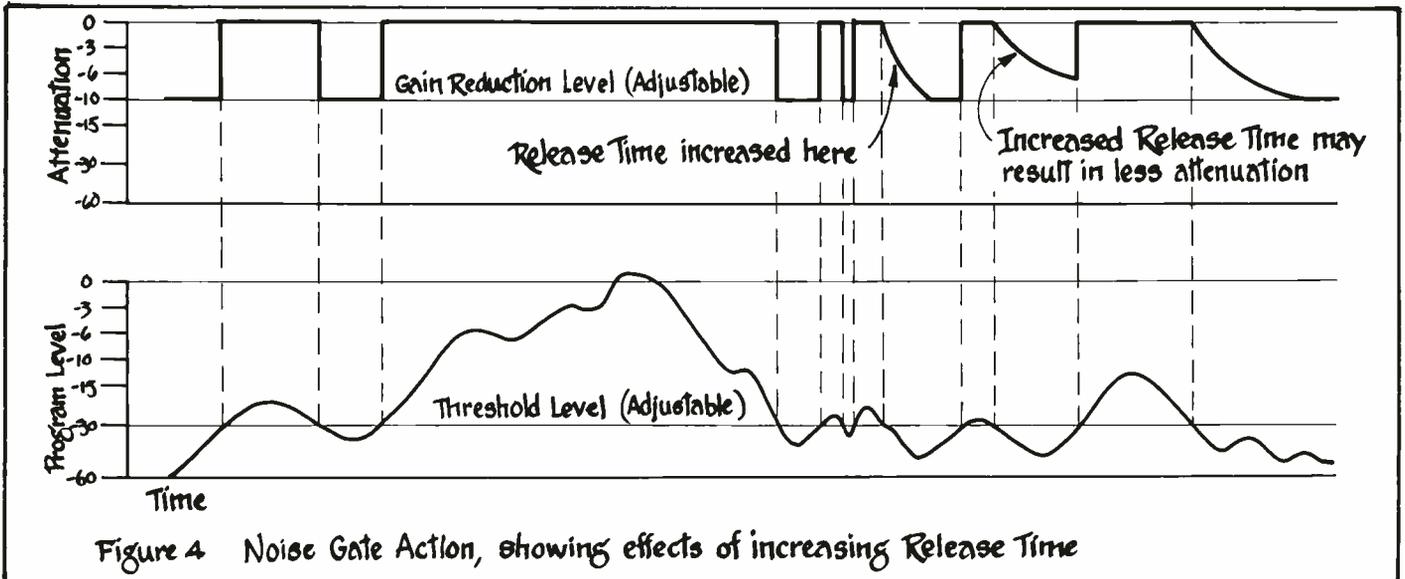


Figure 4 Noise Gate Action, showing effects of increasing Release Time





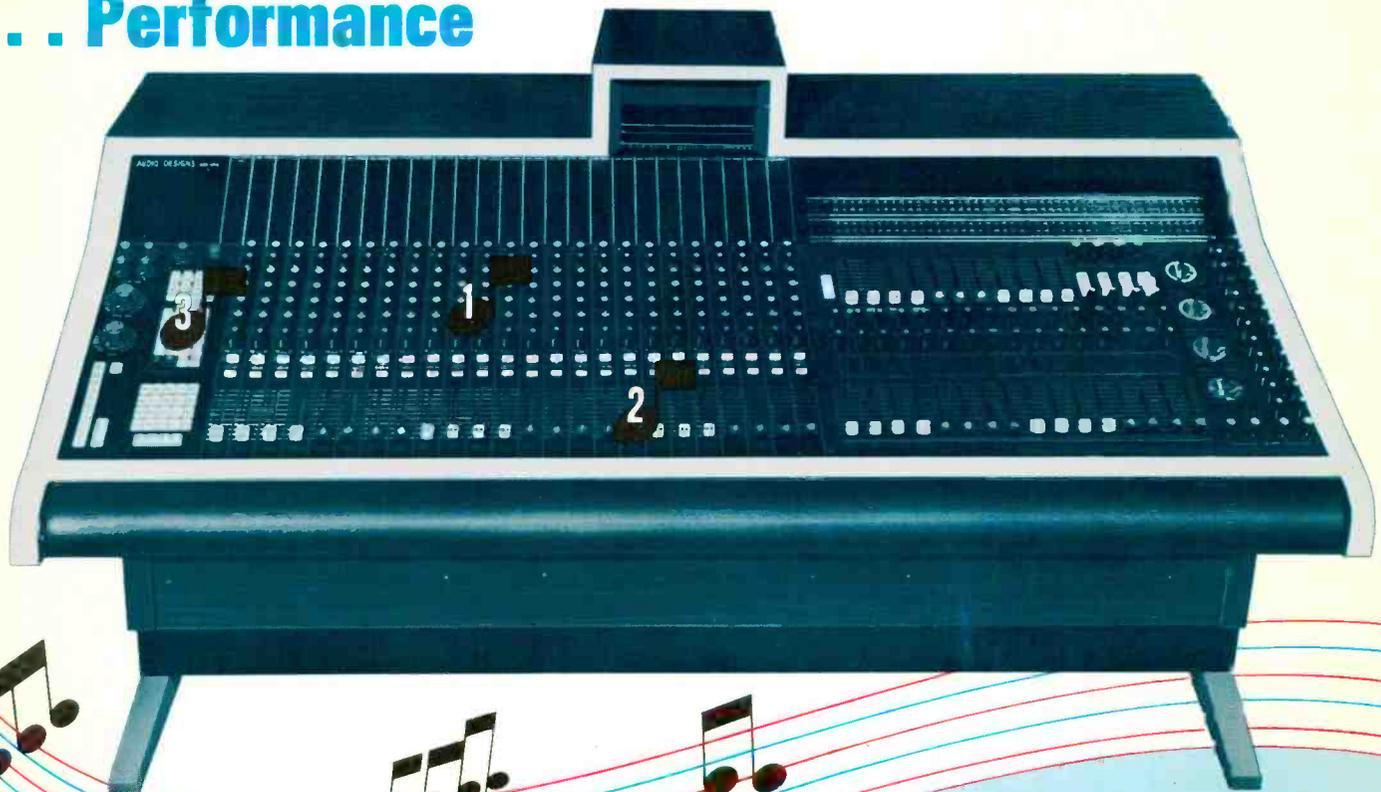
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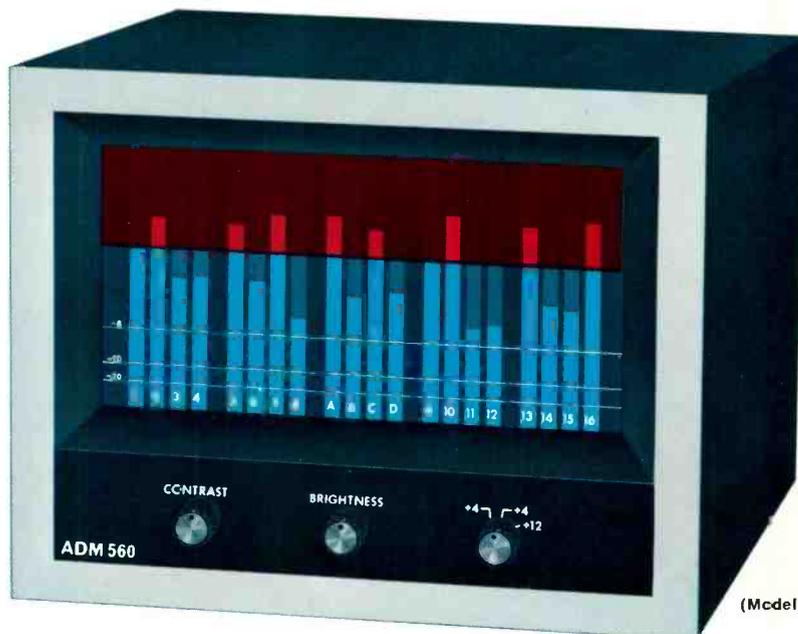
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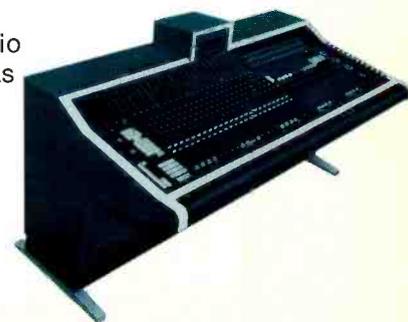


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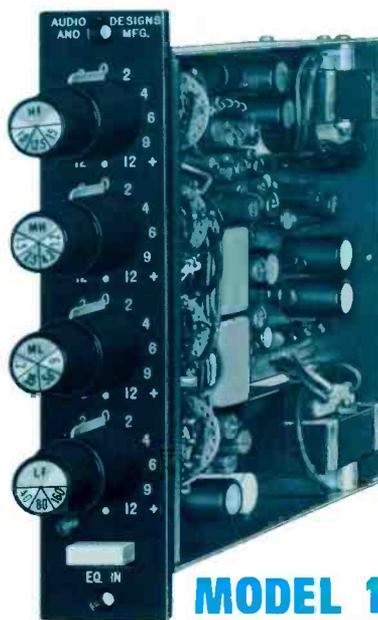
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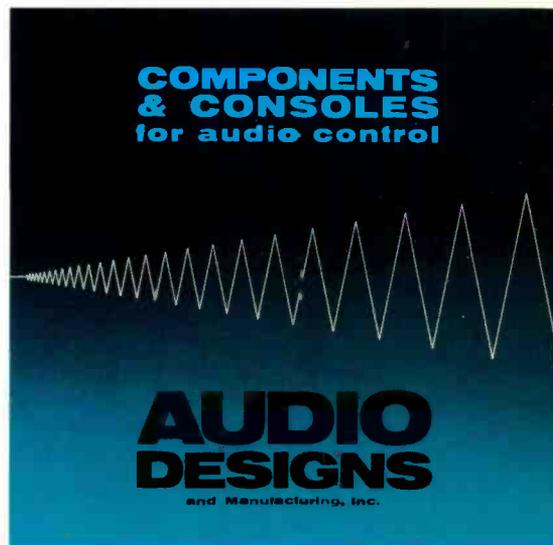
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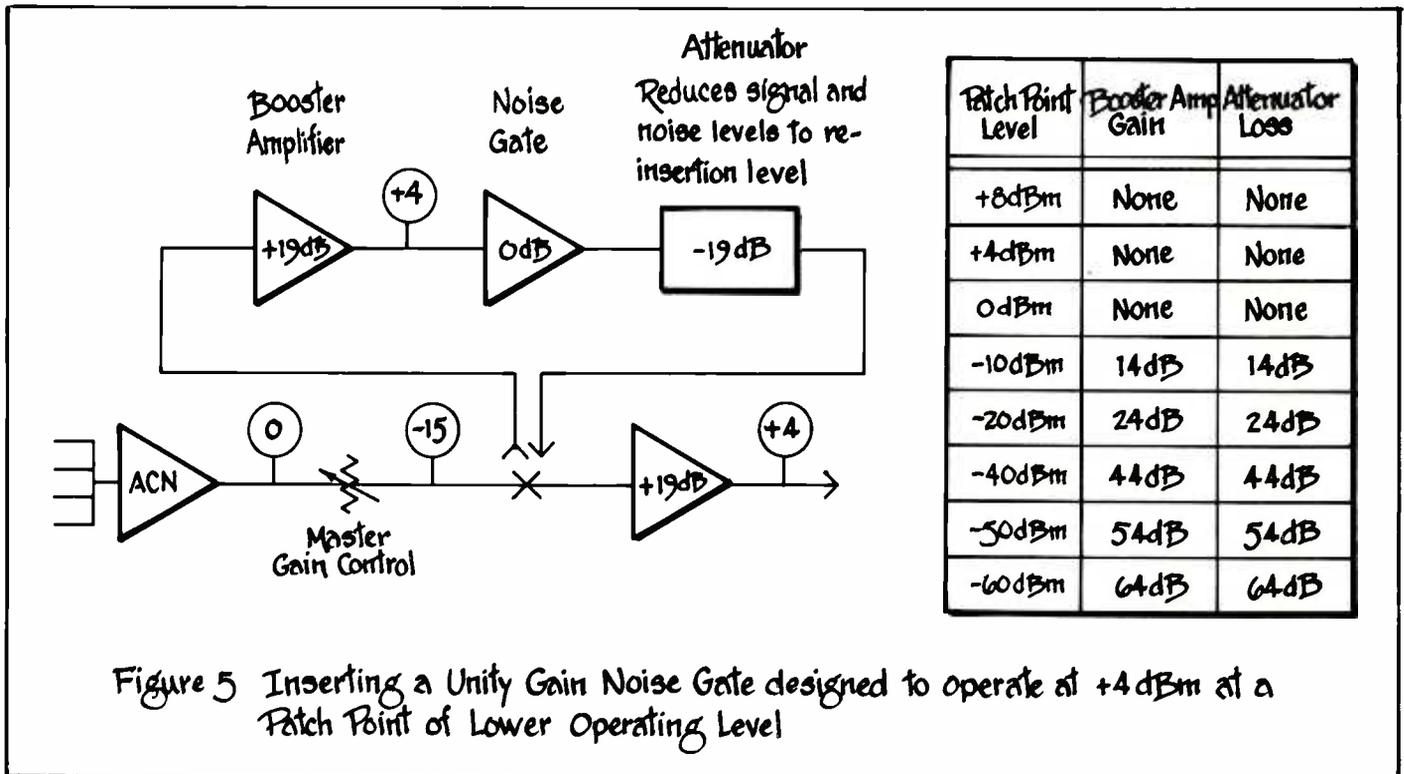


Figure 5 Inserting a Unity Gain Noise Gate designed to operate at +4 dBm at a Patch Point of Lower Operating Level

For example, to patch our hypothetical noise gate between a master set for 15dB of loss and an output amp set for 19dB of gain, in order to maintain a high-signal-to-noise ratio an amplifier with 19dB of gain should be added directly in front of the new device and a 19dB pad added to the output of the device. This brings the signal level up to normal operating level going into the added device. The pad then drops the signal back down to re-insertion point operating level while attenuating the device's internal noise level below -80dB.

Of course if the noise gate is inserted into a circuit which has a buss level of +8dBm nothing will change except a loss in headroom of 4dB. Actually, it could be used at even higher levels, all the way to +24, but a limiter must be inserted in front to hold the maximum input levels down below +24.

A device which could aid immeasurably in the application of noise gates and expanders, would be a black box containing a high pass, a low pass, and perhaps several band pass filters with patch points where expanders, gates, or other devices can be inserted. Add a combining amp with some gains and some loss with slide pots to the filter sections, and you have a very special purpose electronic filter system. (See Figure 6)

The separate patch points, each with its own expander or gate to operate on that band of noise only, would prevent envelope modulation which is common when using a gate on a wide band channel. Other types of devices could also be added to any band as well. One example of this would be to add a limiter to the 2000Hz to 6000Hz band (in Figure 6) in tandem

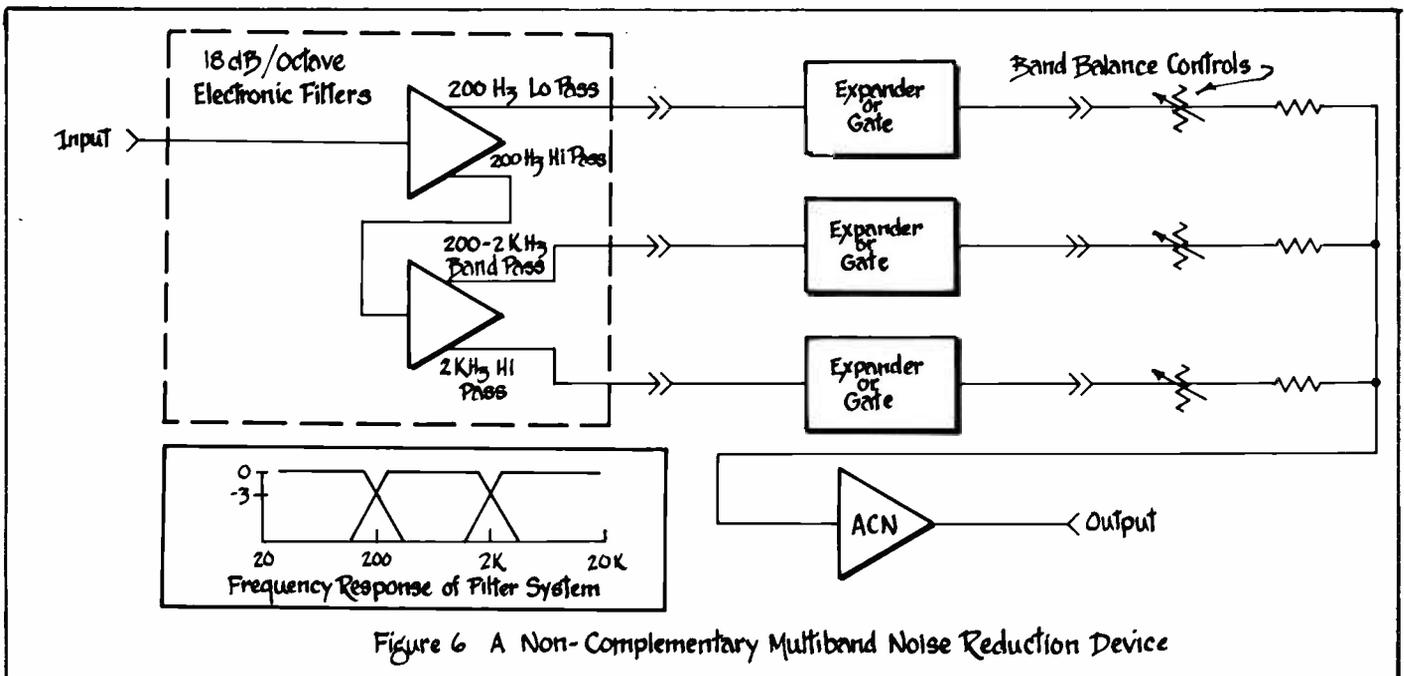


Figure 6 A Non-Complementary Multiband Noise Reduction Device

with the expander. This would give you a high quality "de-esser" (sibilance controller) as well as the tape hiss noise reduction which is prevalent in that band.

A low cost, dependable expander which can be built for less than \$50 per channel (less power supply) is shown in Figure 7. Suggested by Opamp Laboratories, it is extremely simple and uses an opamp to sample the signal level which is rectified and illuminates a light emitting diode. The LED is encapsulated with a light dependent resistor through which the audio passes. As the audio level varies, the rectified signal varies the light from the LED which in turn causes the LDR to change resistance accordingly. The varying resistance of the LDR causes the audio level passing through it to vary also, in an inverse manner. When the program level falls below threshold, the LED goes dark, and LDR resistance becomes very high, and the audio level at the output is reduced (expanded).

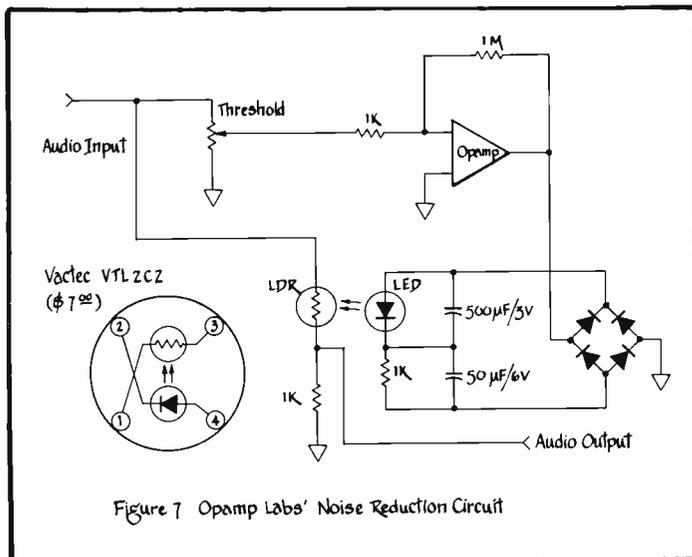


Figure 7 Opamp Labs' Noise Reduction Circuit

Another direction that this writer has considered to reduce noise at the source, has been to kill the bias for each channel when no audio is passing through. (See Figure 8) What is required for this is a very wide range voltage controlled amplifier, Paul Buff's (ALLISON) VCA1, for example, with low distortion, fast attack time and a bandwidth wide enough to pass bias with no adverse effects. Also a high gain pre amp and a fast schmitt trigger with adjustable threshold would be required as

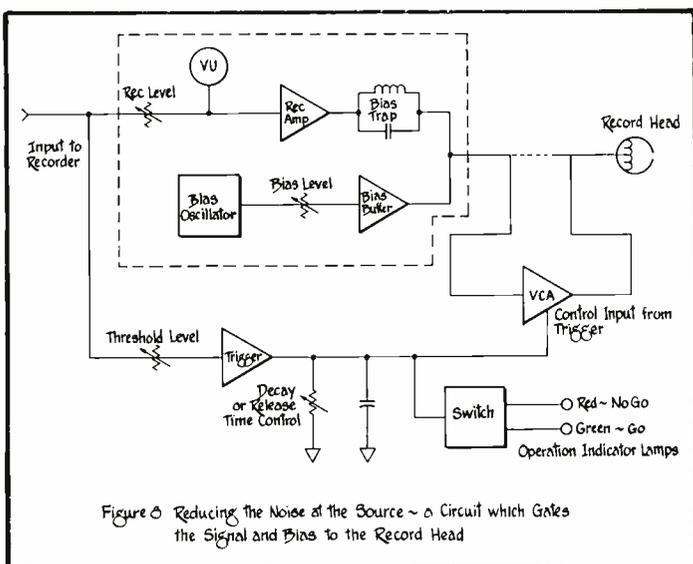


Figure 8 Reducing the Noise at the Source - a Circuit which Gates the Signal and Bias to the Record Head

shown in Figure 8. The action of this device would be to gate the program and bias to the record head only when the audio is above threshold. As with the expander in each channel of a multi-track dub, each threshold of this system should be individually set, 6-12dB or so above tape noise.

When trying out new ideas and circuits, the important thing to remember is no matter how the picture looks on a scope, or how low the distortion reads on an analyzer, how does it sound? Does it really work? Does it make the producer happy? If he is convinced he is leaving your studio with the best possible sound track, then you and your equipment have really done your job.

One of the most successful applications of the noise gate this writer has used to date was to place three Quad 8 noise gates in the output busses of a tube type motion picture dubbing console of 1957 vintage. The project was a pseudo-stereo picture with David Carradine entitled "Country Mile."

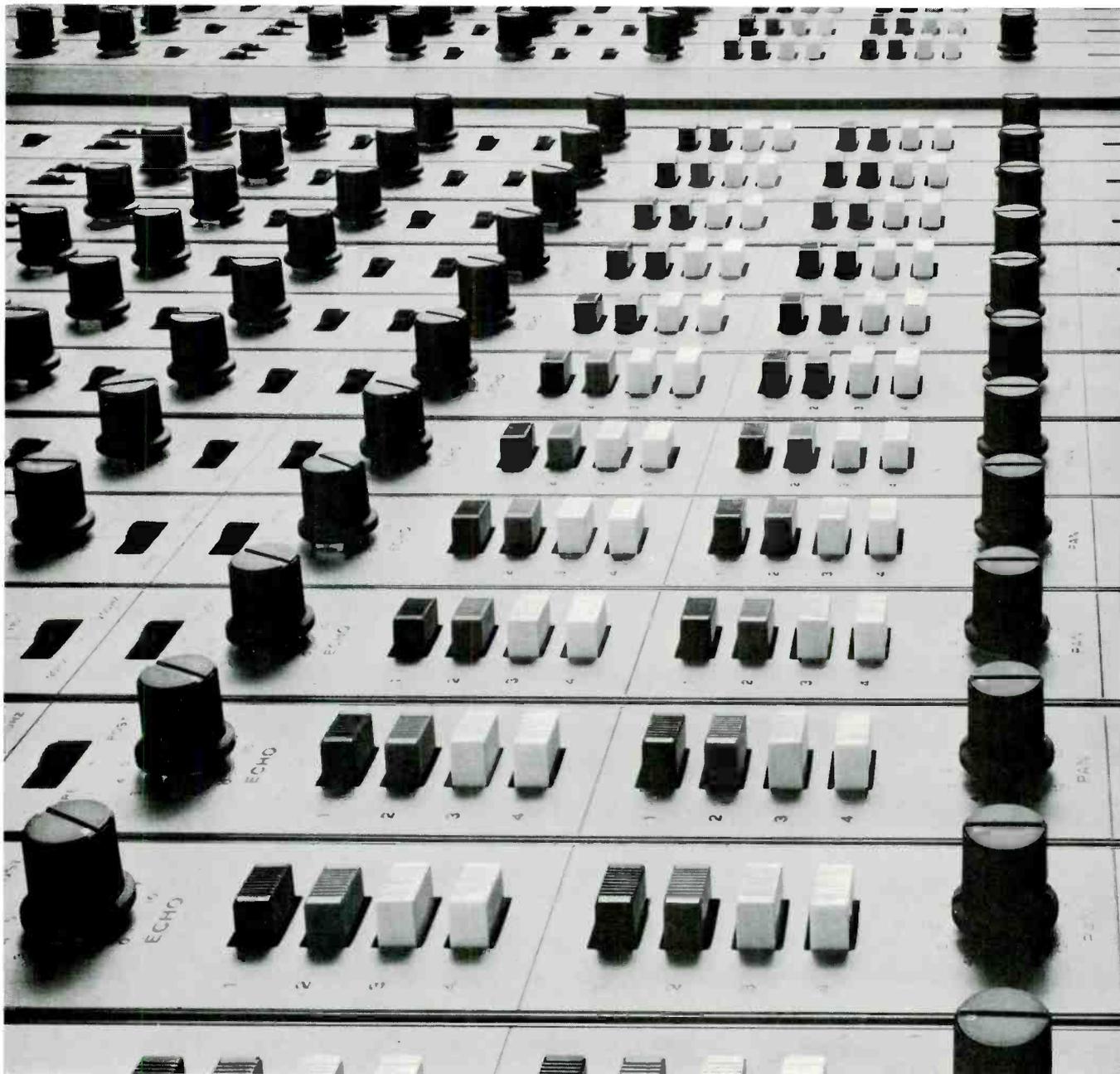
In recording a 3 channel stereo picture the mono dialogue is put through a special cinema pan pot. This is a pan pot with one input and three outputs, and an auxiliary "divergence" control which introduces controlled amounts of leakage. The dialogue is usually placed in the center with perhaps a minimal amount of panning during the dub. Sound effects are also placed through a pan pot, with background effects spread to 3 channels with the divergence control. Music is placed in stereo as it was recorded or dubbed down. Thus, with a handful of pan pots, lots of inputs and 3 outputs, a mono picture becomes a stereo picture in almost no time at all.

Usually dubbing in stereo means adding more amplifiers and devices into the recording than would be used in dubbing a mono picture. This is necessary to make up for losses in the pan-divergence systems and the extra combining networks. The noise level of a console built in the mid fifties tends to build up a bit of steam when used in stereo. This is in addition to the 2nd or 3rd generation tape noise which is usually prevalent in cinema dubbing.

The Quad 8 gates were placed in the left, center, and right recording busses, just before the monitor feeds and the recording machine. The gates in the left and right channels were set for 12dB of attenuation and a release time of about 1/4 second. These gates were not equipped with the modification that softens the attenuation decay rate; the Quad 8 gate normally just switches from on to off (unity gain to expansion) after the duration of the release time. However, the gate used in the center channel was modified to yield a slow decay rate. The operation of the left or right gate was distinctly audible when the other channels were muted because of the gate action, but by setting the center channel gate for only 4dB of attenuation, maximum threshold sensitivity and 3/4 seconds of decay time, the left and right gates and their action were rendered inaudible - thanks to the masking effect of the center channel, which contained most of the sound anyway.

Until another form of recording is perfected and implemented, non-complementary noise reduction systems are a valuable tool to the recording engineer, providing they are used conservatively. This article was an attempt to offer some alternate methods of noise reduction which could be used in conjunction with some of the more commonly used complementary systems throughout the world. No attempt was made to discredit the value of certain types of noise reduction systems in lieu of others. Quite to the contrary, all of the systems now in use have great value to the engineer who is fighting to maintain high quality control of the final product while simultaneously creating his own kind of art and applying his own personal touch and taste to the recording.

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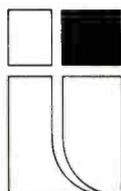
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. . . thoughts on

QUAD MIXING

by JAMES CUNNINGHAM
BRUCE SWEDIEN

Sound Market Recording Company
Chicago, Illinois

Many independent record producers and mixers have, publicly and privately, expressed a genuine lack of enthusiasm for Quadraphonic sound. In fact, predictions of the early demise of Quad have been made by some who have had particularly bad experiences.

Perhaps a re-enactment of a mixdown session will show how some of these feelings originate:

MIXER:

"I hear we're doing a Quad dubdown today."

PRODUCER:

"Yeah, one of the big distributors in the East tells Beasley he can really peddle a Quad mix of the 'Raging Inferno'."

MIXER:

"I thought they went up in smoke at their last holocaust in Chicago."

PRODUCER:

"They did but now Beasley thinks we should do a Quad mix while they're still hot."

MIXER:

"Oh, my God."

PRODUCER:

"What the hell are all those patch cords in the jack field?"

MIXER:

"Well, I've got the echo patched for the negative slap effect and the digital delays are . . ."

PRODUCER:

"Don't give me that 'engineer's talk' crap — pull all those patches and I'll tell you what to do."

MIXER:

"Okay. What's the first tune?"

PRODUCER:

"'Downhill' is the first tune on Roll One — give me the five drum tracks panned across the rear; bass front center, the guitars left and right front, brass left front, vocal group left side, and vocal solo front center."

MIXER:

"You've really given this a lot of thought, haven't you?"

continued



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PRODUCER:
"Certainly."

MIXER:
"Then what do I do with the echo?"

PRODUCER:
"Okay, smartass, I'm ahead of you there. I've decided to appease the ambience freaks and center all the echo return panpost."

MIXER:
"Here comes the mix."

PRODUCER:
"More bass."

MIXER:
"I'll have to center him on all four channels."

PRODUCER:
"Good. Try centering the soloist."

MIXER:
"Now the strings and brass sound puny."

PRODUCER:
"Okay, center them too. What do you think?"

MIXER:
"Except for the drums, it's all mono."

PRODUCER:
"Put the patch cords back in and we'll try it your way."

It is well we leave the control room at this point because several tortured hours later the mixer, in a desperate effort to save the day, springs an automated Quad spinning panner of his own design. The greenish cast of the two men scarcely hides their dejection as they exit the control room.

The old saw, "A little knowledge is a dangerous thing" could be the reason our two characters went astray as well as explain the fairly high percentage of questionable Quad mixes on the market. Unfortunately the best mixers and producers are in great demand and thus may have little time to do their own research of acoustics, psychoacoustics, and the theory of hearing. It is our opinion that a review of these principles as they relate to Quad mixing would help the creative processes of those involved.

One of the most difficult concepts to convey is how our hearing system deals with the spatial world around us. Analogies between sight and sound may be tempting but are often misleading because the speed of light is some 900,000 times that of sound. Since it takes sound about .001 seconds to travel one foot, it takes about .0005 seconds for it to travel between the average pair of eardrums. Also, sound moves through space by pushing around air molecules, so that it loses intensity as it travels.

Therefore, except for those sounds orig

inating in a plane midway between our ears, there are small time and intensity differences between our two ears which enable the brain to tell direction. In the scientific world there is still a lot of speculation on exactly how this process works, but even less understood and more important is how our brain deals with reverberation. These are the *reflections* that occur from the walls, floor and ceiling of a room after a sound has occurred; there may be several thousand in the first second!

Figure One-A shows the beginning of

this process which goes on and on, producing reflections from every conceivable direction and in every conceivable phase. Fortunately, all of these are integrated by the brain into one continuous sound, unless by some freak of acoustics a couple of them are separated in time by 30 ms or so. This gap is outside the integration time of the brain and an echo will be heard. If there is no such gap, the brain will interpret the direct sound as the source, will get a room-size impression from the early reflections, and judge the room liveness from the later reflections.

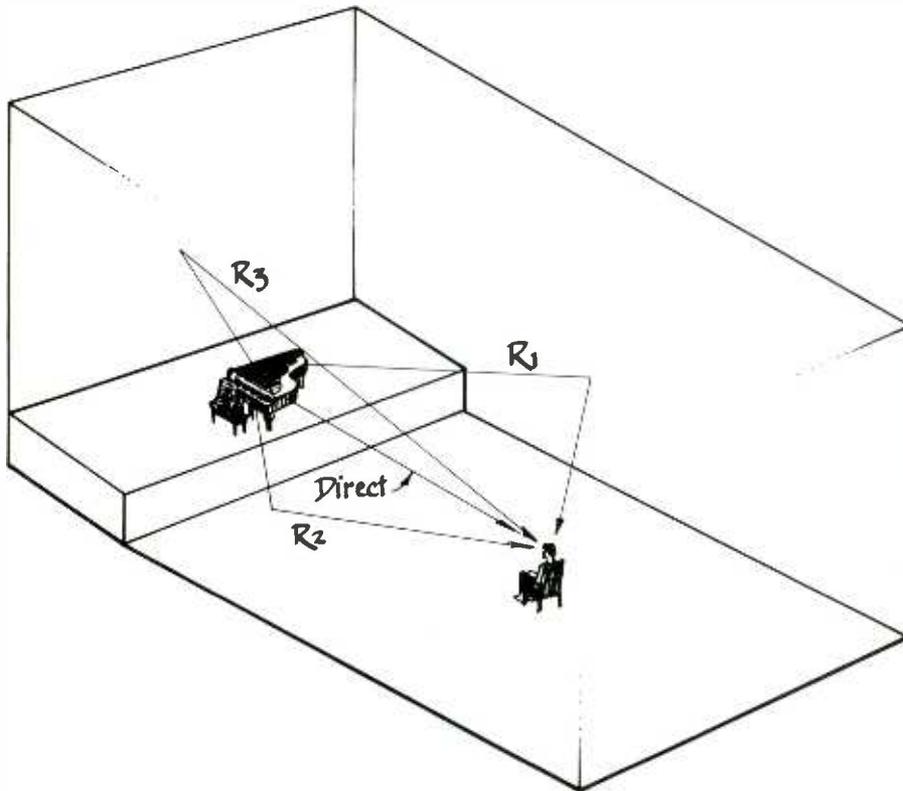


Figure 1A Direct and first 3 Reflected Sound Rays from Source to Listener

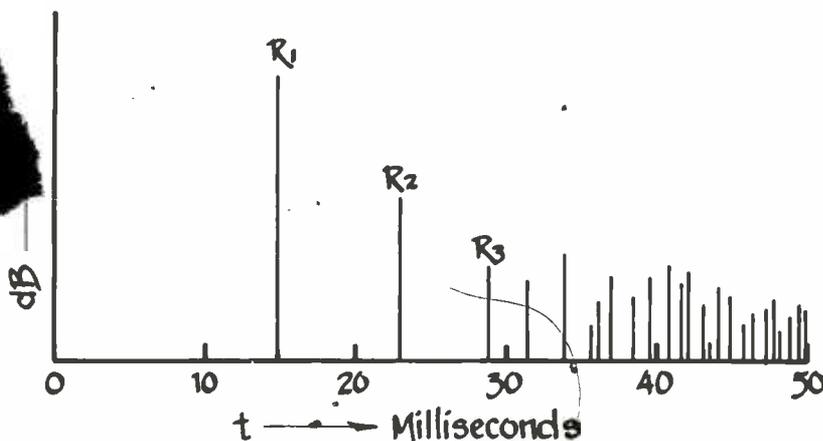


Figure 1B Reflection Growth Pattern of Figure 1A

One of a series of brief discussions
by Electro-Voice engineers



Perhaps the most critical design problem facing any manufacturer is to clearly define the needs to be met by a new product. Not only must performance goals be carefully considered, but also such aspects as appearance, size, weight, and price must be examined in terms of the user and his application of the product.

An example of how these factors affect the product can be seen in two closely related monitor speaker systems now being produced by Electro-Voice. The initial design project was to create a high-efficiency, high-level utility monitor for studio, theater, and sound reinforcement applications that would provide improvements in dispersion, uniformity of total acoustic output, flatness of response, and extended frequency response over previous designs. The result was the E-V Sentry IVA system.

Proof that the Sentry IVA meets its design goals is evident in the broad acceptance of the product in the field. The emphasis on high efficiency, however, resulted in an all-horn-loaded system that is relatively bulky to achieve a low-frequency limit of 50 Hz (3 dB down point). While this exactly suits many applications, a need was also expressed for a system that would offer more extended low frequency response. The Sentry III was designed to meet this modified goal.

Both systems use identical high frequency and mid-range sectoral horns and drivers to achieve good dispersion and uniform total acoustic output. But while the Sentry IVA employs two 12-inch woofers in a folded-horn enclosure for maximum efficiency, the Sentry III uses a single 15-inch woofer in a direct radiator vented cabinet tuned for fourth order Butterworth response characteristics. Response is extended to 40 Hz while output is just 4 dB less than the Sentry IVA at 50 watts input. The overall height of the system is reduced about 1/3 and a furniture cabinet permits use in home environments as well as in the studio.

The Sentry III bridges the gap between high-efficiency studio monitors and wide-range home speaker systems. For instance, most acoustic suspension speakers have insufficient efficiency and output level to satisfactorily reproduce either symphonic or popular music at levels equal to a live performance. But with an output of 113 dB at 4' on axis with 50 watts input, the Sentry III generates useful sound levels with modest amplifier power, and with substantially less danger of amplifier clipping than is possible with typical home-oriented wide range systems.

While there are many applications where either the Sentry III or Sentry IVA might be used interchangeably, each can provide unique benefits depending on the application. And each responds to specific needs of professional sound engineers in studio and sound reinforcement as expressed in field surveys and on-site testing.

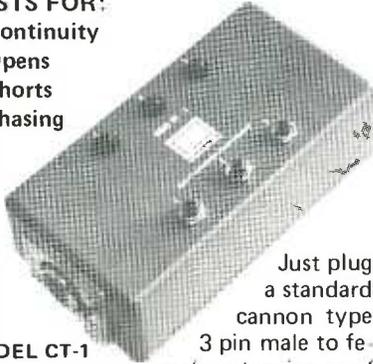
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If, however, we substitute a microphone for our two ears, strange things begin to happen.

For example, you will have no difficulty listening to someone talk to you from the other side of a live room, but if you hold up a microphone and record what you hear, on playback that talking will be barely intelligible.

Although this situation and how to deal with it are old hat to audio people, an understanding of why it occurs perhaps is not.

Figure One-B shows what a typical reverberation pattern looks like; first the direct sound followed by a few early wall reflections, then getting denser with time, as the sound bounces from surface to surface.

An experiment will show in a simplified way what happens when this sound is "collected" by that single microphone. Feed an oscillator as in Figure 2 to both a delay unit and a mixer; then feed the output of the delay into the same mixer. This is equivalent to the direct sound and one reflection. Now vary the oscillator frequency and note the wide variations in level as the tones cancel and add in phase. This is a comb filter because the frequency response looks like a comb. This represents only the first reflection: adding more delays (reflections) to the mixer, of course, makes things worse. If you lower the level of the delayed sound, the variations diminish telling us what we already know; that moving the microphone closer to the sound source alleviates this problem. Also, as the delay gets longer the teeth of the comb get closer, reducing the filter effect. If, however, we feed the direct sound to one speaker and the first delay to another, the tones do not electrically superimpose: there is only a small amount mixing in the air, thus there is little comb filter effect. What this tells us is that in monaural, reflected sound is the villain, especially the early, louder reflections. In real life, however, these reflections enhance the sound, supporting the loudness and character of it.

To put it in a mechanistic way, our brain contains some sort of scanning computer which continuously monitors the acoustic field that surrounds us; "sorting

it out," you might say.

This acoustic field can be divided into two parts; the direct field, where the direct sound predominates, and the reverberant field, where the reflected sound is greater. With our two ears, except in very live rooms like a big church, we can scarcely tell the difference. A single microphone, as explained, has no such powers — so in monaural we must take the only way out — stay in the direct field or lose intelligibility, definition, etc. Directional microphones are a help, but all these tools only reduce the reverberant field, not reproduce it. It is worth noting that only Quadraphonic has dared to put microphones well into the reverberant field in order to reproduce the entire acoustic field.

Obviously neither a mono or even a stereo reproduction system can provide our ears with this acoustic field so that our brain can "sort it out." Quadraphonic can, if properly recorded, much more nearly give our two ears what they get in real life than any other system in use today.

To see why so few Quad recordings have realized this potential, we must go back a few years. In the early days of electrical recording, when it was no longer necessary to shout into an acoustical horn, someone discovered that you had to speak within a foot or so of the microphone or the results were terrible. For pop music, because it is impossible to get one or two microphones within a few feet of a string section and still get a balance, acoustically dead studios were the solution to the problem of too many reflections. Generally these and other techniques were developed to a very high art through the '20's and '30's. In the '40's someone remembered the spooky sounds radio producers got with an echo chamber and decided to try it with music to "restore" some of the life lost in the dead recording studios.

Then came high fidelity with condenser microphones, the LP record, and a host of other developments which enabled the mixer to improve his art still further.

In the early '50's, some thought the millenium had arrived with the advent of the binaural recorder. Now it was possible to put two microphones in a dummy head arrangement, and record exactly what a person heard in real life. In play

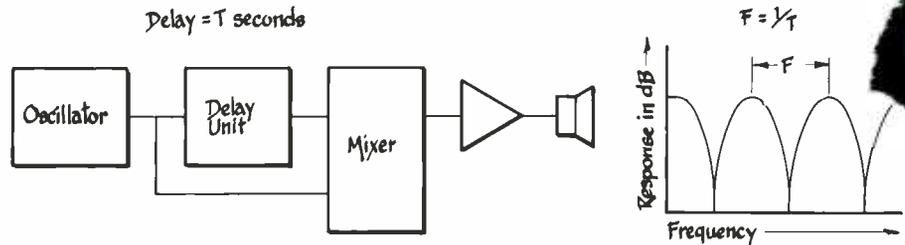


Figure 2 Setup for producing Comb Filter

back over earphones all the original spatial relationships were supposedly preserved so that the microphones could be located any place that sounded good to a listener. Microphone placement and the art of mixing, it seemed at the time, would become unnecessary. Actually the true binaural experience is a unique phenomenon, but for many reasons, some social and some unexplained, it has never become popular. It does, however, help point out that even with all the technical and artistic advances through the years, mono and stereo are attempts to convey an *impression* of the acoustic field and not the field itself.

A clue to the ineffectiveness of some Quad releases is revealed by drawing a parallel between the emergence of stereo and that of Quad. All of the mono studio techniques we have alluded to were brought to bear against stereo in the early days and the result was, of course, two excellent channels of mono recording. As time passed, more and more mixers became aware of the potential of stereo and began to spread the instruments as well as the reverb between the two speakers. In the case of Quad, some mixers have returned to the four channel mono concept, and some have treated it as four stereo pairs. In any case we probably can expect the same slow emergence of Quad techniques as we had with stereo.

In the hope of speeding up this process by the interchange of information, we would like to offer some practical suggestions arrived at from our research and experimentation. There are two general areas to consider which are, incidentally, quite complexly interrelated. They are image placement and reverberation. At the present time, image placement can be accomplished by two methods; a Quad pan pot, or by placing a sound source somewhere between four microphones. The latter method is usually impractical for studio recording, although under ideal conditions it can provide not only good image placement but a realistic acoustic field. The Quad pan pot, unfortunately, only provides precise localization of the four corners, and since it depends on only intensity differences, phantom sources between channels are rather vague, especially the side pairs. Also, as in stereo, there is an intensity fight; that is, a soloist will usually be centered to gain a level advantage rather than reduce the accompaniment level, and lose signal to noise ratio. Another pan pot dilemma is encountered by the listener who moves out of the center position — he can radically upset the balance so carefully arrived at by the mixer.

Once we have examined how to use that other area of interest, reverberation, we should see a way out of the preceding difficulties. Keeping in mind that reverberation in real life comes from all directions, it is obvious that a way must be found to synthesize this from the usual



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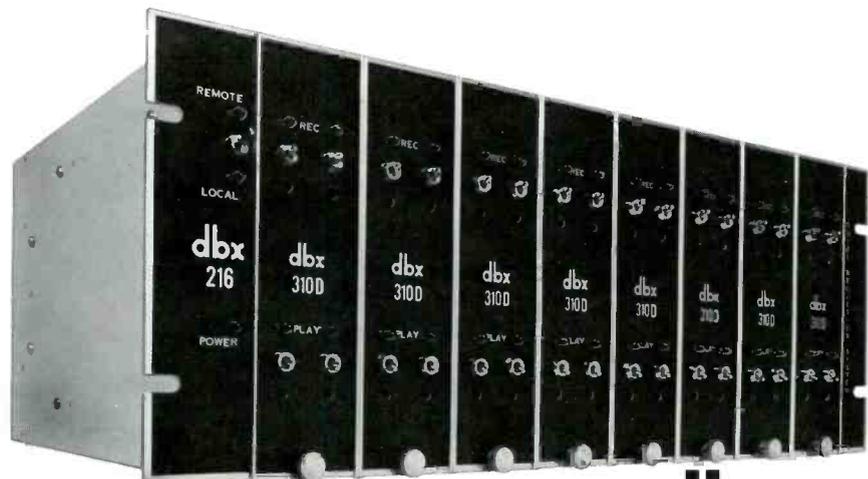
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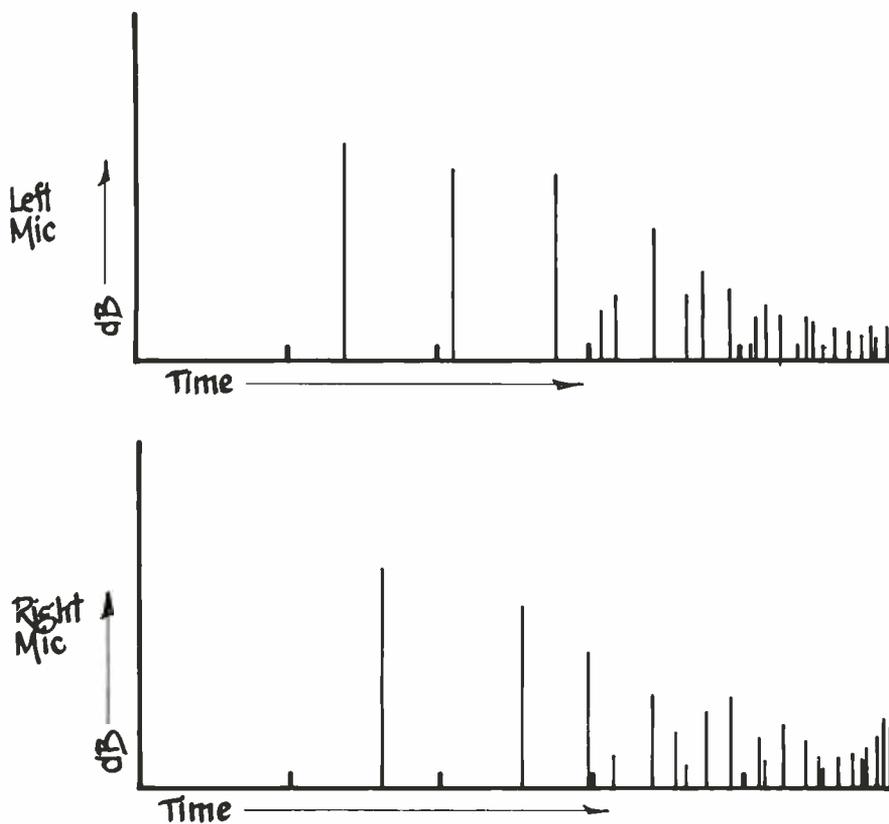


Figure 3 Reverb Pattern of Stereo Mics

monaural studio echo chamber. Fortunately, this is quite easy, and it can be attained in several ways. A mono chamber, for instance, can be fed into a one-in, four-out delay unit — thus magically, although expensively, converting it into a Quad chamber. Less expensive methods might be to put four microphones in a live chamber, four pickups on a plate unit, or split feed two matched stereo chambers.

Figure 3 shows the reverberation patterns two spaced microphones in a room would produce and helps explain how these methods work. Because they are different (incoherent) both in time and intensity, the first left and right pair of reflections produce a solid phantom image of one reflection somewhere between two reproducing loud speakers. Since all successive ones are random the reverberation “spreads” between the speakers. In Quad, four speakers make six pairs of channels and spread the reverberation 360°, simulating the real situation. In the case of a delay unit, the same reverberation pattern for the other channel is merely *slid* in time; now, since they no longer match, incoherence is produced.

There is a problem in the reverberation pattern produced by a typical studio chamber, be it a *live* one or a plate. Because it is equivalent to a small room, there are no sparse early reflections such as in Figure 1-B. In Quad, the ear will instantly detect this and the effect is to clutter rather than support the direct sound. In as much as we are attempting to simulate the real situation, we can, as we shall see, supply these early reflections with delayed sound.

We mentioned previously that reverberation was a way out of the pan pot dilemma, although this probably sounds absurd to any good mono-thinking mixer who has always thought of it as *seasoning* — to be used sparingly. But if we remember that the reason we can hear the pin drop in the Mormon Tabernacle in Salt Lake City is solely because of the intensity support it gets from reflected sound, we may look at it differently. For example, in a Quad dub down, suppose we place a soloist on the left front channel, then feed delayed signals from this track of say 5, 10, 15 ms, to the other three channels (each at a progressively lower level than the preceding one). This track is also fed to the Quad chamber after a delay of at least 30 ms and the returns from the chamber are set at the proper level. The soloist stays firmly in the left front channel for a wide range of listener positions while the delays add body and fullness to the sound and the chamber provides acoustic environment.¹

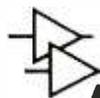
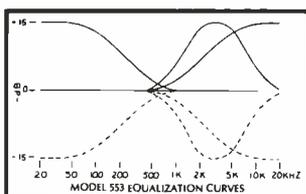
It is interesting to note that a much greater level of return can be used from a good Quad chamber than a mono one returned to all four channels. As we have mentioned, this is also true of the returns

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from the delay unit. If mono compatibility is essential, some compromise must, unfortunately, be made in the Quad mix.

Although most consoles are not equipped to do Quad mixing according to the principles outlined, conversion of them should not be difficult. Many consoles in use today have four echo mixing busses assignable separately from the main mixing busses. One possibility of how these can be put to good use is suggested by Figure 4. The static assignment of instruments can be accomplished through the main buss switches (or pan pots, if available) and the echo busses used for delay unit assignment, Quad echo chamber, and a Quad joystick for motion panning. These devices can then be fed through trimpots to four active combining networks which are then routed to the usual four echo return pots. Beware of the Quad pan pots on the echo return of some consoles; they are not only useless, but can *monoize* your Quad chamber. Another use for a delay unit in a mixdown is to process any stereo tracks such as strings which have some studio "liveness." This is done by assigning the stereo tracks to, say, the front channels and two delayed channels derived from each of these to the rear channels. The delays should be criss-crossed to avoid any comb filter effects on the compatible stereo product. The reversion will spread out, in the manner described previously while direct sound will stay up front.

While these methods, and others in use now, are admittedly crude, we feel at our studio they have been successful in carrying sound recording into new and unexplored areas.

On the horizon are many new developments which should be available as studio hardware. These are totally electronic Quad reverberation units with far more flexibility than anything in use today², a Quad panpot capable of producing precise phantom images horizontally as well as vertically³, and a motion panner which uses doppler, intensity, and direct to reverberation ratio effects⁴.

No attempt has been made to write a compendium on Quad mixing, instead some theoretical thoughts and a few suggestions have been presented here in the hope of directing the enormous creative energy of the American record industry into this new medium.

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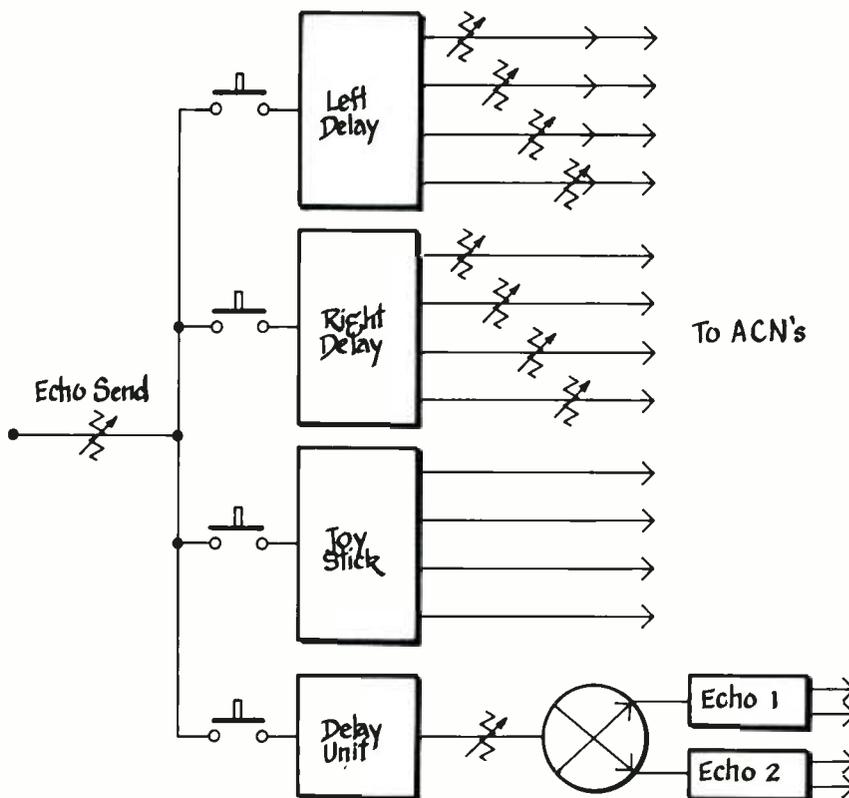


Figure 4 Using Echo Assignment Switching for Quad

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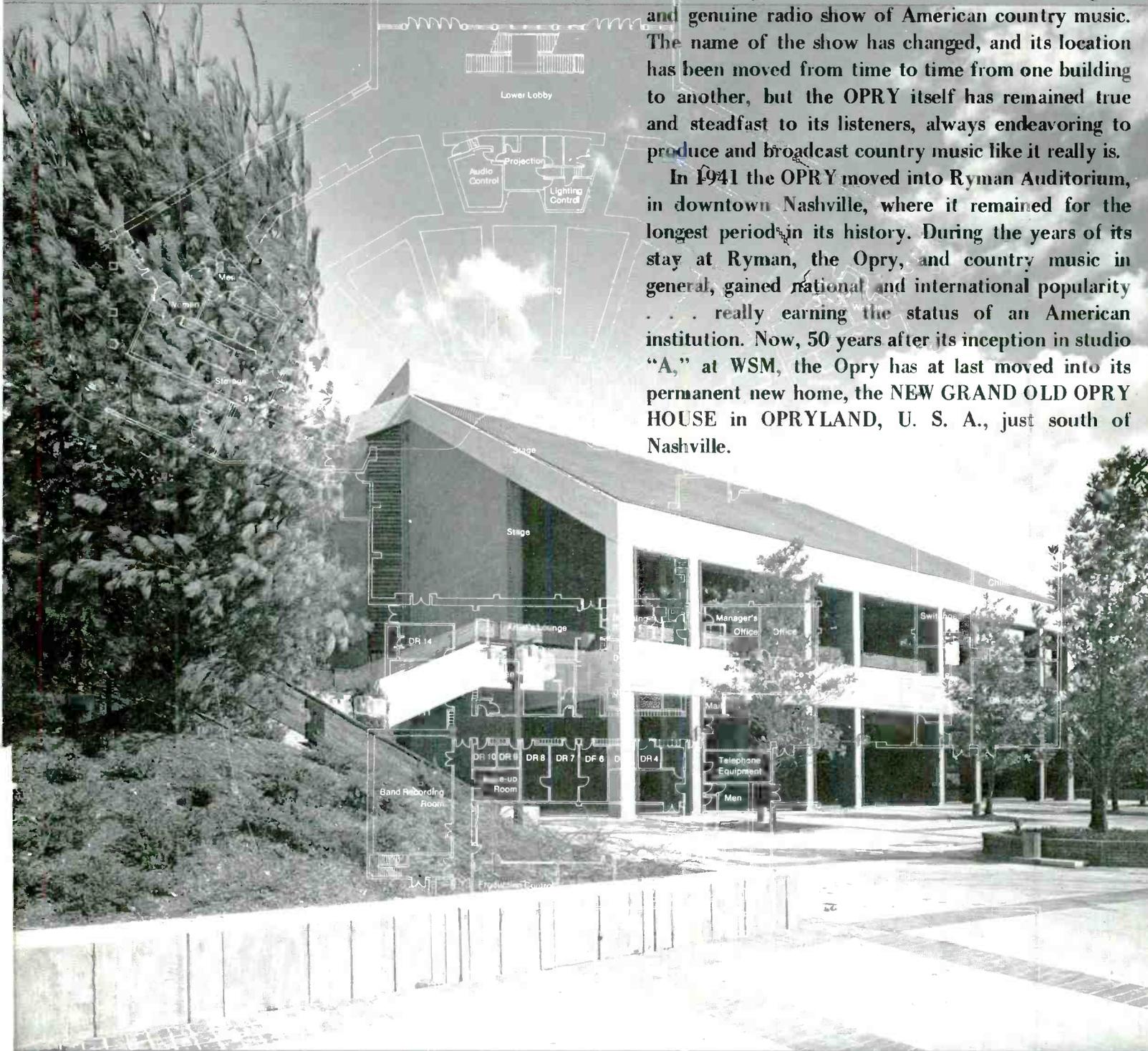

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GRAND OLE OPRY

Owned by National Life and Accident Insurance Company through its broadcast and television affiliate WSM, Inc., OPRYLAND is a 369 acre recreation-entertainment-broadcasting-convention center, including the 110 acre Disneyland-like attraction . . . the central, and overriding theme of which is MUSIC. The renowned architectural firm of Welton Beckett and Associates (Beverly Hills, CA) was commissioned to design and develop the Opry House around this theme.

The centerpiece of the total complex is the NEW GRAND OLE OPRY HOUSE, a superb building; architecturally the functional and decorative extension of what country music seems to be all about . . . pristine, yes, but also an expression of today and the future. The building houses 1) the magnificent 4,400 seat air-conditioned auditorium/theatre. 2) A separate 250 seat, full color television production facility. 3) A 25 foot by 45 foot recording studio. Taken all together the New Grand Ole Opry House represents some 15 million dollars worth of entertainment production facilities, a significant portion of that total being the management's commitment to investment in the most advanced and complete array of audio systems and equipment.

THE AUDITORIUM

The Auditorium is, in a word, a masterpiece. It is spacious and comfortable, with a completely unobstructed view of the 110 by 68 foot stage from every seat in the house. The decor is simple, nothing ostentatious or glamorous, but cleanly and elegantly finished with total attention to audience comfort and manageability. A sufficiency of leg room is left between rows of seats, the aisles are wide enough for an easy flow of people, and the space between the front row of seats and the stage was purposely left extra wide so that throngs of fans can crowd up to the foot of the stage and get close looks and snapshots of their favorite country stars. The seats are a modern version of the wooden pews Opry audiences became accustomed to in Ryman Auditorium. These in the new building are upholstered with padded carpeting which lends not only a warm bright look to the auditorium, but makes them a magnitude more comfortable to sit on. Interestingly, from an audio point of view the upholstered seating is an important function in stabilizing the acoustics of the house, causing it to sound about the same whether or not it is full of people.

On occasions when the stage is too small, the first rows of seating are removable and the floor underneath them can be hydraulically raised up to the stage level, increasing the stage depth by another 25 feet.



All but the very last eight rows of seats on the main floor are in direct line of sight of the central speaker cluster. (photo by Gordon H. Schenk, Jr.)

the traditional pews . . . but, modernized with carpet covered sound absorbant upholstery (photo by Gordon H. Schenk, Jr.)



Apart from doing the Grand Ole Opry show, the auditorium is used for shows connected with the Park, as well as special television shows. The stage is ideally suited to doing big bands, with plenty of room for a full concert arrangement, and the tremendous house cavity for the sound to decay in. This was one of the prime objectives in creating this facility, to provide a complete audio and video recording capability, plus live audience show capability for the largest and most complicated big, big shows.

Located in the back of the auditorium, tucked away under the balcony are 3 control rooms: A lighting control room which commands an incredible 1.8 million watts of dimmable lighting power, a projection booth for films, and an audio recording and broadcast control room which houses an awesome 40 input Neve console with enough buttons and knobs to mollify the most demanding producer.

At the present time the feeling is that the audio control room is slightly cramped and unfinished. The detailing and final arrangements are still being worked out with the probability in mind that the room will be further enlarged to accommodate the variety of simultaneous production requirements it ultimately is expected to handle. Aside from handling the broadcast mix of the stage performance along with pre-recorded announcements for the broadcast program, this room is primarily used for simultaneous 16 track recording and mixdowns. In addition to the Neve and the full complement of recorders headed by the MM1100 16 track machine the room also houses a smaller 16 input Spectra Sonics console used to mix the stage monitors. The activity in the room can get pretty heavy.

THE SOUND REINFORCEMENT SYSTEM

The sound reinforcement system for the auditorium is essentially the product of senior audio systems designer Richard Negus of Purcell and Noppe Associates, Chatsworth, CA., the acoustical consultants for the entire Opry House facility. The primary design objective, as stated by Mr. Negus, "was to achieve a natural concert hall feel, in keeping with the traditions of the Opry, but, and this was the challenge, to use the sound reinforcement system as the *prime* sound source, rather than relying on direct sound from the stage. Thus, everything is amplified. The end result is a clean well defined sound, still retaining natural large hall ambience, emanating from a central overhead speaker cluster. Keeping in mind the various production requirements of the hall it is a unique design approach for an auditorium this size. Muddiness is avoided by special directional tuning of the central overhead speaker cluster."

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a circular array of JBL 2130 bass and low mid-range speakers in columns, and a rather complicated array of Dukane multicellular horns mounted on JBL 2420's for the upper mid-range and highs. The speaker cluster is hung from the space-frame grid work in the ceiling, 33 feet above and in front of the center of the stage. The cluster is, in effect, a single sound source, and is in direct line of

sight to every seat in the house except for the last 8 rows under the balcony. Being essentially suspended directly above the performer location on stage, the sound appears to come from the stage and does not shift from side to side depending on listener location, as so often happens when the sound reinforcement

The acoustical design of the auditorium was aided by a novel interdisciplinary technique developed by Purcell and Noppe. A 1/4-inch to the foot scale model of the auditorium was constructed and at the speaker cluster position an optical diverging lens system was substituted, which dispersed the light from a laser apparatus in much the same manner as the sound would subsequently be radiated from the speaker cluster. Then by optical measuring techniques it was possible to locate acoustical hot spots, as well as attempting various means of effectively dispersing the sound coverage more uniformly. Using this technique potential echo trouble areas were located at the upper sides of the ceiling. Those areas were appropriately treated with special sound absorptive material. There was an additional possible echo problem discovered in the balcony and an acoustically treated wall was constructed along the cross aisles to counter it.

A truly dedicated effort was made to keep the sound levels evenly distributed throughout the house. With the primary sound source being centrally located this goal might appear difficult to achieve. Through a tantalizing bit of audio engineering Mr. Negus made it possible: In effect the vertical directionality of the speaker cluster is controlled by electronic frequency crossover networks!

THE CENTRAL SPEAKER CLUSTER

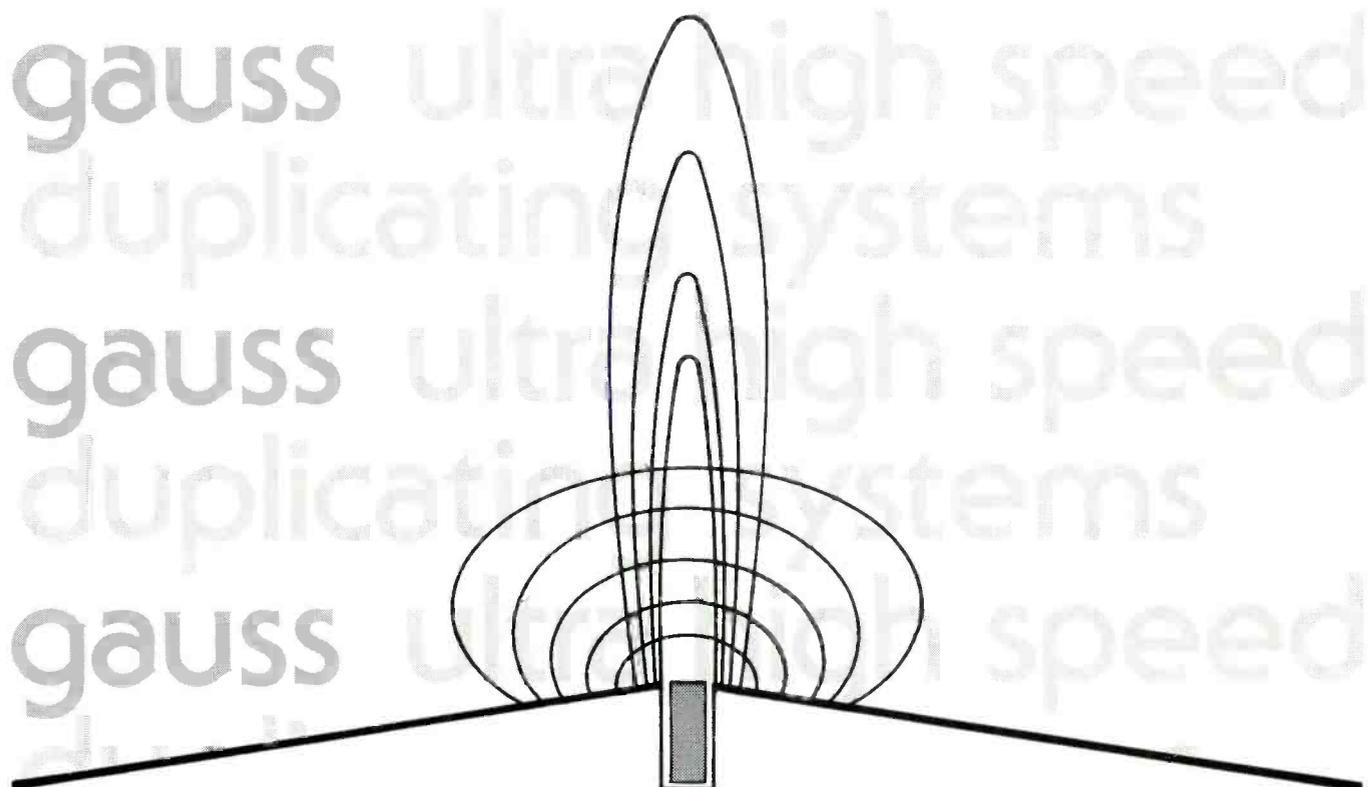
Here's how it works. The bass and midrange speakers (JBL 2130's) are arranged in 12 columns of 4 speakers each, the columns mounted side by side and around forming a cylinder. The directivity in the vertical direction of each column is dependent on the energy fed to each individual loudspeaker in the column. And, given equal energy in each speaker, as the frequency is raised, the polar response of each speaker changes from essentially omnidirectional (at frequencies where the wavelength is longer than the length of the column) to highly directional (at frequencies where the wavelength is short compared to the length of the column). The object then was to maintain a designed polar response from the columns at all frequencies in their range. To do this the length of the column is effectively reduced as the frequency is raised. This is accomplished by rolling off the response of the signal fed to certain speakers in the columns, with different break points for different speakers. The speakers in row B get the full frequency range assigned to the bass and midrange section; rows A and C are rolled off above 500Hz, and row D is rolled off above 300Hz. This combination seems to yield the desired results, directing most of the energy towards the balcony, and somewhat excluding the energy from the floor. Two smaller curved columns direct the required



a full Opry House is still comfortable. The broadcast control room can be seen under the balcony, to the right of center. (photo by Gordon H. Schenck, Jr.)

view of the auditorium as the mixer would see from behind the NEVE console.





Better Sound

Sound. That's what the tape business is really all about. Sound sells tape! And Gauss machines produce the world's best sounding duplicates, no matter which brand of tape you use. The reason is Gauss' exclusive, patented "Focused Gap"[™] recording system. No other system can match it for high-fidelity, low-noise reproduction. It works because:

The Gauss "Focused Gap"[™] recording head, using a conducting element in the gap, focuses the bias field into a narrow beam with intensity unmatched by any conventional head. The 10 MHz bias frequency, essential to the success of this technique, is used only in Gauss duplicators.

The very high frequency, beamed bias field assures deep flux penetration and complete biasing of the magnetic coating. High frequency saturation is improved up to 6 dB over conventional techniques.

Because the signal field is wide in relation to the focused

beam of the bias field, the bias signal is, in effect, shut off before the signal is recorded.

Therefore, bias self-erasure, found in all other duplicating systems, is practically eliminated in the Gauss system. In addition, intermodulation distortion is reduced by an order of magnitude.

While better sound on the tape is the overriding reason to use Gauss equipment, don't overlook its other advantages. Solid reliability, proven through more machine years of field operation than any competitive brand. Unbeatable production rates, guaranteed by digitally controlled stagger loading. Gentle handling of your masters through the patented, horizontal, pneumatic loop bin.

It's a fact that more top recording artists are duplicated on Gauss. For the best sound and the best buy in tape duplicators, Gauss is the standard of the world in high speed tape duplication. A professional audio product of Cetec Corporation.



Cetec
CORPORATION

Audio Systems Division 13035 Saticoy Street, North Hollywood, California 91605 Phone: (213) 875-1900 TWX: 9104992669
Cetec, U.K., Sapphire House, 16 Uxbridge Road, Ealing, London W5 2BP Phone: 01-579 9145 Telex: 837329

Focused Gap is a registered trademark of Cetec Corporation.

coverage down to the floor.

Arranging a number of low frequency radiators in a configuration such as this augments the bass coupling into the air, so overall bass rolloff was necessary to flatten the response.

As we previously mentioned, the last 8 rows of the main floor under the balcony are out of the line of sight, and do not receive upper midrange and highs from the cluster. The lower frequencies, being omnidirectional, carry back to the last rows, but the higher frequencies are reinforced by two rows of Dukane 5A401 speakers which are delayed by 110 and 130 milliseconds respectively through Industrial Research digital time delays.

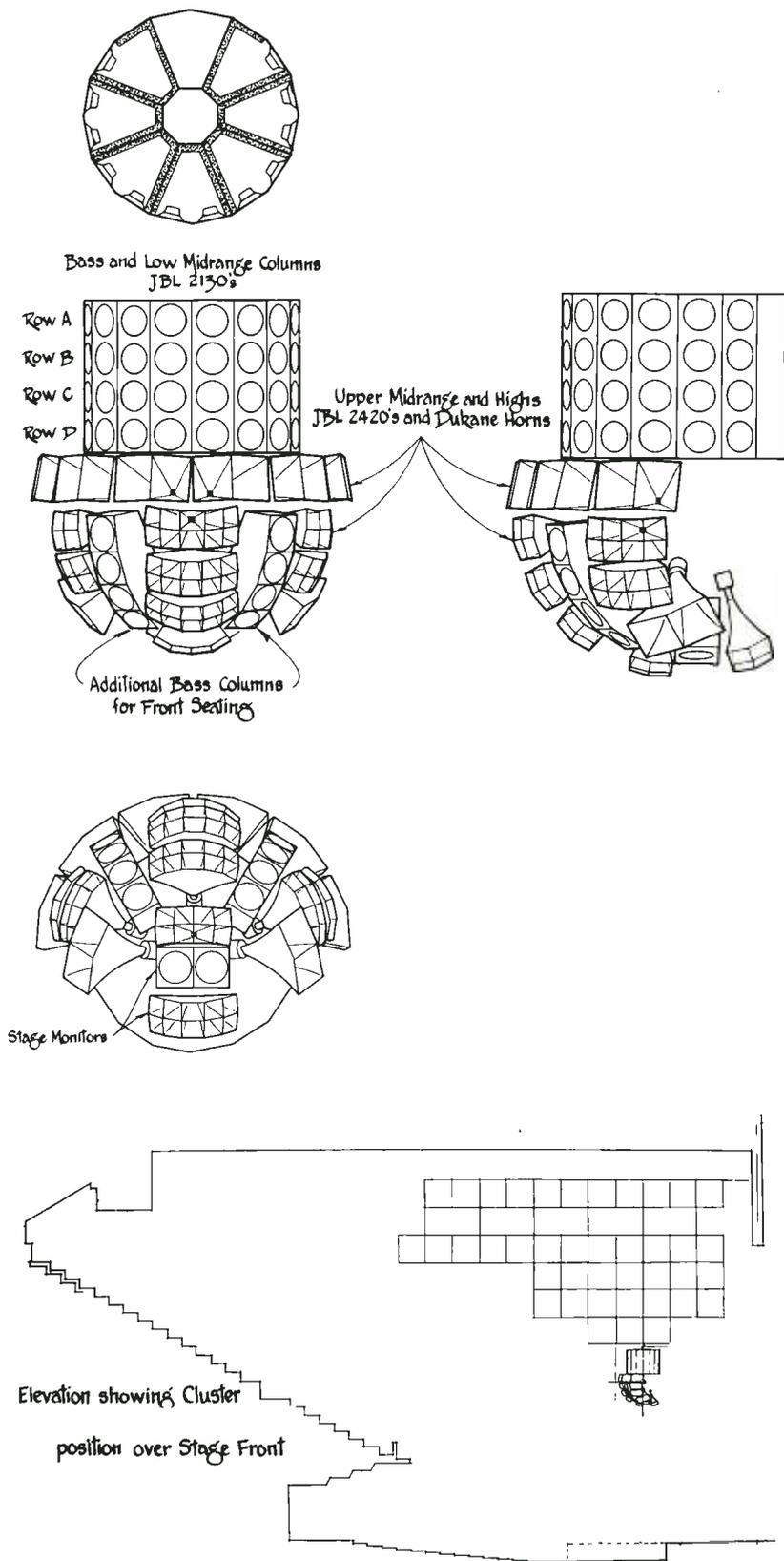
The net result is even sound coverage throughout the auditorium, varying only about ± 2 dB from the loudest part of the house in the front balcony to the quietest part in the rear under the balcony. Typical sound levels during an Opry show are on the order of 83 to 85dB SPL.

The stage monitors, or performer fold-back system, is located in the same cluster as the house reinforcement system. This central overhead portion is not only favorable for radiating sound into the audience, but it is a very suitable location for stage monitoring, being out of the way and virtually invisible. The stage monitor section of the cluster consists of two more JBL 2130's and one additional 2420 with horn, radiating down and rearward onto the stage. For the Opry, and most country shows this arrangement is sufficient, but occasionally with very loud acts additional stage monitors are necessary, which are set up on either side of the stage. Extra amplifiers have been installed for just that purpose.

All power amplifiers for the house are custom built by Dukane and develop a total of 2500 watts of audio power. Each amplifier is direct coupled to a pair of speakers in the cluster that have been carefully selected to present optimum loading on the amplifier. The power amplifiers are equipped with a limiter at their inputs, so that it is impossible to drive the outputs into clipping. Sometimes it gets pretty loud, with the levels occasionally dimbing to 100dB SPL up at the mixer's position.

The console used to mix the stage performance for the audience (as contrasted to the Neve board used for the broadcast) is located just behind the cross aisle in the balcony. It is a fully equipped 20 input Spectra Sonics board similar in most aspects to those found in a well equipped recording studio. There are times when this board will be called upon to send down a stage monitor mix as well, using an auxilliary mixing buss (echo send). As mentioned previously the monitor mix is ordinarily handled by the Spectra Sonics board in the booth downstairs in the broadcast control room. This

Details of the Central Speaker Cluster



typifies the completely flexible manner in which all of the systems in the building may be interfed.

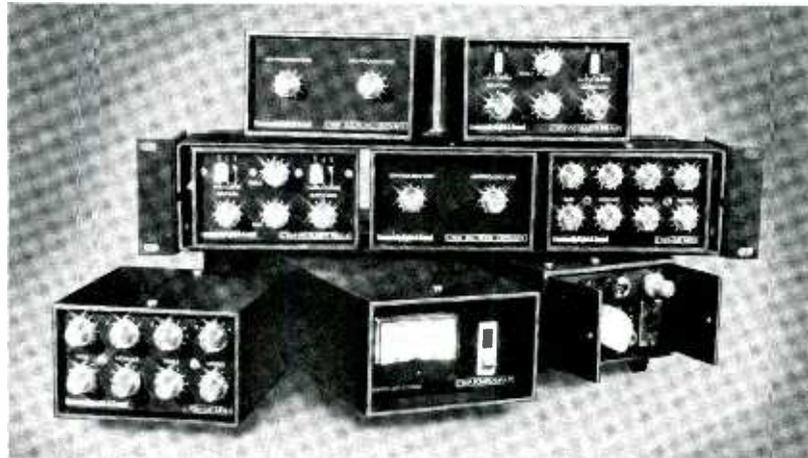
Underneath the stage, behind the hydraulic mechanism used for lifting and lowering the front of the stage, is another item of interest which further illustrates system versatility; the microphone distribution amplifier system. 40 microphone pre-amplifiers are mounted in a rack available for connection to any of the 72 mike inputs on the Opry stage, or to any of the 30 inputs in the recording studio, or any of the 120 inputs in the TV production. The outputs from these distribution amplifiers appear in 4 separate locations; the Neve console patch bay, the Spectra Sonics stage monitor mixer, the Spectra Sonics audience mix board, the Cetec / Electrodyne TV studio console patch bay. This distribution amplifier system, designed by electronic systems consultant Dean Jensen, provides the capability for nearly any mike in the entire building to be controlled simultaneously and separately by any of the major control centers. Each amplifier in the distribution system is strapped for about 20dB of gain, which raises the level on the mike lines to -30dBm and makes them less susceptible to hum and noise pick-up from the SCR light dimming systems and RF from a nearby radio transmitter.

To further guard against noise pick-up, all mike lines have been fabricated with Star Quad cable, which has 4 conductors instead of two; two twisted pairs, twisted out of phase with each other. The audio is applied in phase, and the RF is picked up out of phase and cancels out at the input transformer. The cable has a foil shield, plus a wrapped wire shield. The result is the absence of all noise pick-up problems.

Mechanical noise from air conditioning and other machinery in the building was another potential problem area in the acoustical design. Every piece of equipment that generates noise or mechanical vibration is mounted on vibration absorbing supports. The acoustic power level associated with every fan and motor, the sound transmission through the duct work and diffusers, and the sound absorption characteristics of the room itself were all calculated and correlated to produce a noise criterion of 25, or an absolute noise level of 25dB SPL, which borders on inaudibility.

Opry tradition, however, still rules the house and in keeping with the style of Ryman Auditorium, popcorn machines were installed around the perimeter of the hall, which pop away during the Opry shows, a curious exemption from the rigorous efforts to maintain state-of-the-art audio purity. In spite of the tremendous technological innovations incorporated in the facility, the Grand Ole Opry still adheres to traditional country sim-

ELECTRONIC BRICKS



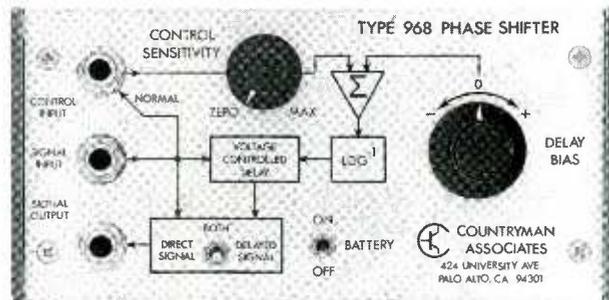
A 120 Watt power amplifier, a four channel mic mixer with three position EQ, a two-way electronic crossover, and pre-amplifier for electric instruments—all in rugged extruded cases that will stand the most demanding service. The C100 Series from Community is a group of high quality electronic building blocks that greatly simplify sound system construction. Straightforward design and careful test procedures insure uniform quality and remarkable dependability. Write for full specifications.

Community Light & Sound

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Circle No. 139

THE PHASER



Would you use phasing and flanging effects more often if they were less difficult to obtain? Now you can produce these effects without tape machines, reproducibly and with complete control.

The Type 968 Phase Shifter electronically delays an input signal and then mixes the delayed and undelayed versions together. It allows you to add the striking "turning inside out" effect of Phase cancellation to any audio signal live or recorded, in the studio or in performance, in minutes instead of hours.



COUNTRYMAN ASSOCIATES

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Circle No. 140

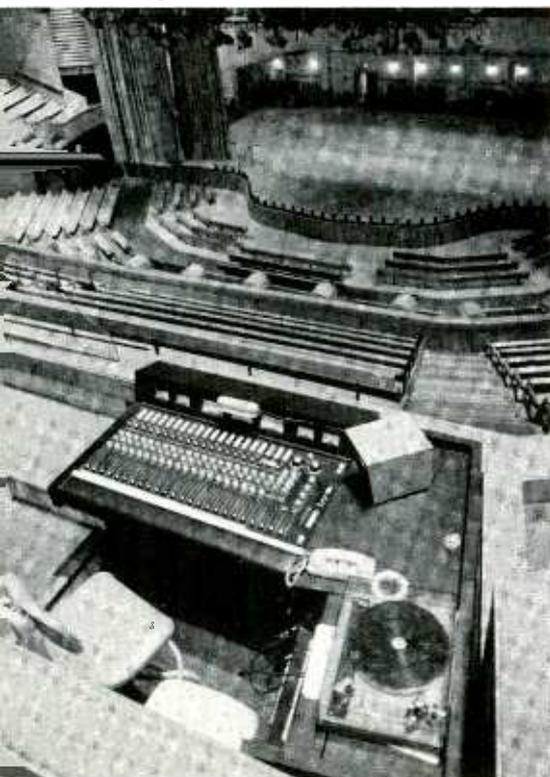
plicity. Even a suggestion to put a grand piano on the stage was rejected in favor of keeping an old open upright piano. Only after a long period of time and after a sizeable number of real country musicians have used it can a "Gimmick" like an electric guitar become accepted on the Opry stage. It is definitely not Opry policy to be progressive in its musical presentations, but the New Grand Ole Opry will certainly not be caught short as new ideas catch on and become part of country music.

THE T.V./PRODUCTION FACILITY

Purcell and Noppe were also responsible for the acoustical design of the TV studio facilities, and, of course, the approach was somewhat different from the auditorium. Here the desired qualities were more like those on a Hollywood sound stage. The reverberant characteristics of the room were kept relatively uniform with respect to frequency, rather than allowing an increase in decay time with decreasing frequency as in the case in a concert hall.

Special attention was also given to exterior noise sources. As the facility is used more or less continuously in video recording and production work, the isolation from overhead aircraft noise was particularly critical, as well as isolation from the mechanical noise generated by the building service systems located adjacent to the TV studio. Double roof construction was used, the concrete floor is floating, the walls are faced with heavy sound traps (besides being very thick), and even the sliding door to the loading dock is a 12 inch thick slab of concrete.

the Spectra Sonics audience mix console looking from the balcony toward the stage



R-e/p 62

According to David Hall, director of technical operations for the entire Opryland complex, the producers and directors of TV shows are becoming more conscious of sound quality in their product, and this requires that the monitor facilities in the video production room be the same as in the TV audio control booth as well as the broadcast control room out in the Opry House; JBL 4320's driven by Crown amplifiers. Further, all the rooms are tuned to match each other as closely as possible. The control rooms are still being modified and rearranged as is natural for any facility less than 6 months old, and for the time being the effort has not been to preserve the frequency response of the rooms at the extreme top and bottom,

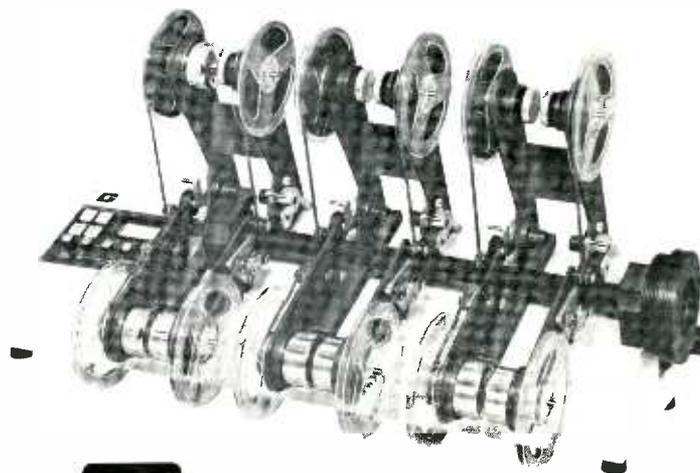
but more to keep the midrange flat, and in general keep out peaks and nodes anywhere in the audio range.

The TV stage is 75 by 75 feet with a 35 foot ceiling and provides excellent space for big orchestras; more than one at a time on occasion. Many of the regular shows that are produced at Opryland have a permanent band associated with them, and sometimes in addition to that there are bands that come in with the guest performers. There's plenty of room to put them all off to the side, of course, but still on the stage.

For the TV productions, following the typical country music formula, nearly all the audio recording is done live, with very little overdubbing done. Usually the audio

After you use the 1056, we'll know one thing about your dub quality: it just got better.

Professional studios that make lots of dubs for radio, welcome the speed and quality they get using the Garner 1056. It offers a whole new set of advantages for producers of reel-to-reel duplicates for radio, AV, or educational needs. Some of those are: • Single capstan drives the master and all five copies. • Solid-state electronics and special heads provide outstanding frequency response. • Two-speed drive allows either 30 or 60 i.p.s. duplicating. • Extra-fast rewind of master tape speeds production. • Unique forward tilt of transport mechanism aids threading. • Conveniently located controls feature push button operation.



GARNER ELECTRONICS

4200 NORTH 48TH STREET
LINCOLN, NEBRASKA 68504

is mixed down to mono and recorded directly onto the audio track of the video machine. Generally, the same program is recorded in 16 track also, so that if the mono mix is not just right, they do have the ability to come back and lock up the 16 track to the video machine, remix the audio and re-record it onto the video tape. Aside from making possible a better audio product, it's economically advantageous to be able to do the rework later on the 16 track tape and not tie up a video crew while working on the audio track. It may be simply a matter of remixing, or it may be sweetening and overdubbing, in any case, once the original tracks are in sync with the video tape, then development can continue on the audio tracks independently of the video.

In conjunction with this is another nifty piece of technical wizardry, the CMX computerized video production programmer. It's not too far removed from "automated mixdown" for multi-track audio, and in fact it's not unreasonable to suppose that the long awaited automated audio technique will eventually be included in the system. The CMX system provides programmed control of video editing, automating functions such as cross fades, A and B roll positioning and timing; and special effects programming.

Typical editing of a commercial TV spot would involve making a time code synced duplicate of the unedited video tapes, then putting the original and duplicate on A and B roll reproducers. Instructions are then typed into the CMX computer, telling it to start the A roll at point X, for instance, and to fade out at point Y, and for the next scene to fade in at point Z on roll B and continue for a predetermined length of time, eventually to cut back to another point on roll A. The computer also controls a third video machine which re-records the mix of A



the TV studio control room. View from behind the CETEC/ELECTRODYNE console

and B rolls, as well as controlling the special video effects board, the slow motion machine, the graphics projection machines, and the 16 track audio machine.

The audio in the TV studio is handled on a 24 input Cetec console, which can be patched as we have mentioned, to any microphone position in the entire building. It can also be fed a mix from any other console in the building, and can feed a mix back to any console. On a large show, for instance, that's televised from the Opry stage, the band may be located on the TV stage and mixed through the Cetec board which feeds the mix to the Neve console out front which combines that material with the performers on the Opry stage for broadcast.

Meanwhile the house mixer up in the balcony is getting the same mix from the Cetec Electrodyne board and mixing it with the performers on stage for the audience in the theatre. At the same time, a 16 track recording may be made from auxiliary busses on the Neve. Very simultaneous.

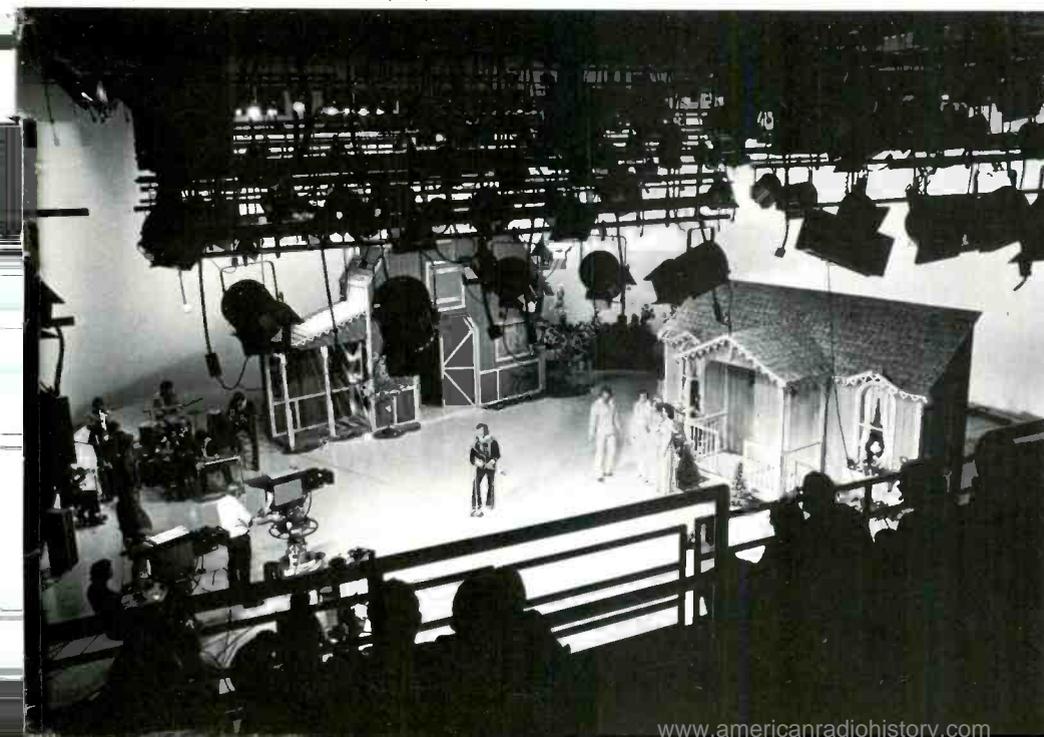
The band room, or recording studio, is not yet in operation, and will be completed in the future as budget considerations permit. At the present time it is simply a 25 by 45 foot room with a sloping ceiling. Eventually it will be properly treated for acoustical control, and will be equipped like most of the Nashville recording studios.

In charge of all audio operations at Opryland is veteran Nashville soundman Hugh Hickerson, who points out, "the entire facility was designed to be much more than just the sum of its individual parts; the usefulness and flexibility of each of the production areas is magnified by its connection to its neighbor. Besides the intricate interconnection of primary audio channels throughout the building there is an equally intricate secondary intercommunication network for paging, control room talkback, special cue systems and general intercom."

What hasn't been mentioned so far is the other audio realm at Opryland; the audio facilities in the 110 acre Opryland park, the mixing booths and systems for the three outdoor shows, a separate full theatre with an audio system for musical stage productions, paging and background music system for each of the separate areas in the park. These, perhaps, are worthy of a separate description, at another time.

The Grand Ole Opry has a new home.

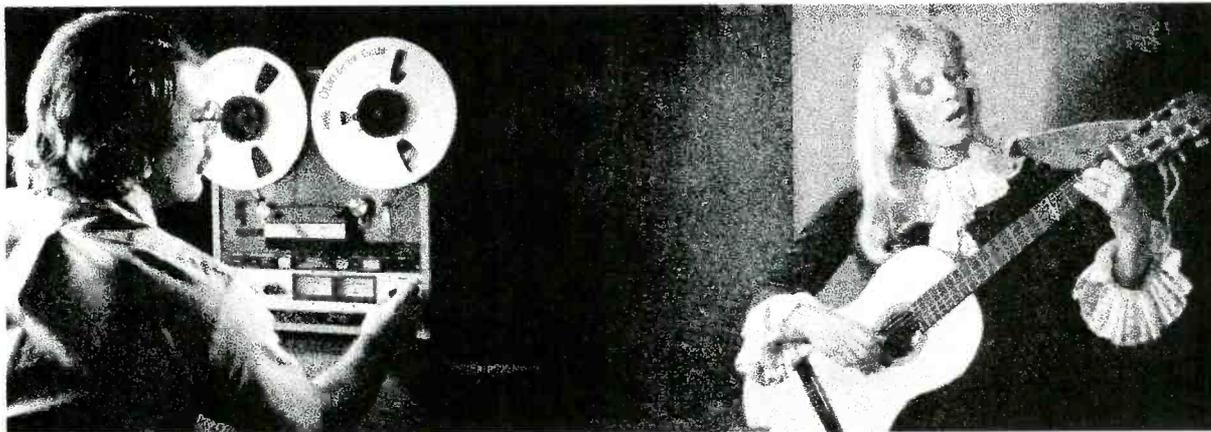
The TV studio, with seating for 250
(photo: Gordon H. Schenck, Jr.)



MINI-PRO!



Little brother to the MX-7000--the MX-5050.



Otari's new Mini-Pro Recorder is everything its name says it is — a compact *professional* recorder. Most important, it's not a warmed over hi-fi recorder with a few semi-professional features tacked on to wow the audiophile. Instead, it's a true professional recorder scaled down in size but not in performance or features.

Who did we design the Mini-Pro for? A whole host of professional users, like the small recording studio, the A/V facility, or the broadcast station that's really beginning to get into production. Or the large studio that needs a compact recorder for its own small studios or its many outside assignments where no-compromise quality is still a requirement. Or for broadcast automation systems where the calculated MTBF of 2000 hours continuous operation can make the difference between success or failure?

How professional is the MX-5050? Check these features: Synchronous reproduce, front panel edit control and mode, two or four channel versions, IC digital control system with motion sensing, optional DC capstan servo system, 15 and 7½ or 7½ and 3¾ ips tape speeds, front adjustable bias, record lockout, built-in test and cue oscillator, head lifters with adjustable-tension cueing feature, plug-in balanced line transformers, built-in mic preamps, Cannon connectors for line input and 600-ohm (+4 dB) output, optional swing-out rack mounting panel, standard reference level calibrate position, and four heads.

Want to know more about this mini with the maxi performance? Or about its MX-7000 big brother, the three-speed machine with built-in test oscillator and some of the best flutter and frequency response specs in the industry? Contact Otari or your nearest Otari Professional Dealer.

OTARI

Otari Corporation
981 Industrial Road, San Carlos, California 94070
(415) 593-1648 TWX: 910-376-4890

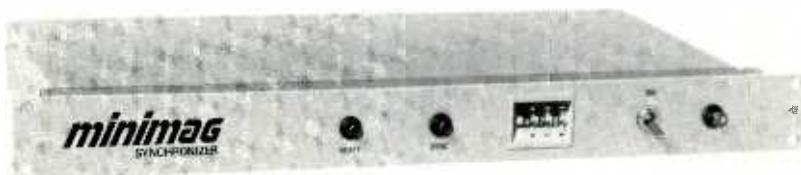
In Canada:
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R-e/p 64

Circle No. 142

www.americanradiohistory.com

NEW PRODUCTS



COMPACT LOW-COST SYNCHRONIZER FOR UNDER \$2000 ANNOUNCED BY AUTOMATED PROCESSES

A new electronic synchronizer developed by Automated Processes, Inc., is described by the company as "the lowest-priced and smallest professional-quality synchronizer on the market today." Called the MINIMAG[®], it measures only 19" wide x 1 3/4" high x 12" deep, and sells for under \$2000. Comparable competitive units, it is said, sell for approximately \$12,000!

The MINIMAG provides all essential functions required for the synchronization of mag tapes. It will interlock any two tape machines, video, multi-channel, sprocketed or unsprocketed audio, and two or more MINIMAGS can be used to synchronize additional tape machines.

Typical applications for MINIMAG include: connecting two 16-track audio tape recorders (ATR) to make them

function as a single 30-track machine; providing variable or fixed delay effects; keeping an ATR in perfect sync with a VTR for audio "sweetening"; synchronizing for TV and FM stereo simulcasts; recording remote overdub tracks, etc.

The MINIMAG synchronizer is supplied as a complete unit, with built-in code generator. It has a capture range of ± 50 seconds and will maintain sync, or variable offset for any length of time regardless of tape stretch or shrinkage. If tapes are within 50 seconds of sync, it will adjust motor control voltage automatically until they are in perfect sync, with or without offset.

Designed for convenient rack mounting, MINIMAG can be installed within 15 minutes. It plugs into any 115/230 volt, 50/60Hz power source, and power consumption is only 2 watts, plus 100 watts for the optional motor drive amplifier required for synchronous motors only.

AUTOMATED PROCESSES, INC., 80 MARCUS DR., MELVILLE, N.Y. 11746.

Circle No. 143

NEW CARDIOID DYNAMIC STUDIO MICROPHONE FROM AKG CAN HANDLE EXTREME SOUND PRESSURE LEVELS WITH LOW DISTORTION

Designated the AKG D-140E the new microphone was designed with the specific and unique on-stage requirements of today's performers in mind. It will comfortably handle high sound pressure levels (128dB with less than 1% distortion).

The D-140E has uniform off-axis response and exceptionally well-maintained directional pattern over the entire response range.

Considerable improvements of the small dimension dynamic microphone element is said to have resulted in increased sensitivity and extension of the overall response range. The Microphone System is internally suspended and encapsulated by an improved, highly-effective wire mesh windscreens, lined with poly-



urethane foam. The D-140E is equipped with a -10dB bass attenuation switch.

User net: \$150.00.

AKG, 100 EAST 42 STREET, N.Y., N.Y. 10017.

Circle No. 144

NEW COMPACT PROFESSIONAL RECORDER FROM OTARI

A new compact professional tape recorder, said to be less than one-half the size and one-third the weight of larger, more expensive professional recorders, has been announced by Otari Corporation, Japan's leading supplier of professional tape recorders and duplicators. Designated the MX-5050 MINI-PRO, the new machine is believed to contain many professional features not found in this price range, while maintaining performance specifications comparable to full size professional recorders.



Among its many professional features are synchronous reproduce, front panel edit control (which allows both spilling and rocking), IC digital control system with motion sensing, adjustable cueing control for audible monitoring in fast forward and rewind, optional DC capstan servo system, 15 and 7 1/2 ips tape speeds (easily convertible to 7 1/2 and 3 3/4), front adjustable bias, record lockout, capstan location on non-oxide side of tape, built in test and cue oscillator, optional swing-out rack mounting panel, Cannon type connectors for input and 600 ohm (+4dB) output, standard reference level calibrate position, separate line and mike input level controls for each channel, versions for two or four channels, four heads, plug-in balanced line transformers, mic preamps, and easy-carry handles.

Price of the two channel Otari MX-5050 MINI-PRO is \$1345.

OTARI CORPORATION, 981 INDUSTRIAL RD., SAN CARLOS, CA 94070.

Circle No. 145

NEW PRODUCTS...

continued -

NAKAMICHI 500 A SECOND GENERATION TWO-HEAD CASSETTE SYSTEM

The NAKAMICHI 500 utilizes a specially constructed crystal permalloy record/playback head whose gap is focused at 1.5 microns mechanically and magnetically, thus ensuring an ideal high frequency response. The Dolby noise reduction system is calibrated to the real 0dB level, not the usual +2 or +3dB level, to maximize signal to noise ratio.



As in all the NAKAMICHI professional decks, there are three microphone inputs, a stereo pair and a blend mic, each with its own level control. For on-location recording, where levels are difficult to ascertain prior to the performance, NAKAMICHI includes its proven peak limiting device.

A memory rewind switch makes it easy to return to any given spot on the tape. The three position selector properly biases and equalizes the deck for the new ferric tapes that have an extended high frequency response, as well as the usual low noise/high output ferric tapes, and the quiet chromium dioxide tapes. A DC servomotor provides constant tape speed, despite line voltage variations and the deck automatically disengages both the heads and the pinch roller at the end of the tape.

Specifications are: power supply - 100, 117, 220, 240V 50/60Hz; power consumption - 40W Max.; tape speed is 1-7/8 ips. Wow and flutter is less than 0.08% WRMS.

Frequency response - 40-17,000Hz ± 3 dB (EX Tape), 40-16,000Hz ± 3 dB (CrO2 Tape), 40-15,000Hz ± 3 dB (Low Noise Tape).

Signal to noise ratio better than 58dB (CrO2 Tape), better than 55dB (EX, Low Noise Tape) (WRMS, CCIR, at 400Hz and 3% distortion with Dolby in). Total harmonic distortion less than 2% (at 1kHz 0dB, EX Tape). Erasure better than 60dB (at 1kHz 0dB, Saturation level). Channel separation better than 35dB (at 1kHz 0dB); cross talk better than 60dB (at 1kHz 0dB); bias frequency 105kHz.

Input: mic input 600 ohm 0.2mV, blend mic 600 ohm 0.2mV, line 150kohm 70mV, DIN 25kohm 13mV.

Output: line 1.0V (max.) variable, headphones 8 ohm 1mW (0dB).

15"W x 4 1/2"H x 10"D and weighs 15 1/2 lbs.

Price: \$399.00

Circle No. 146

NAKAMICHI 550-PORTABLE DOLBY CASSETTE SYSTEM

(Soon to be released)

The Model 550 is essentially the portable version of the '500'! The DC servomotor provides accurate speed control



despite the source, whether it is battery, car jack or 117 volt line current. The built-in high quality monitor speaker facilitates critical on location monitoring. NAKAMICHI RESEARCH (U.S.A.) INC., 220 WESTBURY AVE., CARLE PLACE, N.Y. 11514

Circle No. 147

NEW CROWN M-600 AMPLIFIER MEETS THE DEMANDS OF HIGH POWER AMPLIFICATION APPLICATIONS

Crown International has added a new amplifier, the M-600, to their full line of high quality units. The M-600 is a monoaural, single-channel amplifier that has been specially designed to meet the demands of high power amplification applications. Unit provides continuous operation at rated power, at any rated frequency and is fully protected from shorts, open circuits, mismatch, RF burnout and thermal overload.

The Crown M-600 amplifies signals from DC to 20kHz and provides 70 volt unbalanced line output at 600 watts of continuous power into 8 ohms and 1000 watts into 4 ohms, indefinitely.



Built for durability and trouble-free operation, the M-600 includes built-in cooling which permits continuous full power operation. A two-speed fan shifts to high speed if heat sinks exceed 140°F.; amplifier shuts down to standby mode if sink temperature exceeds 160°F. and then automatically re-activates when tem-

perature drops down below 160° F. M-600 also contains a changeable, plug-in input board which enables the unit to drive any type input load, even a pure reactance without adverse effects. Modifications to the basic plug-in board can be used to add filtering, preamplification, mixing, and constant current sensing. The M-600 also employs a newly patented output bridge circuit which permits extremely high power levels to be safely sustained.

For ultra high power applications, the coupling of two M-600's together through a socket at the back of each amplifier produces a 140 volt balanced output, and a new unit - the Crown M-2000. This configuration produces 2 kilowatts into an 8 ohm load.

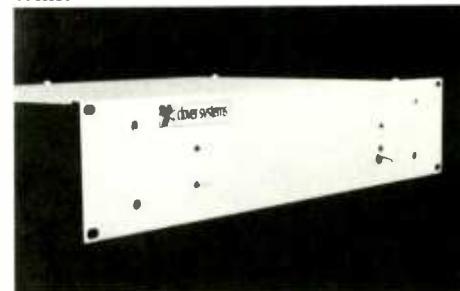
CROWN INTERNATIONAL, 1718 WEST MISHAWAKA ROAD, ELKHART, IND. 46514.

Circle No. 148

TWO-CHANNEL REVERB UNIT BY CLOVER SYSTEMS

Suitable for professional recording, P.A., and broadcast applications, the new CLOVER R-500 twin channel reverb unit is now available.

Featuring four special alloy transmission lines per channel, the R-500 is said to produce a clean and quiet reverberation comparable to existing systems costing three times as much. The R-500 is also the first commercially available reverb system to come equipped with both high and low impedance connections, making the unit compatible with standard +4dBm levels as well as the low level high Z systems.



Other unique features include L.E.D. level indicators on both channels and a S/N of 75dB. Frequency response: 100Hz to 6,000Hz. Decay time: 1.8 sec. Hum and noise: 75dB below maximum output. Maximum output level: +18dBm. Input impedance (unbalanced): High level - Low level 50,000 ohms. Output impedance (unbalanced): High level - 50 ohms, Low level - 5,000 ohms. Nominal input/output levels: High level - +4dBm, Low level - 100 mV (-20dBm). Connectors: High level - barrier strip, Low level - RCA jacks. Dimensions: 19"x3 1/2"x10 1/2". Power requirements: 110 volts, 50/60Hz, 10 watts max. \$500.00.

CLOVER SYSTEMS, 6232 SANTA MONICA BL., HOLLYWOOD, CA 90038.

Circle No. 149



ORBAN/PARASOUND MODELS 621A/621B PARAMETRIC EQUALIZERS

ORBAN/PARASOUND announces the availability of the new models 621A/621B Parametric Equalizers. The models 621A/621B offer four cascaded equalization sections, each with non-interacting, continuously adjustable center frequency, bandwidth, and amount of boost or cut controls. Each section provides up to 16dB peak and can dip to minus infinity, permitting use as a notch filter to eliminate hum and other fixed-frequency interference. Each section tunes over a 20:1 frequency range, with broadly overlapping coverage for maximum flexibility. Bandwidth is continuously adjustable from approximately 1/4 octave to 3 octaves.

An overload light is provided which monitors each section and indicates the presence of peak clipping in any part of the equalizer. The light is driven by a

peak-stretching circuit so that very short overloads will light the lamp long enough to be easily seen. Overloads can be instantly corrected with the integral gain control. Up to 12dB gain is available so that the equalizer can be used at either line or intermediate-level patch points.

Typical 1kHz harmonic distortion is 0.06% at +20dBm out, and unweighted noise in a 26kHz noise bandwidth is typically -80dBm with equalizer controls flat. Slew rate exceeds 2.5 v/microsecond.

The Parametric Equalizer is initially offered in single and two channel configurations on a 3.5" x 19" rack panel. The toggle EQ IN/OUT switches are mounted so that equalizers in multiple installations can be switched in or out with a single sweep of the hand. Each equalizer requires plus and minus 15 volts DC at 60 ma per side.

Price: \$419.00 – single channel (Model

621A), \$598.00 – two channels (Model 621B).

PARASOUND, INC., 680 BEACH ST., SAN FRANCISCO, CA 94109.

Circle No. 150

GREATER DYNAMIC RANGE OFFERED IN NEW SCOTCH BRAND '250' STUDIO MASTERING TAPE

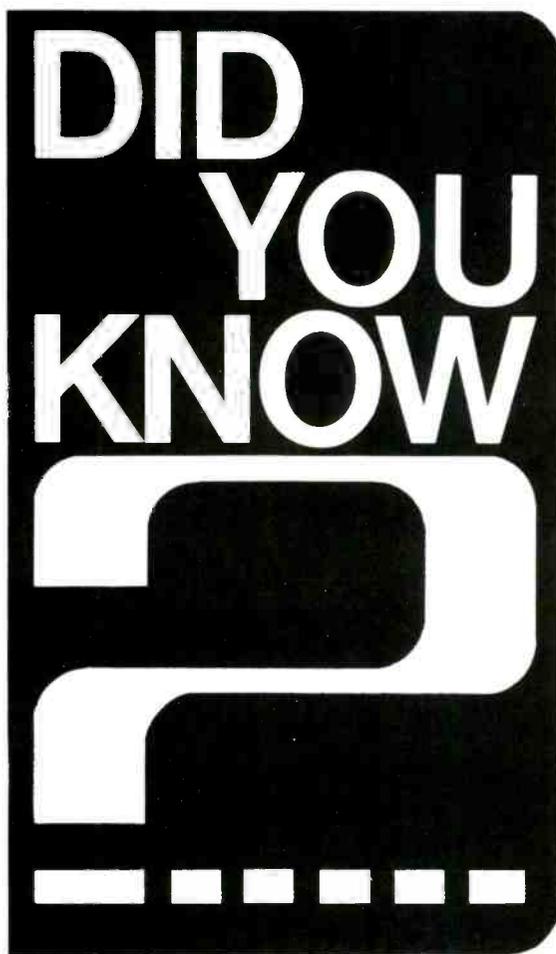
A new high-performance studio mastering tape, Scotch brand 250, has been announced by 3M Company, St. Paul, Minn. With a wider dynamic range than any previous Scotch brand tape, it is said to "out perform all others."

According to 3M's Magnetic Audio/Video Products division, the improved oxide coating of the new tape has these principal features:

Reduction of tape noise, combined with higher output, to effect a signal-to-noise ratio 4dB beyond that of conventional tape on the market.

Improved shape of oxide particles and improved binder, to produce a higher-density coating with a smoother surface. The smoother recording surface provides better high-frequency saturation levels, improved head-to-tape contact, and reduced side-band "fuzziness" around each tone.

Improved high-strength binder system to stand up to extensive overdubbing, shuttling and multiple retakes without oxide shedding or powdering. Greater



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NEW PRODUCTS...

continued -

wearability enhances performance in high speed bin loop mastering operations for duplication.

The textured backing eliminates high-speed wind scatter and prevents cinching during handling or shipment. This back treatment is also electrically conductive to reduce static attraction of dropout reducing dust and dirt.



The resultant dynamic range, 3M says, is 78dB; this is 4dB greater than Scotch brand 206, 7dB greater than the older type 202, and 12dB greater than 3M's pioneering type 111 tape.

Users of type 206 tape will need only minor quick set-up changes in bias and level to switch to the new 250 tape; no changes in equalization are required in moving from one to the other.

Scotch brand 250 tape is available from 3M Magnetic Audio/Video Products division representatives at prices about 20-30 per cent above those of type 206. The new tape is supplied in 2, 1, 1/2, and 1/4-inch widths.

3M COMPANY, DEPT. MA4-22, BOX 33600, ST. PAUL, MINN. 55133.

Circle No. 152

MULTI-TRACK FIVE SECTION VARI-BAND EQUALIZER

Multi-Track announces their new improved five section vari-band parametric equalizer. The new unit has five simultaneous operational sections versus the three with which the previous model was delivered.

Each section has + or - 15dB of boost or cut, bandwidth control from 16dB/octave to 2dB/octave. There is also an in/out switch with red LED indicator for fast in/out comparison of any section or all sections simultaneously.

The bandcenter frequency sweep ranges for the five sections are 20-100Hz, 100-600Hz, 600-3kHz, 3k-6kHz, and 6k-20kHz. With the addition of these new frequency ranges the device, it is said by the company, will produce the kind of operating flexibility found previously only when a graphic equalizer or a parametric equalizer was used individually.



All circuitry is operational amplifier, and used no transformers or inductors. Available in a standard 3 1/2" x 19" rack mount package.

Price: \$450.00.

MULTI-TRACK, P. O. BOX 3187, HOLLYWOOD, CA 90028

Circle No. 153

MODEL 750 LABORATORY POWER AMPLIFIER

A new low cost high power amplifier said to be capable of delivering over 700 watts into an 8 ohm load is now available from BGW Systems.

The BGW 750 can be operated in either Mono (bridge connected) or Stereo Mode with the flip of a switch. This unit features forced air cooling, SCR crow bar protection, front panel mounted circuit breaker and as much as 900 watts total output power. 3000 watts of output power transistors provide a tremendous safe operating area.



Power Output (average continuous power): Stereo Mode - both channels driven; 440 watts into 8 ohms (220 watts/channel), 700 watts into 4 ohms (350 watts/channel), 900 watts into 2 ohms (450 watts/channel).

Stereo Mode - One channel driven: 230 watts into 8 ohms, 400 watts into 4 ohms, 600 watts into 2 ohms.

Mono Model (Bridge connected operation); 425 watts into 16 ohms, 700 watts into 8 ohms, 840 watts into 6 ohms, 860 watts into 4 ohms.

Frequency response: ± 3 dB 20Hz to 20kHz; ± 3 dB 5Hz to 60kHz.

Harmonic or IM distortion, less than 0.2% at 200 watts per channel or less into 8 ohms. Hum and noise, (20Hz - 20kHz)

105dB below 200 watts into 8 ohms. Input sensitivity; 2 volts $\pm 2\%$ for 40 volts out (200 watts, 8 ohms stereo operation) or 2 volts for 80 volts out mono operation.

Size: 7" x 19" Rack Mount x 14 3/4" deep, 1/8" steel front panel, black finish with aluminum handles.

Weights less than 50 lbs. and available 4 weeks ARO.

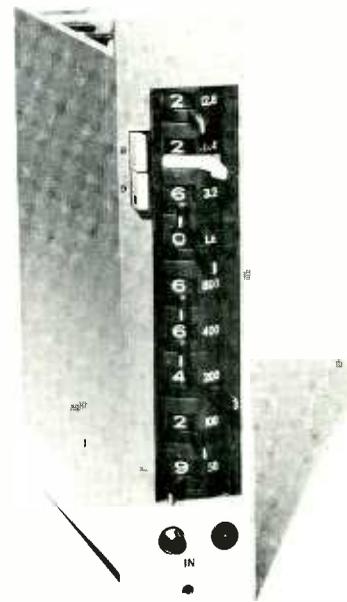
Price: \$899

BGW SYSTEMS, POST OFFICE BOX 3742, BEVERLY HILLS, CA 90212.

Circle No. 154

NEW SPHERE 900 GRAPHIC EQUALIZER

Sphere Electronics, the Console Company, announces the availability of the new Sphere 900 Graphic Equalizer. The new unit is designed for ease of operation and for installation in new or older consoles where compactness and dense packaging is either necessary or desired.



Nine specific frequencies have been selected for optimum flexibility in music and speech equalization. By using frequencies in octaves, shaping of the audio spectrum for the particular effect desired is accomplished with minimum phase shift and related distortion.

An unusual feature of the equalizer is the provision for shifting the 6400Hz frequency as desired up to 8000Hz, or down to 5000Hz, thus permitting the most precise control of the important "presence" frequencies. Boost or cut of all frequencies in eleven steps from -15dB to +12dB. An equalizer in-out switch with an LED indicator is also provided. The unit can be strapped for either bipolar or unipolar power supply.

Price is \$325.00.

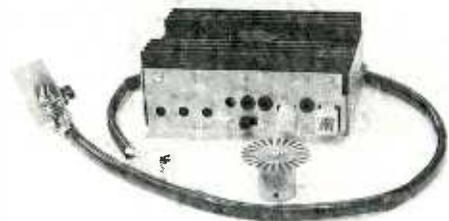
SPHERE ELECTRONICS, 20211 G PRAIRIE, CHATSWORTH, CA 91311.

Circle No. 155

TENTROL ENSURES STEADY TAPE SPEED

Accurate control of tape tension for steady speed is provided by TENTROL, just introduced by Inovonics, Inc., of Campbell, California.

TENTROL provides constant tension from beginning to end of any size tape reel by controlling the torque of the supply-reel motor. The unit consists of a reel speed sensor and control circuitry and can be installed easily in the field.



TENTROL eliminates tape speed changes, and thus changes in pitch, with tape reels as large as 14 inches. This allows duplicators to use larger reels on slaves without loss of quality. TENTROL also extends head life by eliminating excessive tension, and improves high-frequency performance by reducing azimuth and head contact variation.

An additional TENTROL unit can be installed on the takeup motor to provide constant takeup tension as well. Two units can provide fast starts at 30 ips and eliminate capstan creep.

TENTROL units are available for nearly all Ampex tape recorders and for many other popular machines. INOVONICS, INC., 1630 DELL AVE., CAMPBELL, CA 96008.

Circle No. 156

HARMAN / KARDON ANNOUNCES NEW CD-4 DEMODULATOR ADAPTOR

A new CD-4 demodulator adaptor designed for use with existing four-channel receivers which lack CD-4 circuitry has been developed by Harman/Kardon.

Called the "44+," the unit provides the impedance characteristics required by the special cartridges necessary for discrete disc playback, and feeds the high level inputs on existing quad receivers.

The function switch's three positions allow for: CD-4/AUTO, which actuates the CD-4 circuitry when the carrier frequency impressed in the groove walls of all CD-4 discs is present; STEREO, which defeats the CD-4 circuitry completely, and BYPASS, which directs the signal from the turntable or record changer immediately into the amplifier or receiver.

"Design variations have been employed with a view to improving performance; simplifying circuitry, construction, and operation, and improving reliability.

"The benefits are expressed in reduced CD-4 circuitry size and the absence of



superfluous controls such as a carrier level adjustment."

"The interior layout of the '44+' allows for easy servicing, should it be needed, and isolates critical circuit areas from hum and noise producing components.

Suggested retail price of the Harman/Kardon "44+," is \$119.95.

HARMAN INTERNATIONAL, 55 AMES CT., PLAINVIEW, N.Y. 11803

Circle No. 157

VERSATILITY KEY TO NEW LIMITER

A versatile new limiter that, it is said by the company, will fill any limiting or compression need has been announced by Inovonics, Inc.

The Model 201 Average and Peak Responding Limiter is designed for studio recording, mastering, broadcast, film, sound reinforcement, and other audio applications.



The average level and peak limiting functions operate simultaneously and independently. Front-panel controls are provided for all functions, including variable attack/release time and response action.

The Model 201 provides smooth, "effortless" sound with its unique openloop control approach and distortion-reducing circuitry. Price: \$480.00.

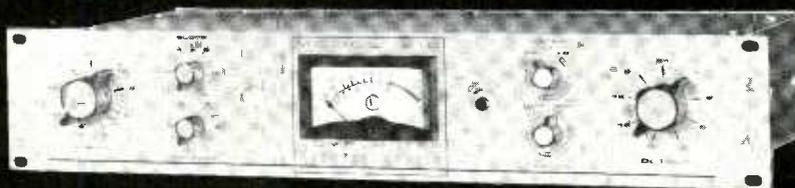
INOVONICS, INC., 1630 DELL AVE., CAMPBELL, CA 95008.

Circle No. 158

PROFESSIONAL CASSETTE EQUIPMENT INTRODUCES NEW CASSETTE LOADER

The Model 300 Cassette Loader is

COMPLIMITER™



MODEL 610

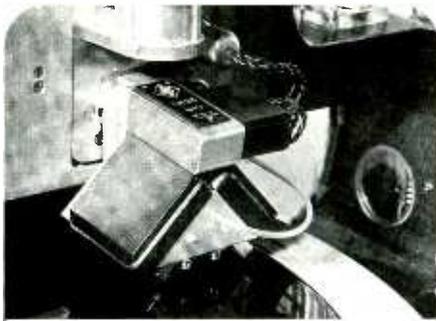
Used in recording studios; disc mastering studios; sound reinforcement systems; TV, AM, FM broadcast stations to maintain a sustained average signal at a level significantly higher than that possible in conventional limiters, and with performance that is seldom attained by most linear amplifiers. Rack mounted, solid state, functional styling, the Model 610 is in stock for immediate shipment.

Specifications are available from:

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(801) 392-7531





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Circle No. 160

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No. 1 in performance and No. 1 in popularity.

- The versatile Universal Audio 1176 LN peak limiter has ultra-fast attack time, push-button selection of compression ratios for every program requirement, and adjustable attack and release times.
- The LA-3A Leveling Amplifier is a no fuss RMS limiter/compressor with a patented electro-optical attenuator. Just set it and forget it. Half rack size, 3-1/2 inches high.

They both offer a bonus of no increase in price! The 1176 LN is under \$500.00 and the LA-3A under \$400.00. UREI quality, of course.

Available through your UREI dealer.



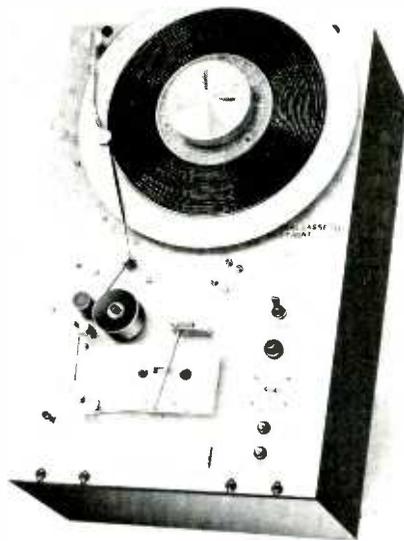
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Circle No. 161

designed to bring to the industry a dependable, professional high-speed cassette loader at an economical price. The loader features 120 ips loading speed with the



cassette time dialed directly in minutes. The accuracy of the loader is -0, +3 feet of tape. The vacuum splicing block provides ease of splicing permitting production of 500 cassettes in an 8-hour shift, accounting for operator fatigue and breaks. A take-up switch winds the loop of tape into the cassette after splicing. The loader provides gentle tape handling by the use of dynamic braking and electronic hold-back tension. The accuracy and operation of the loader is controlled by reliable digital integrated circuitry. Cue-tone loading and automatic cutting are available.

Priced from \$950.

PROFESSIONAL CASSETTE EQUIPMENT, 1660 20th STREET, SANTA MONICA, CA 90404.

Circle No. 162

LOW-COST PROFESSIONAL-QUALITY EQUALIZER FROM AUTOMATED PROCESSES, INC.

A new low-cost modular equalizer developed by Automated Processes, Inc., has been announced.

The Model 553 Equalizer is suitable for a wide variety of applications in broadcasting, recording, film mixing, and sound reinforcement installations. The shelving type low and high frequency families of curves produce overall balance changes in the musical spectrum, while the 3kHz mid-frequency peaking curves specifically affect the "presence" range of the music and dialogue.

The high, mid, and low frequency controls are continuously variable with up to 15dBm of boost or cut. There is a silent In/Out switch with LED indicator, and transformer isolated output to a maximum of +24dBm. Power requirement is ±15 VDC @ 30 mA, and the dimensions (1 1/2" x 5 1/4" x 6" deep) permit inter-



changeability with other equalizers in the Automated Processes line.

Price of Equalizer Model 553 is \$105. AUTOMATED PROCESSES, INC., 80 MARCUS DR., MELVILLE, N.Y. 11746.

Circle No. 163

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122-16 . . . MCI JH-8

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124-2 . . . Scully 284-8

8-track with Syncmaster, the most popular 8 track of them all, in good operating condition . . . \$7,550.
124-3 . . .

12 track Scully with 2 transports (one inch and half inch), extra 8 & 4 track heads, in good condition, use as separate 8- and 4-track machines, or together as 12-track, one console mount houses both transports, 12 track syncmaster, original cost over \$22K . . . \$9.8K (pick up an extra 2 track head and you've got it all!)
124-6 . . .

12 track Scully with 8 & 4 track heads, remote and sort of a Syncmaster, rough, but it runs, is fairly quiet and you can't beat the price . . . \$6.7K. (This is what the real estate folks would call a "handy man" special!)
124-8 . . . Scully 282-4

4-track in console, manual lifters, old style, but still meets all specs . . . \$2,700.
124-9 . . .

Scully 100 with every extra available. 16-track with extra 8 track heads, extra remote panel, now in regular operation for rock, a real bargain for \$11K.
124-11 . . . Scully 288-16

Big Scully 16 track that's still the favorite of many major studios (ask A&M), originally sold with Syncmaster for over \$24K, this one's in regular service and a real bargain for only \$12K.
128-3 . . .

Audio Design 12 input 4 output console used in well known 8 track studio, all the standard Audio Design built in quality and performance, good looking board, only 2 years old, cost nearly \$20K . . . \$10,500.
129-4 . . .

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129-8 . . .

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Several more 12 track, 8 track and 2 track Scully's offered at great bargain prices . . . call us for your needs and see what we have at the time. All these units offered subject to prior sale, 10% deposit holds for two weeks inspection, deposit refundable if you can't get together with us or the owners.

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- 1 Ampex 351 — top plate MCI electronics — two track IN CONSOLE 7 1/2-15 ips \$1850.00
- 1 Ampex 351 — top plate MCI electronics in Scully portable cases two track stereo 7 1/2-15 ips \$1750.00
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continued from page 11

EASTERN OFFICE OPENED BY CHICAGO'S LASALLE AUDIO

Cindy Guzzo, General Manager of LaSalle Audio announces the opening of a branch office in Teaneck, New Jersey. This office will be under the management of Irv Joel, formerly of A & R Recording. Mr. Howard Lieberman, also formerly of A & R, has been appointed Sales-Engineer for the New Jersey office. The LaSalle Audio office in Teaneck, New Jersey will service the northeastern states, The Greater New York, New Jersey Metropolitan area and will carry the same product, consultation and service as the office in Chicago.

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Studio Supply Company unconditionally warrants any turn-key studio installed by us

- total system and individual pieces of equipment
- parts, labor and travel expenses for a period of 90 days from completion, over and above any manufacturer's warranty

This isn't new—it's been that way since Day One. When manufacturers parts and labor warranties exceed this, we back them to the hilt.

Of the two major turn-key studio builders in the United States, only Studio Supply Company has complete service staff, spares, and full in-house bench and field support for every item we sell. We have even been asked to (and are glad to) fix gear the other guys have sold.

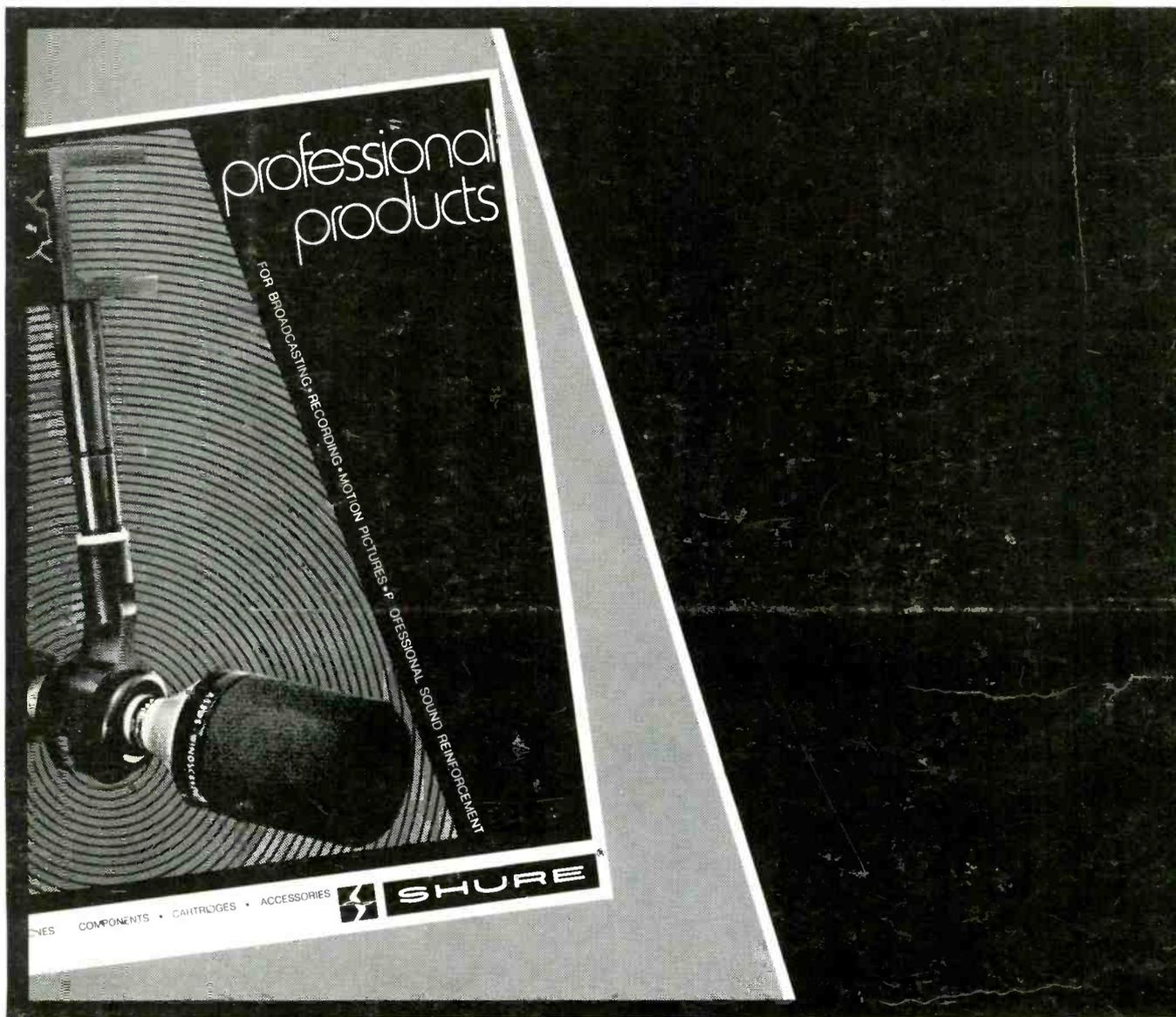
From the day we take our first look at a new product, to determine its performance, suitability and reliability, our service guys are reading the manuals, talking with the designers, and intimately learning all circuits and systems to insure that from the first piece installed, service is timely and competent.

Our people have more experience, know edge, and expertise in the service of our systems and the gear we sell than any similar organization. Each prime field service man has over 150 hours of intensive classroom training and our guys collectively have well over 100 years of professional service experience.

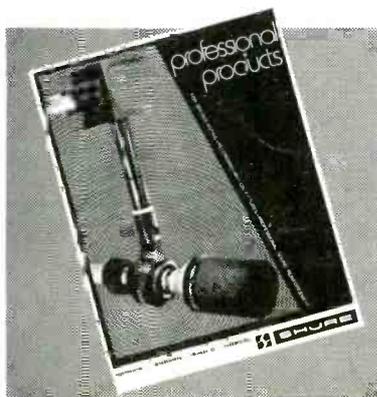
The reason we accept long term service responsibility for the studios we build is...

WE DO IT RIGHT THE FIRST TIME

Circle No. 167



Studio equipment home shopping guide



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