# Recording engineer producer

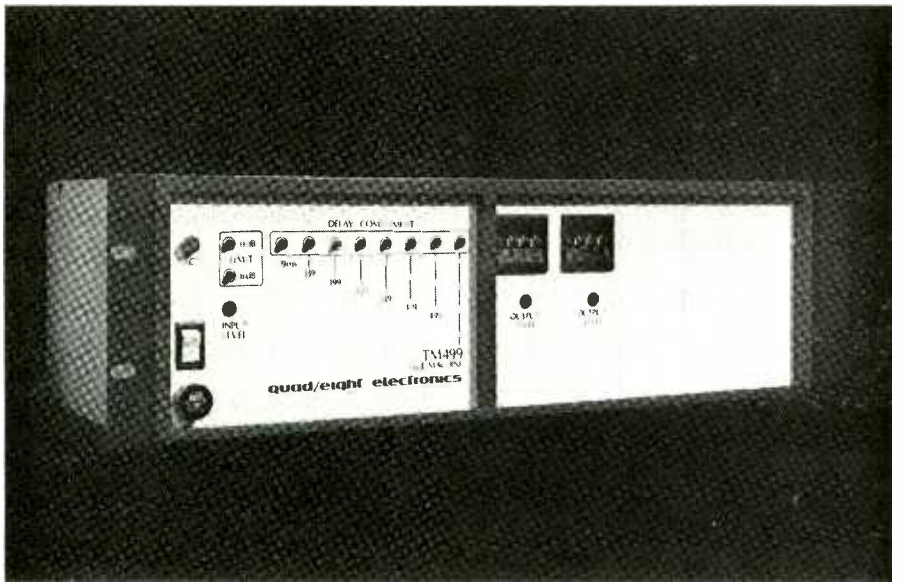
INCLUDING: CONCERT SOUND REINFORCEMENT



VOLUME 5 — NUMBER 3 $1.50 JUNE 1974

THE CALIFORNIA JAM — PAGE 53

# the time machine




## TM499 DIGITAL AUDIO DELAY LINE

**An** electronic audio signal delay instrument, the TM 499 represents the most advanced product available for any audio time-domain alteration application. Conceived with the latest design in audio to digital technology, the TM 499 incorporates innovative circuit design and operational features not found in other time-delay devices.

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*Circle No. 102*

*Re/p 5*

# Introducing the new "C." Our best AG-440 yet.

Introducing the Ampex AG-440C. Latest model in an unbroken line of the world's most respected professional audio recorders. From the company that produced the very first professional audio tape recorder and has always been the standard of excellence against which all others are measured.

Ever since we produced our first AG-440 unit, delighted users have been kind enough to share with us their ideas to make a great machine even better. It was user suggestions that helped us design the AG-440B, and it was user suggestions again that inspired the new AG-440C.

Users requested **improved tape handling,** so we installed sapphire tape guides for less skew, tighter phase stability, and improved high frequency/high amplitude performance.

Users requested **easier editing,** so we redesigned the transport to allow tape spilling without going through the tension arm.

Users requested **motion sensing,** to allow them freedom to push any transport command button at any time, without fear of breaking the tape or stripping a gear. We installed the extra circuits and controls to make this possible.

Users requested **automatic monitoring in Sel-Sync mode,** so we made the switchover from output to input channel automatic whenever the Sel-Sync command is "record."

Users requested **more linearity at the high end,** so we extended the high frequency response as far as we could. Now the AG-440C is the world's flattest machine — from 30 to 25,000 Hz.

Users requested **pushbutton record/playback selection** for each channel. The knobs are gone, the buttons are in their place. And you can read the indicators all the way across a studio.

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Users requested **detent channel setup** for quick, positive return to preset levels following calibration. We complied.

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**AMPEX**

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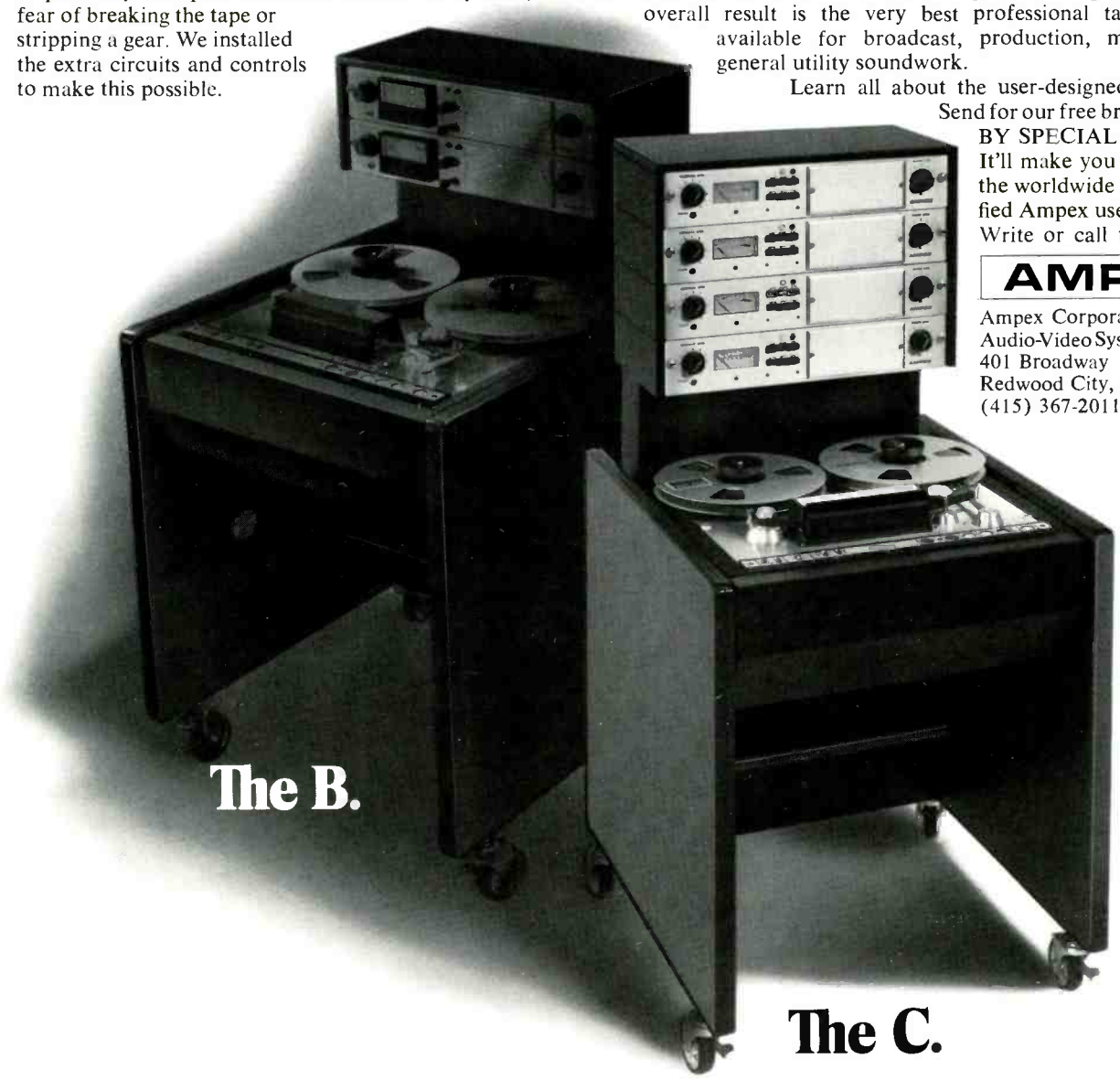




Circle No. 103

# RECORDING
**engineer/producer**

– the magazine to exclusively serve the recording studio market . . . all those whose work involves the recording of commercially marketable sound.

– the magazine produced to relate . . . RECORDING ART to RECORDING SCIENCE . . . to RECORDING EQUIPMENT.

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*JUNE 1974*
*VOLUME 5 – NUMBER 3*



making the 1973 GRAMMY award winning album "INNERVISIONS" . . . conversations with engineer/producers MALCOLM CECIL and BOB MARGOULEFF and mastering engineer KENT DUNCAN — 17 — *Gary Davis*

ACOUSTICS IN STUDIO DESIGN — 29 — *Tom Hidley*

a production analysis; album: "NEIL YOUNG" with commentary by producer DAVID BRIGGS and engineer MARK RICHARDSON — 41 — *Paul Laurence*

"THE OCTOPUS" — 49 — *Anthony Blazina, Peter Butt*

concert sound reinforcement: 54,000 Watts of audio power = 105dB SPL at one mile = 200,000 satisfied rock fans . . . how TYCHOBRAHE did "THE CALIFORNIA JAM" — 53 — *Wayne Yentis*

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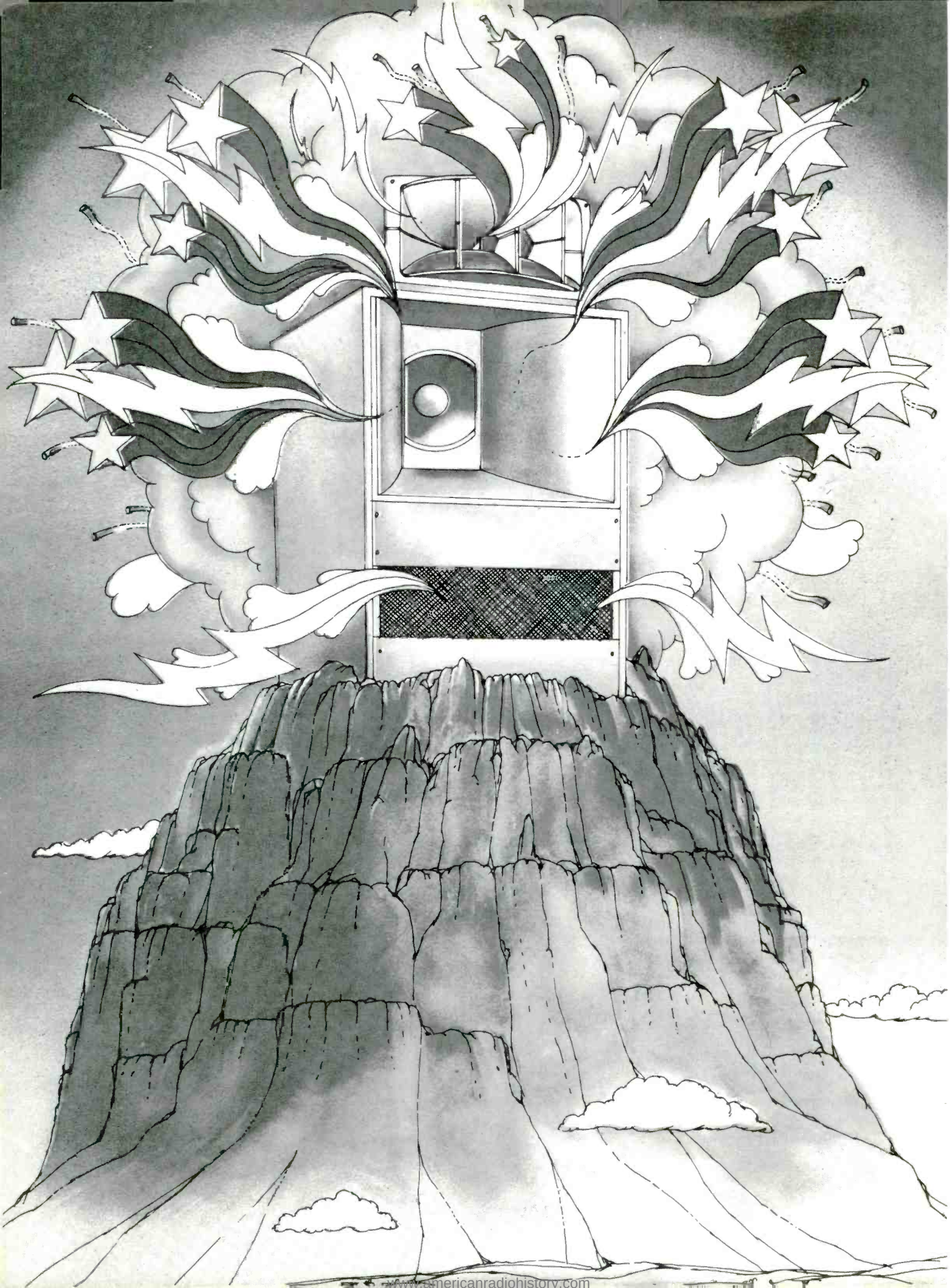

# Altec, we challenge you.

Any company that achieves a position of leadership must be prepared to meet the challenge of innovation. In the recording industry, this is a particularly crucial factor—because constantly evolving musical material demands ever newer and better recording techniques.

For nearly 30 years, one name has dominated the studio monitor market. Altec. In 1973, Altec had more than twice as many speakers in recording studio use in the U.S. than its nearest competitor. And nearly as many as all other brands combined. (Source: Billboard's 1973 International Directory of Recording Studios.) That's leadership without question.

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## The challengers.

From front to back, it's the 9849A, the 9846-8A and the 9848A. If you listen for a living, you should know more about them. Write or call. We'll send you all the facts and figures.

*Circle No. 104*

# Letters & Late News

From: DAN DUGAN
SAN FRANCISCO, CA.

*I am very very very happy to see your article, "Seen Any Good Records Lately" in R-e/p. In my memory this is the first time that an article dealing directly with the aesthetics of working with sound has appeared in any of the technical magazines that I read.*

*Its uniqueness points up the poverty of the American approach to sound as a purely technical craft. May you prosper! Thanks again.*

**Reader Dugan's complimentary sentiments were consistantly echoed in an assortment of cryptic notes on returned Reader Service Cards. Critics, too, were vocal. Author Laurence's approach is, at very least, comment provoking. His second effort appears on page 41.**

**– ED**

---

From:
ANDREW A. GRIFFIN
PURRfection – TECHNOGRAPHY
SPRINGFIELD, MO.

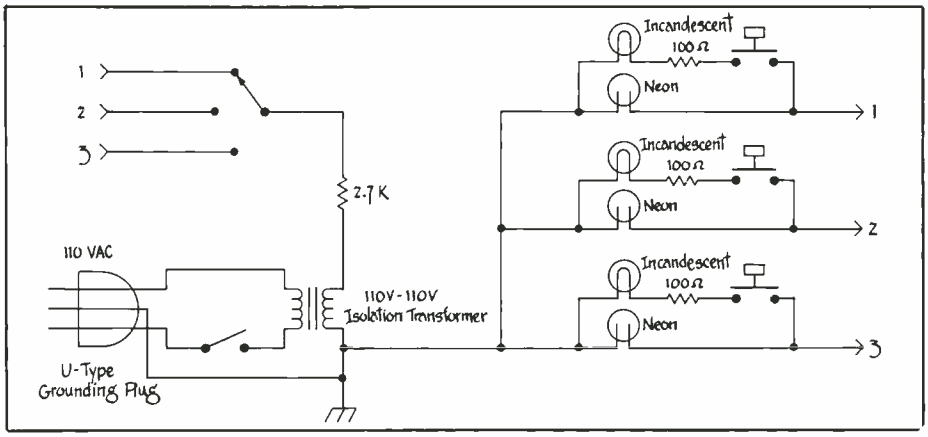
*Re: The 'el cheapo' Mike Cord Tester*

*This is a good idea but it has one fault; the most puzzling problem with mike cords isn't outright shorts and intermittants, but that little high impedance gremlin that turns the cord into a "Bridged T RCL Filter" rather than a simple parallel RC circuit.*

*This kind of short, if in the range of several hundred Ohms, will not show up in the "el cheapo" circuit, but will show up on a "megger" * as well as in the monitor system. I am not saying go out and buy a megger, although a properly equipped studio will have one. Instead, by adding a line cord and isolation transformer, three push button switches and three neon indicators, a simple megger can be built into the "el cheapo" design.*

*Mounting tip ring and sleeve jacks in parallel with the XL connectors will allow you to test your patch cords as well as mike cables. Even double circuit patch cords (WE338A) can be tested with the addition of the proper jacks, two more sets of lamp indicators with switches, and two more positions on the selector switch for the two extra conductors.*

** megger – for full description see pages 1641 (25.116) and following of the Audio Cyclopedia*




*Mount the whole shebang in a plastic housing for safety. The operation is pretty straightforward, plug her into the wall, and plug the cord in question into the proper connectors, and turn on the spring loaded power switch. Turning the selector switch will check conductor continuity as in the "el cheapo," with the neons as indicators. In each selector position, press the push button for the neons that do not light. If an incandescent lamp lights, it indicates a high resistance short between that conductor and the conductor on the selector switch.*

*I chose neons that fire at 65 volts and the incandescents are #44 dial lamps which will operate at 60 volts for about 10 to 15 seconds before blowing. The dropping resistor will protect the lamps somewhat, but will allow them to light dimly at around 3 volts. Use clear caps on the incandescents so that dim indications can be seen.*

*CONSTRUCTION CALLOUT*

- *1 – Box, to suit, Bakelight with aluminum or steel cover.*
- *1 – Switch, Toggle, SPDT, Spring return to OFF position.*
- *1 – Isolation transformer, 115VAC–115VAC, 25–50VA.*
- *1 – Line cord, with plug.*
- *1 – Resistor, 2.7K, 1 Watt.*
- *3 – Resistors, 100 Ohms, 1/2 Watt.*
- *3 – Switches, push button, momentary contact.*
- *3 – Lampholders, with series resistor, for NE 67 neon lamps.*
- *3 – Lampholders, for #44 incandescent lamps.*
- *3 – NE 67 (6AC) neons, selected to fire at 65V.*
- *3 – #44 lamps.*
- *1 – Switch, rotary, 1 pole, 3 positions.*

*Ad Lib – Input and output connectors for types of cables being tested.*



**From: KATSUYUKI HANDA**
**RECORDING ENGINEER**
**POLYDOR K.K.**
**TOKYO, JAPAN**

*It has been a year since I left the West Coast of the U.S., where I stayed for about two months. During my stay there I was very much surprised at the many differences in the way recording is done in America and in Japan. These differences, I think, are caused by the development of the 16 (or 24) track tape recorder. I suppose, however, that such differences will soon be fewer and fewer as everything nowadays progresses so quickly.*

*Thanks to Mr. Larry Levine at A&M Records I was able to observe and assist at the studio for one and a half months. Later I worked as an assistant at MGM Records for about half a month through the kindness of Mr. Ed Greene. I also visited several other recording studios in America.*

*From these experiences I would like to mention some things concerning American and Japanese recordings. When these observations are read please take the following into consideration:*

- *1 – The difference between American and Japanese music, and the differences in the markets for music in the two countries.*
- *2 – My viewpoint being only that of a recording engineer.*
- *3 – My stay in America having been very short.*

*I – MULTITRACK RECORDING*

*One of the major differences which exists is the method in which multitrack recording is used. Briefly stated, multitrack is utilized at its maximum in the U.S.A., while it is not in Japan, so far. Admitting, that there are some few Japanese records for which the multi recorder is fully utilized.*

*Multitrack in American studios is used to produce music of a higher quality. At Japanese studios, however, it is used mainly physically. For example, to prevent leakage of stronger sounds into weaker ones. A synchronized recording of strings onto a tape on which other*

*instruments have already been recorded is very common here.*

*On the contrary, I noticed in the U.S.A., a rhythm instrument was most often recorded first, and afterward melody, obligato and sound effect instruments were recorded respectively. Of course, there are some in the U.S.A. like Burt Bacharach who first fixed the sound quality and balance of the rhythm section, and after that proceeded to a multi (track) recording of strings, brass and wood sections, all together. In the case of the American vocal record, rhythm section seemed always to be recorded with the vocal. In Japan vocal is recorded last, and Japanese musicians play without knowing whether the finished record is an instrumental or vocal one; still less whether a female or male singer. This cannot, in my opinion, do anything but harm the quality of the completed music.*

*[Ed: It would seem that engineer Handa is observing that multitrack techniques in Japan strongly emphasize the storage capabilities of multitrack machines, and that at this point in time overdubbing, sweetening and creative additive mixdown have yet to be used extensively.]*

*II – MICROPHONES*

*There also is a big difference in microphones used. We, Japanese engineers, tend to regard a microphone with good physical characteristics or of good sound quality as a good one, but Americans seem to value the characteristics of each microphone. Here all microphones are compared with Neumann U-67, while in America many kinds of microphones are valued for their own individual characteristics. A good example is that Sony-made microphone of ECM type which though seldom used here was often seen in American studios.*

*American engineers use condenser, dynamic and ribbon-type microphones utilizing their respective characteristics and sound qualities, but we first record with a microphone of which frequency characteristics are flat, and later an equalizer used.*

*III – LENGTH OF RECORDING SESSION*

*The next big difference seems to exist in the hours spared for recording. Naturally this produces a difference in the quantity of multi tape used for the recording of a record. This might stem from the difference in size of American and Japanese markets. I think 10 to 20 times as much time is used to make a recording in America. I personally observed some American engineers trying to record an obligato of the drums, for five hours. Japanese engineers are always requested to record in a much shorter period of time.*

*IV – TUNING AND BALANCING*

*As for tuning and balancing, Japanese musicians too much depend on an equalizer. The sound quality or level of a bass, a bass drum, a piano or an acoustic guitar is generally left to the engineer, here in Japan. We electrically make the piano sound tighter or make the sound of a bass or a bass drum heavier, instead of tuning the actual sound from the instruments. The same thing can be said for balancing. When a violin or the drums are played weakly or on a constant level, the machine is often used to feature them by means of an electrical treatment. Thus unnatural sound or balance comes to exist.*

*V – CONCLUSIONS*

*1 – The usage of a multi tape recorder is still on the developing state in Japan.*

*2 – Performance and sound quality are dependent on recording machines too much in Japan.*

*3 – The Japanese record market will change.*

*This is the task to be seen by young Japanese musicians, producers and engineers.*

---

**"CD–4 FORUM" MONTHLY AVAILABLE**

JME Associates, audio / engineering consultant to proponents of the CD-4 discrete quadraphonic system, is issuing the first copies of a new monthly publication, "CD-4 Forum."

JME's John Eargle notes that "CD-4 Forum" will shed new light on recent discrete developments, both in hardware and software.

According to Eargle, one of the publication's purposes is to correct some wrong assumptions, if they exist, about discrete audio reproduction.

"CD-4 Forum" subscriptions are free to anyone in the audio industry, indust

cluding hardware and software producers and retailers.

**JME ASSOCIATES, 6363 SUNSET BLVD., HOLLYWOOD, CA. 90028.**

---

**MODULAR DEVICES ANNOUNCES FORMATION OF NEW SUBSIDIARY – MODULAR AUDIO PRODUCTS**

Modular Devices, Inc., a rapidly growing manufacturer of operational amplifiers, audio amplifiers, and special military products has formed a new unit – Modular Audio Products, Inc., Julius Brick, President of the parent company and the new subsidiary announced today. Mr. Brick also announced that Martin Gittleman, formerly of Automated Processes has joined the new company as Vice President – Chief Engineer.

The new unit will expand and further develop the existing product line of Modular Devices in the professional audio field. This engineering oriented company will provide a new focus and fresh broad line of components for consoles and sound systems applications. Initial product line will include amplifier modules, equalizers, compressors, peak limiters, switching and control modules, and accessories.

Commenting on the new subsidiary Mr. Brick said, "What we've created is a single source of state-of-the-art products which will fulfill today's recording engineers' requirements. These products will include the entire spectrum of electronic components from the microphone output right up to the speaker itself. In addition, not only will we supply the product, we will also supply the technical assistance that goes with it."

---

**"SPHERE ELECTRONICS" AUDIO SYSTEMS DESIGN AND MANUFACTURING FIRM ANNOUNCED BY McLAUGHLIN**

Veteran audio equipment designer Don McLaughlin has announced the formation of Sphere Electronics, a new audio systems design and manufacturing firm. The company will be located at 20211 G Prairie, Chatsworth, California 91311, (213) 349-4747.

Simultaneously, McLaughlin has appointed Wallace Wilson as the eastern representative. Wilson, doing business as Sphere Audio Sales Co., will headquarter in Nashville, Tennessee.

Both McLaughlin and Wilson were previously associated with Electrodyne Corporation.

Sphere is currently producing sophisticated custom audio consoles with many advanced concepts. The systems will be constructed primarilly with Sphere's own component product line. Typical of the custom consoles and systems is the recently delivered custom disc mastering console to Nashville Record Productions. (pictured) This console included many custom features such as graphic equalizers, ganged filters and detented straight line attenuators. The monitor system is capable of selecting 9 different points in the console system for immediate comparison of various functions without affecting the program or preview signal paths. The preview to program crosstalk is said to be better than 80 dB up to 20 kHz.

---

**3M—MINCOM FIELD SERVICE SUPPORT PROGRAM EXPANDED**

A program of expanded and intensified technical service support for users of 3M professional audio recorders has been introduced by 3M Company's Mincom division. While a nationwide system of independent dealers will continue to sell the line, 3M Company will take over the direct responsibility for field service and technical support, the company explained.

According to David F. Clark, division technical service manager, the program does not represent a change in the company's basic service philosophy: "We always have stood behind our products with our people, our resources and our technical knowledge. By freeing our dealers of the direct responsibility for service, we merely are simplifying the process for a customer who requires the service or technical communication that we can provide."

After a dealer has installed a professional audio recorder, servicing the product will become the responsibility of 3M Business Products Sales Inc., field service organization, which has offices in major cities from coast to coast. Backing up this field network will be a technical support group located at 3M Company world headquarters in St. Paul, Minn.

This central technical support group will consist of Gordon Menard and

Joseph Coakley, technical service engineers, both of whom are experienced in the industry. They will direct all activities involving technical communications and training with field service personnel. They also will serve as a source of customer feedback for division engineers.

## OTARI SETS UP U.S. COMPANY TO HANDLE RECORDERS AND DUPLICATORS

A U.S. subsidiary company, called Otari Corporation, has been established in the San Francisco area by Otari Electric Company of Tokyo, Japan. Purpose of the new company is to provide nationwide distribution of Otari's extensive line of magnetic tape recorders and duplicating equipment, as well as to provide complete service and parts back-up. Heading up the American company are Mitsuo Takekawa, president, and Brian F. Trankle, marketing manager. Trankle was with Ampex for 17 years in several top management posts, including most recently, international product manager for the Ampex Tape Division.

According to Trankle, Otari Electric Company is Japan's largest manufacturer of professional tape recording and duplicating equipment. Its product line includes 1/4 and 1/2 inch professional recorders, high speed cartridge and cassette duplicators, in-cassette duplicators, duplicator quality-control monitoring reproducers, tape winders, and cassette tailoring machines.

Trankle added that Otari Electric Company was founded in 1966 by a group of former Teac engineers, among them Masayuki Hosoda, now president of Otari Electric. The firm was established to design and manufacture the highest quality tape recording and duplicating equipment for professional use in recording and broadcasting studios, tape duplicating and distribution, and education.

Products to be offered in the U.S. include: MX-7000 Professional Recorder, a field proven machine available in 1/4 and 1/2 inch versions, with one to four channels of electronics. Principal features are three speed electrically-switched operation (15, 7-1/2, and 3-3/4 ips), rugged construction for long term reliability, built-in test oscillator to speed bias set up and amplifier adjustment, and a universal power supply for 115/230 volts and 50/60 Hz operation.

Model DP-6000 High Speed (240 ips) Duplicator System is available in cartridge and cassette versions. It includes a bin-loop reproducer and up to 20 slave units. The bin-loop reproducer features a vacuum system for quiet operation and gentle tape handling, and a dual capstan drive configuration. A dual capstan drive is also a feature of the slave units.

Model DP-4050 In-Cassette Duplicators are designed specifically with the needs of the spoken word and educational user in mind. The DP-4050-OC has a reel-to-reel master with six cassette slaves. The DP-4050-CC has a cassette master with five cassette slaves. Duplicator speed ratio is 8 to 1.

Model DP-6750 is a cassette tailoring machine that winds and automatically splices both prerecorded and blank cassettes.

Otari Corporation's U.S. headquarters are in a newly constructed building at 981 Industrial Road, San Carlos, California 94070.

## HOMER HULL NAMED SCULLY/METROTECH NATIONAL SALES MANAGER

Homer hull has been appointed National Sales Manager for the Scully/Metrotech Recording Divisions of Dictaphone Corporation, a new position. Earl J. Peterman, Vice President and General Manager said that the appointment of Hull reflects an expansion of sales operations for the divisions. He will report to Donald F. Smith, Director of Marketing and will be located at the Scully/Metrotech operational headquarters at Mountain View, California.

Hull joined Scully/Metrotech as Eastern Area Sales Manager in 1972. Prior to that he was with Ampex Corporation.

The Scully division designs and manufactures recorders for use in professional studios while Metrotech's product lines are primarily in the broadcast logging industry. Hull will supervise sales for both divisions through a network of regional offices located in major recording centers throughout the United States.

## THE SONGWRITERS' SHOWCASE

by Paul Laurence

The Alternative Chorus Songwriters' Showcase appears to be one of the last bastions of altruism in an otherwise (it is said) cynical and opportunistic record business. The Showcase is a non-profit organization that performs several valuable functions for the industry in 1) making available to recording, publishing, and producing companies promising new material and, 2) offering needed personal attention and exposure to songwriters to help them direct and develop



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their own talents.

The Songwriters' Showcase now in its third year, is the brainchild of "veteran coffeehouse folkies" Len Chandler and John Braheny. The idea of a songwriter showcase was a direct outgrowth of their own experiences. Said John, "It was our intent to present high-quality original material to the recording industry without the writers having to go through all the usual changes, like going into a publisher's office and trying to play him a song while he's on the phone. That's assuming you can even get in to begin with! Even so, he'll probably only want to hear two or three songs. Now we work completely differently — we'll listen to as many of a writer's songs as he thinks are good. Our purpose is to connect the writers with the people of the industry and showcase those songs which we feel will create industry interest".

Altruism notwithstanding, all has not been easy for Chandler and Braheny. The Showcase began humbly on August 15, 1971 at the Ash Grove. From there, it moved to Lincoln Center West, a theater on Hollywood's Fountain Street that (despite its grandiose name) seated only 60 people. In October 1972, its increasing popularity necessitated yet another move. Capitol Records volunteered the use of its facilities, and in association with BMI and Beechwood Music, underwrote the mailing and studio costs with no strings attached. Last Fall, the Showcase was deposed again, this time by fire regulations as the room at Capitol was always filled way beyond capacity.

The Songwriters' Showcase is currently being held at Art Laboe's Club (8433 Sunset Blvd.) every Thursday from 7—9 PM. The format has since been expanded to include a question—and—answer session with professional songwriters, producers, and publishers beginning at 6 PM.

Said Len "Being at Art Laboe's has turned out to be a blessing in disguise. We're attracting more industry people than ever before. Still, the presentation itself is really just a part of what we do. Each one of our cassettes contains a portion of over 50 songs — we figure we've listened to over 25,000 in all. In addition to the tapes, we have a filing system cross—indexed to the tapes. Each time we audition someone, whether on tape or in person, we make up a card that has evaluations and comments on all the tunes we heard. In this way, any song that's ever come in is only at arm's length".

The procedure for participating in the Songwriters' Showcase is relatively simple. In-person auditions may be secured by calling the Showcase (213) 655-7780) from 10—6 weekdays. Tapes can also be submitted for audition purposes c/o the Songwriters' Showcase, 943 N. Palm Ave., West Hollywood, Ca. 90069.

For each Thursday night, 6 writers and their backing musicians (optional) are presented doing from 2—6 original tunes. They need not necessarily sing, but Len and John do ask that they be involved in some way in the performance.

The Showcase's success speaks for itself. Over 30 songwriters have received publishing and/or recording contracts as a result of having appeared on it. Writers like Daniel Moore ("Shambala"), Don Dunn and Tony McCashen ("Hitchcock Railway"), and Gary White ("Long Long Time"), to name but a few, have all been presented under Chandler and Braheny's watchful eye.

Don't miss it.

# EXCELLENCE & QUALITY

## Audio Control System
## Model 1024-24

- MODULAR CONSTRUCTION
- EXPANDABLE TO 24 INPUTS
- QUAD PANNING ON EACH INPUT
- EIGHT SUBMIX BUSSES
- THREE CUE BUSSES
- GUARANTEED PERFORMANCE
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- STEREO AND MONO BUSSES
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award winning album . . . . "INNERVISIONS"

CONVERSATIONS WITH ENGINEER/PRODUCERS

# MALCOLM CECIL
## AND
# BOB MARGOULEFF
## AND
## MASTERING ENGINEER
# KENT DUNCAN

BY GARY DAVIS

*R-e/p: You fellows fill several roles. You're musicians and composers, playing your "Original Performance Synthesizer," you're also engineers and producers. Are there any problems or conflicts involved in this? Or does it make it easier for you?*

MARGOULEFF: It makes it easier, because the thing that's important is that many engineers have never had experience in the studio, and therefore it's more difficult for them, to understand what's needed. For example, what kind of a cue mix do you give an artist? What's he going for? And you have to be able to support an artist in the studio, it's not just getting it down on the tape. The energy has to go the other way, back out into the studio, and if you know what the artist is going through, if you have some kind of empathy for what's going down, you can do a better job. You have to understand, being an engineer-producer, you have to not only be able to control the media, but you have to be able to manipulate the environment. And I mean that in a positive sense. You have to make the environment conducive to creative work. And that means everything from lighting to the vibes, the karma of the room. You have to be really sensitive to that, you have to know if it's conducive to one kind of song or the other.

*R-e/p: How did you become involved in all these areas?*

CECIL: Our backgrounds give us the necessary wherewithal. Between us, we've covered every facet of the business of music, at some level or another, professionally. Both of us have been in music from very early ages. We bring with us the knowledge, so that nobody else is required ultimately, in the studio, other than Bob and I. We can make our own music, write it, perform it, record it, take it along to a disc cutting plant, make the refs, escort it to a pressing plant, press it up, make arrangements for all the label copies, printing, covers. We do all the photography, we do all the layout and art work, we supervise all that. We are capable of it, and in fact we have, and did a very successful album which was released in England of our own group, our own synthesizer band, before we met Stevie. This was like four years ago. The thing became quite a hit.

Now I've been a studio musician in England for years, I was also a professional jazz musician. I'm not talking about part time, this was how I earned my living for many years. And I also spent considerable time with the BBC, and whilst there a lot rubbed off. And I learned a lot from a number of field engineers and also from the associations with the various people that I had there. And I learned that 'producer' and 'engineer' and all these other terms are things that other people call you. They're not necessarily categories that one has to fall in to. It's convenient for other people to categorize you that way, but it doesn't mean to say that because there's producer and engineer, musician, writer, and so forth, that those functions cannot be different capacities of the same individual.

The basic function that we fulfill, therefore, is we're very much like the Chinese proverb, the I Ching things, where they describe the flowing of water. Water flows and fills up all the holes and seeks to find its own level, and that's pretty well what Bob and I do when we're working with artists. Whatever space in that spectrum they wish to take up, however much of the creative energy they want to put in, however much of a reality they represent, we just flow around them and fill up the rest. And we leave them their space and we find our own level. And we can flow around them until we completely immerse them, so to speak. And we cover whatever spaces they are either unwilling to fill, or unable to fill, or unaware of. A lot of them are unaware of the things we do. That is important also for their own egos. Otherwise they couldn't create in the studio, and they have to have their room in space. As a producer, there's only room for as much ego as the artist will allow you, in the sense of his creativity. A producer and an artist truly have to have respect for each other in the studio. I mean it doesn't have to be formal, but it has to be there. If that respect isn't there, then the work doesn't get done. If that respect isn't there, then it results usually with somebody getting clapped into irons, and the producer is usually the one doing the clapping because he's the one that's got the authority.

*R-e/p: That's the role that most people would say is the producer role.*

CECIL: With some artists it's more of a job than with others. With some artists one even has to speak for hours to their attorneys on the phone, or the people who are enormously involved with them, in order to bring home a point. For example, you may be seeing something that's going down in the studio and then finally it hits you, "I know why so and so is not happening," but there's no way you can communicate that directly to the artist. Somebody has to be made aware of it. So you battle with his organization, or you battle with the people who are around him, and you start poking and digging, trying to change the circumstances so you're back in the creative situation.

*R-e/p: This is an important facet of production, but you still have to remember the end product.*

CECIL: We thought about this a lot and came to the conclusion that what you are producing is a black disc that people play. Now if you want to go into the more esoteric thing, what is that disc? It's 18 minutes odd per side of people's time. That's what you're doing, really, is you're taking an 18 minute performance and you're presenting it to people and you're saying, "This is the 18 minute performance of so and so doing his thing, as best we know how to present it to you, and as best as he can, to my knowledge, perform it."

*R-e/p: The music that you guys create is very unusual to my way of thinking. While synthesized, it doesn't have an electronic sound per se. It doesn't sound artificial, it kind of flows, it has a cohesion.*

MARGOULEFF: I've been playing synthesizer since 1967. And know a lot of people who play the synthesizer. Electronic music is a very valid form of music. Many people have chosen to use the synthesizer as an imitative tool. It isn't a totally imitative tool, but there's a law of diminishing returns. For example, when I'm working on a session, and I want the real sound of horn or violin players, I'll go out and get

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them. There's a point of diminishing returns with the synthesizer in trying to imitate other instruments.

What the synthesizer is really good for is creating its own reality. It's the only instrument of our generation, of our time, it doesn't have any history; for example the piano, it has a long lineage of development, or the guitar, or even the electric guitar, it's an electro-acoustic instrument. The synthesizer is a totally electronic instrument, and it's only possible because of the technology that we have. Ten years ago, they were very expensive, and very cumbersome devices. They took up rooms and rooms and rooms and they used hand wired vacuum tubes. It was difficult to create music on a device like that because it was simply unwieldy. But like any other modern form of technology, it's become less expensive and more accessible to artists as time has gone on because of the transistor and various kinds of packaged electronics. They've also become highly stable and we've developed a unified system of controls, so we can control a multitude of things simultaneously. And this has made the synthesizer a musical instrument. It is not a machine and not an imitative tool, it is the musical instrument of our time, of our generation, and it's just in its infancy. People say it sounds electronic. That has to do with the way it's played, not with the way the instrument is. The only limitation it has is its player.

*R-e/p: How did you fellows hook up with Stevie and what's his feeling about "The Original Performance Synthesizer"?*
MARGOULEFF: Three years ago, he walked into the studio with a friend of ours. It was a Saturday afternoon, Memorial weekend, and Malcolm and I were working on some Richie Havens projects at Media Sound in New York. A friend of ours, a bass player by the name of Ronnie Blanco, who knows Stevie, brought him down to see the synthesizer. Our first album had already come out, an album called "Zero Time," and Stevie heard the album and liked what he heard and came down to meet us. And we just sort of started working. We weren't together an hour and we had started recording, we haven't stopped.

*R-e/p: He just fell in to the instrument?*
MARGOULEFF: Right. I think in the first three weeks we cut something like 30 basics.

*R-e/p: How much of the "Inner Visions" album has your synthesizer on it?*
MARGOULEFF: Well, most of the bass parts are synthesized, a lot of the horn lines are synthesized, some real instruments and some electronic sounds. Electronic sounds are purely their own color. I'd say probably most of the album used the synthesizer as the bass.

*R-e/p: Was the synthesizer done in real time with other instruments or were the tracks done separately?*
MARGOULEFF: Most of the tracks were done as overdubs.

*R-e/p: Is there something about the synthesizer that makes it an unusual instrument to lay down?*
MARGOULEFF: Well, there's a lot. The sound is very pure, very coherent, being that there's no acoustic space at all. You have to sort of create an environment or a space for it. And the trick with good synthesis is to create a sound that works with the rest of the track.

*R-e/p: In terms of the actual wave forms, do you get into a lot of square waves or saw tooths?*
MARGOULEFF: Everything. It depends on what sound you're going for. It makes it difficult to cut a record too, because you can get a lot of level out of the synthesizer. It's clean, very clean.

*R-e/p: How about reverb, delay and other processing of a synthesized track, is it pretty much the same as anything else?*
MARGOULEFF: Well, once it's down on the tape it's pretty straight ahead. You can deal with it pretty well like you deal with any other track.

*R-e/p: How is the material coming out of the synthesizer presented to your mixing console for recording? Is it 2 channel, 4, 8, whatever? What options do you have open with that sort of equipment?*
CECIL' Well, the instrument itself is capable of giving us simultaneously 16 different musical lines, each one with its own tonal quality. Which one could say, well, it's 16 mini-synthesizers in one big package. In a sense, that's true. That's its maximum.

*R-e/p: How do you end up using them?*
CECIL: Normally we don't use as many as 16 voices simultaneously; we call each one of those a voice. We'll go for more finesseful voices, which is putting together the equipment that would otherwise go to make up separate voices to come up with a much more finesseful sound. So we end up with no more than about 8 voices. And these we've been reducing down by going into a Sony mixer which has a capability of 4 outputs. We then patch its outputs into the console, or the tape machine. This is the usual way in which we work. Sometimes we tune 4 or 5 synthesizers with different sounds, couple them together from the control voltage point of view, so that we feed them like unisons. In that way we can simulate a lot of instruments playing together in unison. That sound is very unique, and you can't do it with a simple synthesizer.

*R-e/p: If you're essentially recording a mixed down product right off the bat, do you ever need all those outputs?*
CECIL: It's more a matter of the way The Original Performance Synthesizer evolved. With earlier, simple synthesizers, it was taking too long for a musicians' creative flow; it was taking too long with the technical aspects of getting one voice together and then another one, and then he would want to go back to the first one and we'd already reprogrammed that section. This was in the time when the instrument wasn't really quite up to its capability, it wasn't wired the way it is now. We wanted to go on the road but while the instrument we had was fine for recording, it was inadequate for live performances. So we decided that we would not put our energies into the making of another album until we had the instrument with which we could go around, like we have now. During the time we put the instrument together, we've been doing purely studio work. We now have enough keyboards and enough routing within the instrument to be able to change colors and lines instantly.

*R-e/p: Does it have a lot of memory?*
CECIL: Yes, the memory capability is quite large. We have an EMS 256 incorporated along with some logic that we found expanded its capability a great deal. We just sort of turned the whole thing into a computer rather than just a sequencer, in that it can repeat sections, it can find its way to another part, and so on and so forth, which all has to be done externally with the basic 256. We've now arranged all of that external stuff and made the whole thing part of the instrument, so it now has its own logic plus sequencing. And that gives it a capability to remember lines while you play with other parameters of the sound.

*R-e/p: OK, so now you take this thing, and you mix it in with the regular acoustic and other electric instruments, on other tracks, right?*
CECIL: Well, normally, with Stevie, for example, all of the other instruments are already there. Sometimes he'll start with the synthesizer as the basic but then he generally uses it as the bass line. He'll normally start with keyboard basic, if he's doing a track on his own. Or where he's using a group of musicians, he'll start with the rhythm section. On one song, "Superstition," he started with the drums. That was how that was written, and it turned out beautiful.

*R-e/p: Musically, what is the function of the synthesizer? Does it perform many functions or just set a mood?*
CECIL: The answer to that question is very broad. It's also very simple. It depends on the attitude of whoever it is that's the creative force behind the use of it.

*malcolm cecil*

*R-e/p: Does Stevie have a particular attitude toward it?*
CECIL: Yes, Stevie has a specific attitude, everyone does. Stevie has an attitude, Bob has an attitude, I have an attitude, Ravi Shankar has another attitude, the Isley Brothers have got another attitude. And it's really the bounds of your own abstractions, really, where it stops. Stevie uses the synthesizer to play things that he can't find any other way of expressing. He uses it to express the feeling he has, and to play sounds that he's not normally able to do. He's able to play the bass lines. He's not a bass player, I mean he can't play an electric bass or an acoustic bass, but he can play the bass notes on a synthesizer keyboard.

The synthesizer allows you to play all the instruments that you want to play, all of the sounds — — to be every instrument, to be the orchestra, to be the entire final product. One is

no longer limited to having to write down on paper, or explain verbally, or play your music to somebody else, have them process it in their mind, use their skills and motor abilities to recreate it on their instrument with their sound, and then you're stuck with telling a third person, who is now an engineer or something, how you want it to sound, how you want to modify that sound. That's a long way from where it started in your head.

*R-e/p: So somebody who knows a keyboard can do almost anything.*

CECIL: Well, it's not only keyboard, we've got interfaces for every conceivable type of instrument. We have interface for guitar, you can even sing into the thing. It's not perfected to the point where one can sing words or anything like that. But it will follow the pitch of your voice, it will follow the attacks and sequences of the timing, so that you can get a musical line down. And you can do that on pretty well any instrument. At the moment, since it's in its infancy, it does require technique. We have drum interfaces, and so on and so forth, so it's not limited to keyboard, although it's very finesseful when used with the keyboard.

Also, the keyboard is not limited to its normal use. You can tune it so that it's 24 notes, 17 notes, to form an octave. You know you can make an octave, instead of from C to C, you can make it from C to F, or from C to G. It'll give you 17 and 19 tone scales. But this is all academic, this is what I call elephant shit, it comes from theory things.

Really, people use the instrument as extensions of themselves. They use any instrument that way and this instrument has the capability of extending yourself in any direction as far as you want to go, as far as you can conceive, and the only time you stop is when you're satisfied. When you're programming to get a sound, first you have to make the sound, make the instrument. Wouldn't it be great to hear a 25 foot alpenhorn, you think, or a 150 foot alpenhorn? Well you no longer have the limitation that a man has to blow it. And if you want a 150 foot alpenhorn, you think, "My God, how would that thing sound?" So you visualize and abstract in your mind and program away listening for what you think, for the sound that's in your head, trying to come close to it, and using your experience and your past trips down this road to lead you. Short cuts and things you learn by experience, you learn any instrument that way; that is a limitation, but it need not be the limitation on somebody working with Bob and I, because we have the experience and as long as the guy can give us a rough idea of where he wants to go, we can usually escort him down the road until he becomes satisfied.

*R-e/p: Kent Duncan told us that "Inner Visions" was sort of the impossible album to cut, although he managed to cut it. When you did the mixing, were you aware that it was going to be difficult?*

MARGOULEFF: Well, it wasn't impossible from a musical standpoint. It was almost impossible from a technical standpoint, to get it on the way we wanted to. It wouldn't have been impossible if we had rolled off bottom, for example. But we felt that we could get it cut the way it went down, since we had good equipment and good people. And being that we used a Westlake system for both recording and mixing, and Kent's room is Westlake, we were able to maintain a consistent approach, which I think is very important in being able to get it down the way we wanted it. Again, the real problem was that the record was a little too long to really have free rein in terms of spreading the grooves out and getting the sound in there. The problem was that each side was actually a minute and a half to two minutes too long. But somehow, we did manage to do it. It took a long time, using the lathe's computer and cheating the computer a little bit. It wasn't easy, but we cut that record with no EQ at all; it was cut flat and it sounded just like the tape.

*R-e/p: Is most of that bottom end due to the nature of synthesized music?*

CECIL: It's not like electric basses where you pluck the string and the main energy is in the first 2 milliseconds, and after that it's relatively low energy level. And normally Stevie and other people record a bass through a limiter, in order to pull up the end of the note, so that the note has some length. But the actual energy content under those circumstances is much reduced after the initial punch of the note. And as I say, that's a percussive picked instrument. Whereas, with the synthesizer, you're capable of putting in a great deal more sustained energy. Because of the low frequency, it's not easy to hear. The apparent level is low, although the actual energy content is high. Especially when you come to cutting a disc with that energy, the excursion has to be excedingly wide. So you run out of space real quick, when you're using heavy bass all through. With the synthesizer it's very easy to get into very sustained low frequency energy. That's the problem, even in slow songs.

*R-e/p: Is phasing a critical area?*

CECIL' Well, what happens is, if you get any of that bass into a chamber, or if you don't put that low frequency information in the mix absolutely center, then you get low frequency phase problems coming back. The main place to look out for those is not on the synthesizer, but on the low end of the piano; the Fender-Rhodes. Normally when you're recording stereo Fender-Rhodes, the tendency is to place it left and right; the low energy normally goes on one side and the high energy on the other side inside the piano. There is some low frequency content on both sides, but it's not necessarily in phase. And what happens is that when you actually go to try to cut the disc, what you'll see is the low frequency phasing energy go from one wall to the other wall, then you'll know the electric piano is the problem because the vibrato gives it away.

We had problems with that on "Inner Visions," and we just had to ride those spaces, those particular intercut or phase problems, and we just had to solve each trouble spot individually. It's always a different problem and always a different cure. The synthesizer doesn't normally give us phase trouble at the low end, because we put that stuff central.

*R-e/p: You both have very wide interests and knowledge. You got a Grammy with "Inner Visions." Obviously that would have a certain amount of satisfaction attached to it. What is it that regularly gives you the most satisfaction?*

CECIL: Being part of the creative process. Being involved with it. Doing something different to that which has gone down before. I mean I don't mind if someone else has done it, if I've never been that way, it's different enough for me. I like to feel that I'm working with the best that there is on every level, having new experiences which are exciting and challenging.

*R-e/p: So to that extent you're fulfilling yourself as you do the work and not waiting until the finished album is there in order to derive satisfaction.*

CECIL: If the satisfaction doesn't go in at the beginning, it doesn't come out at the end. The pleasure that I feel going down, I have to feel that pleasure in the piece, or whatever the feeling of that piece is. I mean, sometimes a piece can be very tortuous going down, but it's important because when the song comes out it does communicate in that way, it turns you, and that may be the purpose of the song, or the work, it doesn't necessarily have to be a song. But whatever it is, I have to feel something, as it's going down, something more than "Oh, the level's right." It has to be something inside that's fulfilled for me when I hear it at the time. Otherwise, if it doesn't move me, my feeling is that either I've picked the wrong artist or it's not the right performance. And therefore something has to be done to get a better performance. Now that's production. Now engineering, that other facet, has got very little to do with that creative process. Engineering is being ready, keeping the technicalities out of the way.

*R-e/p: So the engineer's got to make the technical aspects of the studio drop out of sight so the guys can go in there and create.*

CECIL: Right, his principle job is to become invisible and/or transparent, in fact. He has to be there, but in no way is there room for an ego, none whatever.

duncan margouleff

*R-e/p: What are the actual album credits you receive?*

CECIL: The credits that we receive are as associate producers. And it's the same as the film credit, associate producer, in the sense that we have only secondary commissions. Our commission is not from the record company but from the artist. The artist runs his own ship and he's given carte blanche by the record company, and we take over as a sub-commission from the artist. That way, the artist maintains the control that he feels he may need to dictate the finality. In other words, he is the law. That way he doesn't have to hassle if he is dissatisfied. He can kick us overboard, and then we have to sink or swim.

*R-e/p: Kent, Kendun is an independent master-*

Dear Readers of R/P Magazine,

I've been so busy building, selling and installing "Memories Little Helper" automated mixdown systems (designed for retrofit into existing Consoles or installation in new Equipment) that I forgot to write an ad about it. I promise I'll come up with something really spiffy, next time. If not, may a diseased Yak storm through my lab and spill all my sorted resistors on the floor.

Love,
Allison

*ing facility and is pretty well camouflaged from walk-in business by this Burbank location. How did you come to be involved with Bob and Malcolm on the "Inner Visions" album?*
DUNCAN: When it was originally cut and after release there were an incredible number of returns due to skipping – there were many overcuts. Motown knew the album itself was good and was going to sell, so they were going crazy over the fact that they couldn't have records.

Bob and Malcolm were working on the problem with other mastering rooms where they fiddled around with it for days. Those studios told them it couldn't be cut at the level they wanted to lay on the record. Reluctantly, the decision was made by Stevie and Bob and Malcolm that, rather than sacrifice the level those other engineers said was necessary and to cross the bass over for easier cutting, they would take a tune off the album. They were down at Record Plant editing a tune off the album when someone suggested, "Why don't you go up to Burbank and try Kendun?"

They brought it out here, and after doing two hours of test cuts, we also had to tell them, "At the level that you want to cut it at, it is essentially the impossible record." However, we also said that if they wanted to invest three or four days in doing test cuts and exactly programming the computer to cut this particular record, it could probably be done. They were excited about the idea of cutting "the impossible record," and because they were so sure of how good it was and Motown was willing to invest the time and money, we went ahead.

*R-e/p: Did the project actually take a long time to complete once you began working on it?*
DUNCAN: We started at midnight Wednesday and we finished the parts at noon, Monday. I would suppose that there was a total aggregate of eight hours sleep in that time – for Bob, Malcolm and myself . . . all of it here in the cutting room. The reason it took so long was due to our approach. We set up basic parameters for the album in our computer, which we have altered to act a little more accurately than a stock Neumann system. Then we cut the album to find the overcuts. The first time there were about thirty because we tried to put parameters into the computer that it wouldn't accept. Then we essentially wrote a program for the computer, feeding it different information, according to time, through each side. For instance, at 3 min. 9 sec. we would feed 6 dB extra at 1 kHz to the computer to open the spacing for a midrange peak.

*R-e/p: So then, rather than EQing the material, you were EQing the computer.*
DUNCAN: Right, the record was cut flat. We did no changes to the audio at all. Bob and Malcolm brought in a tape that could be cut flat, and the mix that you hear on the album is the mix that they came out of the studio with. Which, as you know, is the Grammy award winning mix for the year, so there's a lot of credit to them. But the problems developed only because it was 23½ minutes long, and because the only bass instrument was the synthesizer. If the record had been 18 minutes long, I think anybody could have cut it at the level we cut it at. And it's not an exceptionally hot album, strictly from the standpoint of level. It has a lot of apparent level because of the brightness of the mix, which is fine.

*R-e/p: What is the function of the cutting computer?*
DUNCAN: Well, the computer system in the lathe is fed originally from the preview head on the playback machine just before the regular playback head feeds the cutter head. Everything in our console is double-ganged in program and preview, so every EQ change, level change, balance change, echo return, is also performed on the preview signal and the lathe knows exactly what the program is doing. In the Neumann computer the preview signal goes through a lot of electronics, all solid state, to determine what the groove should be doing. In every quarter turn of the turntable, it sizes the groove – how far it was from the last groove, whether it was a big swing or a small swing – so it can pack them in closer together or open for a bass thing.

*R-e/p: You mean the computer stores what excursion happened at that point in the last rotation?*
DUNCAN: Right. It remembers, I think, six quarters of a turntable revolution. Every one quarter it changes, and then of course it updates. In that way if you've just been in a loud passage, and you're coming up to a soft passage, it causes the pitch to drop way back so that you'll pack it really close to the last groove, and conversely if it's a big bass note it'll open it so it has room to do its lateral motion. Also, if there's some phasing coming down the program line, it'll compute, "OK, we've got an out of phase bass here that's going to cause the cutter to lift 5 mils, and we're only cutting 3 mils, which will lift right off the record, so we'll deepen 3 mils so it'll only come up to -2 mils," and then of course, the computer will immediately counteract that depth command, because if it stayed down, it'd go down to the aluminum.

*R-e/p: So it's remembering what went down, and anticipating what's about to happen.*
DUNCAN: Yes, and all of this is determined by integrated circuits which we have redesigned for greater accuracy. In other words, we have changed the attack and release time of all these circuits and really tailored the lathe to cut pop music, because that's primarily who our clientele is. Frankly we learned a great deal about disc cutting while we were redesigning the computer. A lot of people know it sizes the groove for you, and you shouldn't do this, and you shouldn't do that, but they don't know why or how it works. Because we know exactly what the computer does, we can cut better. It's really a matter of better use of the same space.

In order to better use that space, we have also had to modify the output stage of the Neumann cutter amplifier to develop a little more than twice the power of the stock amp. This is because the RIAA curve dictates that a 10 kHz tone will use something like ten times the power of a 1 kHz tone, so the extra cutter amplifier power is needed for adequate transient response. The improvement can be heard as a cleaner sound.

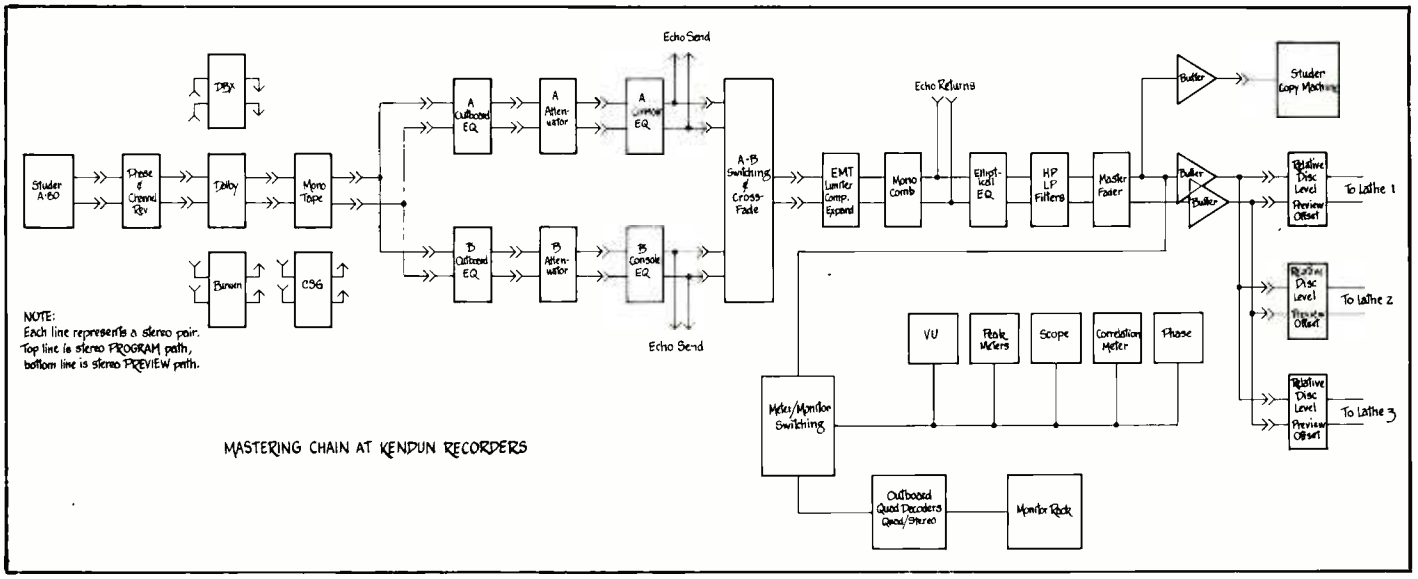
*R-e/p: How did you actually do the double ganging?*
DUNCAN: Well, the console is a Neumann console, and it comes delivered that way. Our own equipment we had to convert ourselves, we just ordered multi-wafer switches. Then you have to have very precise specifications for the equipment so it tracks properly. Most cutting rooms have separate controls to simulate what they're doing in program. We've designed and built our own equalizer, and it's a 30 frequency overlapping five knob equalizer that is exactly precise. If you take a stock equalizer from virtually any console company, you'll find that +2 is really +2½, and +4 is +3, so that it's not exactly repeatable. Parametrics are fine, but they're not exactly repeatable, even if you write down the settings and get things back to 2 o'clock or to 6 o'clock or wherever, or half way between the two marks, doesn't mean it's not going to drift; whereas our stuff is exactly detented in steps and it's calibrated consistently, so that you know it stays the same. By grinding our resistors to get precise values at both the peaking frequency and level, +2 is +2.000, and so forth. One set of our equalizers is very broad and the other set of equalizers is very sharp so you can do a notching thing or a broad thing in that given frequency area.

*R-e/p: You have almost a parametric situation without using a parametric EQ.*
DUNCAN: Exactly. We do have the ITI parametric, but we also have our own, plus the Neumann equalizer. Now other people have pairs for presetting, but nobody to this extent.

*R-e/p: OK, you have the ability now to do an unbelievable amount of equalization but at the same time you were saying that you try to use it as little as possible.*
DUNCAN: Always. As a matter of fact, there are patch points all through the chain, so that if you're not using a unit, you can patch around it, and go essentially from the playback head of the machine to the cutter head amplifier.

*R-e/p: Was there any problem adjusting your two lathes to run in parallel with each other, to track just like the other equipment?*
DUNCAN: Well, normally there wouldn't be. But our lathes were built in different years, and each one is slightly different because the manufacturer is constantly changing his designs to try to make them better. This is what originally got us into the thing. While the circuit was the same, one was pretty much discrete electronics and the other was integrated. And the time constants were different, even though they had been designed to be the same. Now they work together, and we're kind of protective of what we've done. It was very expensive, not as far as parts, but very expensive as far as time was concerned.

*R-e/p: Aside from calibrating the logic in the lathe, there are obviously scores of adjustments, not just regular running adjustments, but presets and calibrations and alignments on these lathes. Looking at the number of screws the lathe has, it's unbelievable. Where did you get the training and the background to understand what all of it's about, and to know how to use it to the best advantage?*
DUNCAN: Well, a manual is supplied with the lathe that explains how they should be set. If you go by the manual, you're cutting very conservative records, and not very interesting records. It was just a matter of experience; futzing with them and watching what they do cutting for ten years now, and constantly making adjustments. Every Saturday morning we close to realign the systems, which is an




MASTERING CHAIN AT KENDUN RECORDERS

electronic check to see that the systems are still flat. The frequency response is checked every morning before cutting starts, and then every Saturday morning, the lathes are aligned and programmed and symmetry is checked in the amplifier system. And many times, almost every Saturday, we'll do some tweaking on the parameters of the computer, just over what we've learned that week. "Gee, I think it will work a little better this way," so we'll try it for a week, and tweak up the time constant in one if the cards, some of that went down during Stevie's album and more of it's gone down since then. I think if I had the "Inner Vision" project to cut over again I could put another dB of level on it now, because we don't ever stop learning. I don't think anyone does who really cares.

Specifically, there are some 20 parameters that are set in by the operator into the computer system, in the Neumann. This is still true, even after our alteration to it. Every studio sets them to their own specifications, and they generally follow the instruction manual that comes with the system. We don't. We have set it pretty much for the kind of material that we cut. And as we said, with Stevie's album, much of the time spent with test cuts was actually spent adjusting the computer to fit the program material better. Classical music cuts very much differently than pop music, and "Inner Visions" with synthesizer cuts very differently from normal pop music, because of the low bass and the fact that it's constantly phasing.

*R-e/p: Do you also realign your tape machines to match each tape?*
DUNCAN: Of course. We take the tones on the tape and align them to the input to the cutter amplifier; so should any amplifier in the tape machine or in the console or in the Dolbys or in the outboard EQ be changed, which changes level, it doesn't matter, because it's always aligned with what's fed into cutter amplifier, and the cutter amplifier is aligned to itself. So that you can exactly repeat levels six months later.

*R-e/p: What kind of tones should a guy put onto his tape to help you out? Let's say he's mixed it down in Nashville and wants to bring it up here to master it.*
DUNCAN: I like to see four tones. 15,000 to do the aximuth, followed by 1,000 or 700 to set the level, followed by 10,000 to set the high frequency EQ, followed by 50 cycles to do the low end. Many people use 100Hz; however, on most tape machines the reproduce EQ is at 50 cycles, and if you align 100 to 0dB with a 50 cyclé equalizer, very often you'll find 50 cycles or 40 cycles up 2 or 3dB. The important thing to take into consideration, is the fact that when a mix is done in two places, there should be a master set of tones for the album. They should use that to set up the recording two track, everywhere they go. Otherwise they'll bring us tapes that, from tune to tune, change in azimuth. And there's no way that you **can pr**operly make up for that without mak**ing a two** to two copy of the whole thing to get **everythi**ng back on azimuth, which is time consuming, expensive, and you lose a generation.

*R-e/p: At what level should these tones be recorded?*
DUNCAN: They should all be at the same level. It doesn't really matter whether they're elevated or whether they're zero or whether we even know.

*R-e/p: But in terms of Dolby, doesn't the absolute level matter?*
DUNCAN: There's probably nothing as confused in this business, even locally among some very creative and knowledgeable people, as Dolby tones and alignment of Dolbys. I developed some theories about these, which were controversial at the time, so I approached Ray Dolby's company with them and confirmed my suspicions. And generally, the following is true. *Not generally, exactly the following is true.* If you're going to record Dolby, then the tones should be regular NAB and stretched Dolby. You should have the Dolby in bypass and initially align the machine as you would if the Dolby wasn't there. Now this would be all you'd need if all Dolbys are always flat. I have eight Dolbys here and they vary as much as $\pm$ 2 dB, which is a range of 4 dB in the top and the bottom end. This business of laying down a set of flat NAB tones followed by a Dolby tone presumes that all Dolbys are flat. Well, suppose the recordist's Dolby was down 2 at the top end. You align the machine with NAB tones and then lay the Dolby tone, which is roughly 1,000 cycles, it's a modulated tone, and you don't know the top end was down. Now suppose it comes in here and our Dolbys are also down 2 dB, so you're down 4 dB at 10,000 cycles from where you started. And there's no way to check that because you didn't stretch your tones. If you also stretched your NAB tones, when you brought it in here, we could see that it was 4 dB down, and bring it back up.

There's only one useful purpose for the tone which is built into the Dolby, and that is after your machine is aligned NAB with the Dolby in bypass, then you switch the Dolby in, use the Dolby tone to adjust the Dolby to the machine so that the units are together. If you underdrive or overdrive the Dolby the sound changes, significantly, because you're in a 2 to 1 situation. But after that initial set-up, all the master tones should be stretched, so when it comes back in here, we can do the same thing and we can flatten our machine-Dolby combination to your machine-Dolby combination. Just because there is no way to adjust the frequency response of a Dolby as an operator, it's wrong to assume it's flat, and this is why tapes sound different. And really there is no substitute for a flat machine and a flat tape. Anyway, this business of Dolby alignment is very controversial and you'll get some letters on this probably, because now you're going to say, "Well, if you do bring up the machine 4dB at the top end to align for the loss in the Dolbys if they were, in fact, not flat, now you're going to overdrive that octave in the Dolby a little bit, so it's going to sound a little bit different." But I contend that bringing this back up to flat and putting up with an overdriving of that section of the Dolby is better than having it down 4dB at 10,000 cycles and putting up with what that sounds like. Enough for Dolby tones.

*R-e/p: Then we'll change the subject. Did the vinyl shortage, the use of extenders for pressing compound, aggravate the difficulty doing "Inner Visions"? Or is the pressing a separate and unrelated area?*
DUNCAN: Plastic these days has presented a problem, as everybody is pretty much aware. And it's likely that the plastic situation is going to be pretty much as it is today for the next 6 to 8 months. Now, on 45's, some plants have gone to styrene, which is a reasonable material considering the vinyl shortage. How-

ever, what happens is that while the press is closed, and the styrene is forming to the plates, it's actually hitting the plates and molding, but then shrinking away slightly from the plate, and this causes distortion, and it's aggravated by level. Now, no plant uses styrene for LPs. However, with the amount of extender, and presently at Columbia it's 25%, not only does the record become noiser, but again distortion is much higher because of the imperfect plastic. So generally we're taking the level down nearly 2dB from where we used to cut it. And we're getting better sounding records from that. And we had one project that was a highly critical thing from the recording standpoint and from the mastering standpoint, and we were just destroyed by what the records sound like.

*R-e/p: You mean the refs were good and the pressings were bad?*
DUNCAN: Just awful. The test pressing came out and we couldn't believe it was the same record. So we ended up recutting it and taking the level down 2dB. That helped, but at the same time we lost our signal to noise by 2dB, which was bad enough as it was, but it more than outweighed the distortion.

*R-e/p: It sounds like it's pretty important to check the test pressings these days.*
DUNCAN: Yes, but it's not always easy. One footnote to the Stevie Wonder thing, part of the reason it took so long to be cut was there were probably like 14 sets of parts that had to be cut on that project. While some people reading the article are used to cutting an album with one set of parts for one plant, commercial albums require several sets and, in the normal run of things, it takes two days to cut an order like that, and, in our case, a couple more days to get the settings.

*R-e/p: Is that number of parts needed simply because the number of albums pressed are going to require it?*
DUNCAN: Well, it's based on the number of albums that are going to be released. But also what gets into this is economics, as far as the record company is concerned. If they press at 14 plants across the country, they're going to have to ship finished product much less distance and save a lot of money on freight. Whereas if they press at Santa Maria, for example, and have to ship albums to New York the freight bills would be extraordinarily high.

*R-e/p: Wouldn't that cause a wide variation in the quality of product that shows up on the racks?*
DUNCAN: Yes, great difference, which points up something that the artist and even the studio may not be aware of. Generally, what happens is when you cut one or two sets of parts for each of seven plants, you'll get a test pressing back. And some labels won't even give you a test pressing from each plant. But even if they do, the test pressing is from one set of mothers, and if there were two sets of parts, there were two sets of mothers. So you're only hearing one of the two sets of mothers. Plus, off each mother they may take 20 or 30 sets of stampers, and you're only hearing off one set of those stampers. So, on a project the size of Stevie's it becomes impossible to keep track of what's happening. We figured, on Stevie's project, we would have had to listen to 740 test pressings to make sure each set of stampers was all right. That's why, in the final analysis, you have to rely on the QC at the pressing plant. Because a set of stampers may last for 2,000 records, or may only last for 2 or 3 hundred, depending on things that happen in the press cycle.

*R-e/p? Are you satisfied with that situation?*
DUNCAN: Really, I hate listening to records. I got so used to listening to refs, which have incredible dynamic range, and very high signal to noise ratio, and I'm just destroyed when the test pressings come back, because it's just an imperfect process. It's a great thing for mass merchandising but it's just awful.

*R-e/p: Is their quality control adequate?*
DUNCAN: Deutsche Grammophon consistently presses records that are of just excellent quality. If you go to Japan or if you go to Germany, virtually the only place you'll find a lathe is in the pressing plant. It's all part of the same cycle. And when they come off with a test pressing they take it back to the lathe operator, so he's more directly involved with the people. There's such a movement here among record producers to have quality pressings, that I'm surprised that one of the big U.S. producers hasn't backed a record pressing plant where they charge 75¢ a pressing instead of 40¢ and get quality. Certainly the vinyl problem is something that's with us, but I think it's short term. And the quality is just not what it can be, and we know it can be better because we hear it coming out of Europe.

*R-e/p: Can you take extraordinary steps in the cutting to improve the final product?*
DUNCAN: From the cutting standpoint, I don't know. Except that, for instance, if we have a 16 minute side and it's any kind of quality at all, many times it can be cut with an ending diameter of about 7". Whereas the typical ending diameter is 5-1/2". We would like to cut in to 7", because as you go into the record, the centrifugal force on the stylus is greater, forcing it out and you have tracing error, increasing as you go in. And if you could stop the record at 7", which is perfectly fine as far as all of the parameters that the groove needs to be because it's a short side, why not have better quality? But virtually every record label in the country rejects those back to us, because it doesn't go inside of 6", which they feel they have to prove to the consumer that it's a full record. The consumer isn't being cheated, but they will not allow us to cut like that. Many times we'll send something that's 6-1/2" and they'll call up and holler and we'll say, "Well, it sounds better," and they'll oftentimes let it go by. But as a rule, they won't let us do what we know is better because they feel that the public is going to scream.

*R-e/p: How about putting a note on the album jacket that it's been specially cut to a wide diameter for better fidelity?*
DUNCAN: I would love to see that kind of thing. The problem is that some major labels basically don't like to see us cutting their projects, because they have their own cutting rooms and they make more money if they cut it at their own place. So, they're always on our backs, and if they can jump on us, they usually do, in any particular area. The reason that we still are in business and are successful is that the producer knows that we're doing better work and that we care more. And we have to because we wouldn't be successful otherwise. But they'll send us a page of parameters to which we have to adhere, which is something that, typically, states at the top of the page, "Cutting Parameters for Independent Studios, October 1, 1956." And it's just the problem of the inertia of these big companies. I'd like to see some executive say, "Hey, maybe there's a better way, and it doesn't cost us any more to update, to be in tune." There are lathes now that'll cut better than what playback styli can pick up, the tape machines are now better than the tape, so the tape manufacturers have got to get off their tails and make better tape, because it used to be the other way around. Unfortunately, this business is run by accountants. And if they can go to a pressing plant and save 2¢ a pressing, times a million records, they say, "Wow, we're going to go over there and the stockholders will appreciate the extra 1¢ a share," even though the noise on the record is going to be 2dB more. And those are the kind of decisions that are made on high management levels at some companies. Now there are other companies that really do care what their product sounds like, and they won't use certain pressing plants. But in this strange year 1974 with the plastic shortage, even those parameters have to be relaxed a little bit.

*R-e/p: If a record company does care, what can it do about the pressing quality?*
DUNCAN: Jac Holzman, for instance, is one of the incredible guys in this business. He cares what his records sound like. He had one guy on his staff, in New York, who used to come down to the pressing plant unannounced and pull one off the line and run into the QC room and listen to it. Jac kept pressing plants on their toes, and he just wouldn't accept bad product, and that's why for many years, Elektra Records were the best records ever in this country of any big commercial labels. I'm sure that there are small labels of which I'm not even aware that have incredible quality specifications.

*R-e/p: Aside from the physical layout here and the equipment and all that, there's got to be something about an independent facility, something that led you to open this place, something that is bringing people here, beyond the hardware.*
DUNCAN: Well, anybody can buy the hardware. Now, we've made some slight improvements to it, which make it better, they make it better in transient response, and they make it better in conservation of space on the record, because that's a fixed thing that everybody has to deal with. But if you can con your computer into using it better, you can either cut hotter or cut more time, or both. Part of what started the impetus of the independent mastering facility, and this is really a new business within the industry, is this attention to detail. In addition to Kendun, there's Sterling in New York, there's Mastering Lab and Artisan here and maybe one or two others that are significant in this independent mastering thing. But together those four facilities are doing over half of the chart records. That's because it only takes a day to master an average album and get as many sets as they need. You get thirty albums a month, or more often sixty a month because we run twenty four hours a day.

*R-e/p: Well, previously, where was the mastering done? At the record companies?*
DUNCAN: By the labels. For instance, here in town, Capitol has five lathes, RCA has four or five, Columbia now is closed, A&M has five lathes I believe, and Elektra has one. Warner's has two and Dunhill has one.

I don't want to knock old engineers, because there are some great people around, like Phil Ramone, great engineer, and there are some great classical mixers, who have benefitted from their experience and have stayed in touch. But there's this group of people who haven't, and when they get a tape that's hard to cut, they'll make it easy to cut, either by taking the level down or by making it mono, or folding in the sides, or filtering it, and this is wrong. What we do is to listen to the tape and try to improve it, with EQ or by balancing it from tune to tune. There are really two reasons for this independent mastering thing. One is that there are a few poor mastering engineers, always at the major labels because they're union protected, which is why they're still there and cutting records when they shouldn't be. The second reason is that with the advent of multitrack recording, it takes you many nights to mix, where it never used to, and you just aren't remembering precisely, where you had everything panned and where you had everything EQ'd, for three weeks on every tune. Now it doesn't take everybody three weeks to mix an album but certainly a week to mix a traditional pop 24 track album, just because there's a lot of stuff on it. And we can help give the entire album a balance, a uniform feel.

*R-e/p: How specifically do you do that?*
DUNCAN: Well, the thing that we're doing is that we're able to hear the whole album within an hour or two, whereas they haven't heard some of those mixes in a couple of weeks. And so we're making them cohesive in the sense that the level flows from tune to tune and that there isn't a drop in level. We're making up for that situation where their machine was aligned at +3 all except for two days when somebody had aligned it for 0 and nobody checked it. That's obvious, everybody does that. But then we're doing some critical listening, and some creative input to the producer on EQ. While an album sounds very good and it's very cohesive, it may have gone another direction as far as overall EQ because they haven't taken it in perspective. And the whole thing may be too bright, or the whole thing may be too bassy, generally. With that kind of thing we can say to him, "Hey, listen to these two other albums that we've just finished. I like the sound that you have, it's just that it's too bright." And he'll say, "Yeah, I didn't realize that, we got so into the music we forgot about listening to something else." If the horns aren't loud enough, we push them at say 3,000 or 2,800Hz so they jump out like a solo and don't get lost in the background. So we're making better records. Now, sure, that kind of thing can be remixed and if you've gotten to the extent where you're doing massive EQ at many frequencies, it really ought to be remixed. But we're saving the record companies a lot of money by doing those kind of things, rather than have them spend a thousand dollars a night going back and remixing the tune. They come in here and spend an afternoon and save remixing maybe three tunes that didn't sound as good as they thought they did.

*-END*

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**CAPSTAN DRIVE:** Phase Locked D.C. Speed Variable 5 to 45 I.P.S. or 2.5 to 22 I.P.S. Dependent on Capstan Diameter
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**FLUTTER AND WOW:** .05% DIN at 15 I.P.S.
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**FREQUENCY RESPONSE AT 15 I.P.S.:** Reproduce: 30 Hz-16KHz ±2 db; Cue: 30 Hz-16KHz ±3db; Record: 30 Hz-16KHz ±3 db
**SIGNAL TO NOISE (30 to 18 KHz):** 2 Track Reproduce: 62 db Below +4 dbm; Cue: 60 db Below +4 dbm; Record and Erase Less Than 4 db Noise Added to Bulk Erased Tape
**DEPTH OF ERASE:** Greater Than 75 db Below 0 VU
**ELECTRONICS DISTORTION:** Less Than .1% THD at 1 KHz, Less Than .2% IM 60 and 6000—4:1
**INPUT:** Level -15 to +24 dbm for 0 VU Impedance 10,000 Ohms Balanced
**OUTPUT:** Level +4 dbm for 0 VU, Source Impedance 50 Ohm Balanced Maximum Output at Clipping, +24 dbm
**EQUALIZATION:** 3 Speed NAB Internally Switchable to CCIR
**BIAS AND ERASE FREQUENCIES:** 120 KHz
**BIAS ADJUSTMENT:** Separate Bias Adjustment for Each of Three Speeds
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**CUE:** Switches Automatically to Input When Entering Record
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**HEIGHT:** 35"
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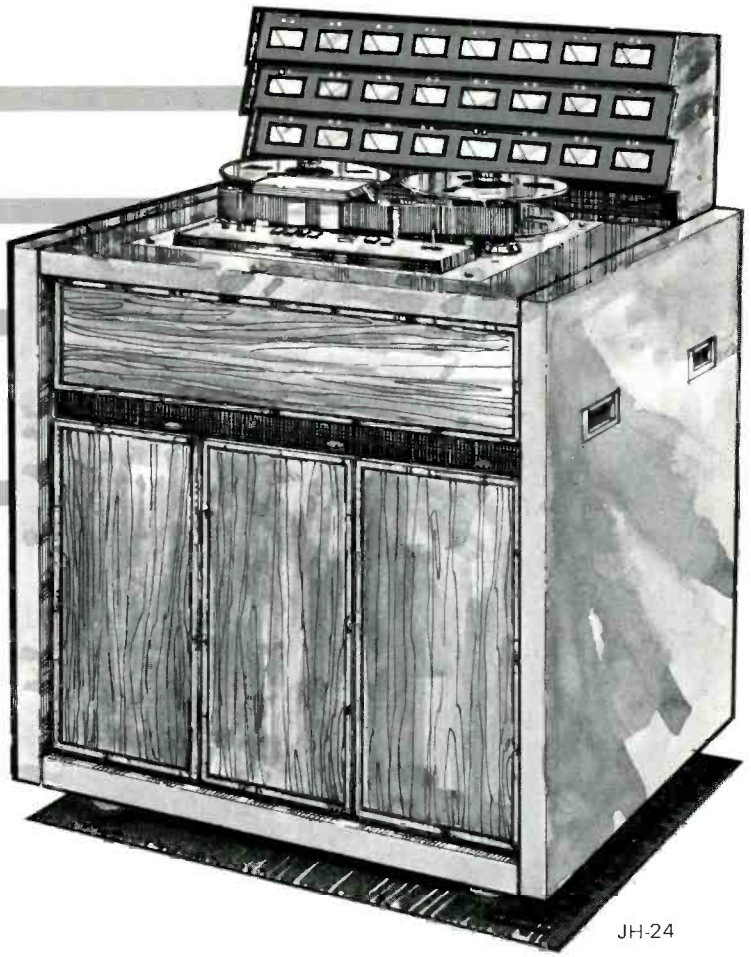
**DEPTH:** 26"
**SYSTEM WEIGHT:** 190 Pounds

JH-110

*Circle No. 115*



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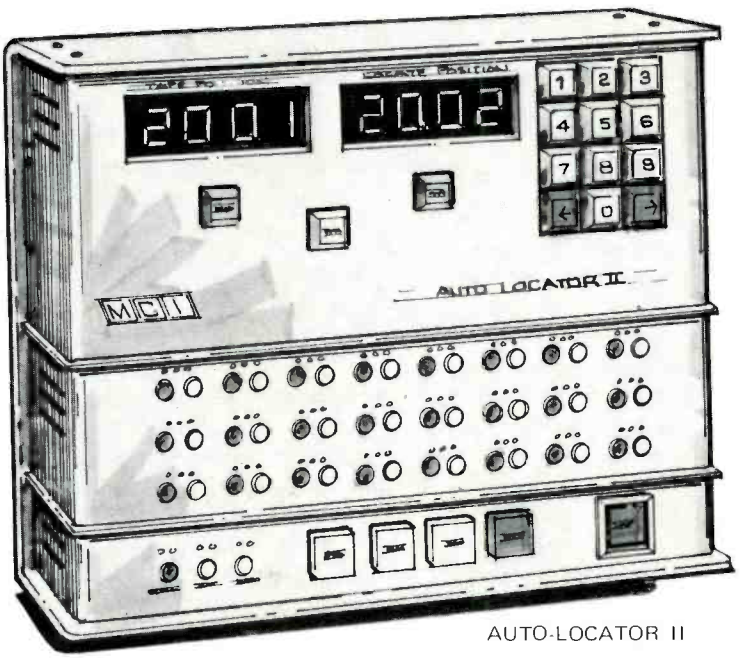


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The MagLink control unit normally displays the position of the master machine and any of up to six slaves. The display is divided in two sections, each consisting of eight characters. The upper section shows the position of the master, and the lower shows the offset of any selected slave from the position of the master. The maximum possible offset for each machine is greater than 24 hours.

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Circle No. 116

# ACOUSTICS in STUDIO DESIGN

BY
TOM HIDLEY
WESTLAKE AUDIO

In the middle '60's, music grew increasingly louder as it became more and more electronically oriented. We measured sound levels at the microphone in front of an amplified bass that reached 112dB SPL. It would sound great to the mixer when he listened to the live date on a four channel monitor system; sometimes all four monitors would be in front, and other times just three in front. Then came the mix-down to stereo or, often in those days, to mono. The rhythm would sound really good until other faders were opened. As the strings came up, the rhythm would gradually wash out. Time after time the original "tight" feeling of the session was lost to a roomy sound, the bass and drums getting a bit loose.

A lot of things were implied, including microphone and even console overload. But it became evident that most of the problems were directly related to insufficient acoustic isolation. At extreme sound pressure levels, the floor itself commenced to vibrate. This vibration would travel into adjacent mike stands, be picked up by sensitive condenser mikes, and, ultimately, find its way onto the multi-track recording. As a result, a large low end out-of-phase component was placed on the tracks. This component went unnoticed during the live recording because the acoustic properties of the control room were somewhat more forgiving than the mixing bus of a console. Nevertheless, as the various tracks were mixed together, the out-of-phase and fundamental bass components fought one another, creating what is commonly termed the muddy or loose sound.

The loudness of individual instruments wasn't the only problem we faced. For example, we stood in the middle of Count Basie's band and measured a reasonable 104dB SPL during a double-forte passage. Only a few months later we had the opportunity to stand in the middle of a much smaller group in numbers, and found levels of from 108 to 110dB SPL. This took place in the middle '60's, and it marked a clear trend. It used to be that when Wally Heider would do big band remotes, he would typically use one pair of stereo condenser mikes to handle the reeds, trumpets and drums. There might be an additional solo mike, a few more for the rhythm section, and one center stage vocal mike. That was *it* for 17 men. Before long the scene had changed, and 17 mikes were commonly used for just 8 or 9 musicians. In order to achieve satisfactory recordings with an increasing number of mikes used on fewer musicians, who were louder than ever, a change in the requirements of the recording environment was clearly needed.

## EARLY REMEDIES

The studio was the recording environment, and in those days the approach was to try to make the wall systems contain or handle the sound. Typically, Polycylindrical devices were stacked along walls and hung on ceilings. In many cases the walls were made diaphragmatic, enabling them to dissipate the bass by moving with it. These measures seemed to work, but only to a point.

At the time, I was doing maintenance for an L.A. studio, and thus had to deal with these evolutionary problems. We went so far as to build a large drum platform that was completely suspended above the floor by large coil springs. By using 6 or 8 springs compressed by about 1/3, we were able to substantially reduce the floor vibration caused by the impact of the drum set, especially the bass drum.

Looking back, these experiments may have seemed somewhat primative but there were no textbooks to tell us, "when the SPL reaches a certain point from the bass drum this is what you have to do." We began to see problems, and

we had to learn to cope with them. Working in JBL's loudspeaker factory in the late '50's gave us a pretty good idea of how speakers work, as well as basic ideas and philosophies concerning sound reproduction. Many of those early ideas stayed in our minds, particularly as we gained practical experience in the studio. Gradually we discovered what would work and what would not, but only after a good deal of trial and error.

One of the things we learned about was how to let a drummer play at full level and still provide adequate attenuation without boxing him off in a separate room. Ways were found to cut the 112dB output of a Fender Bass down to 85dB, minimizing leakage and to put five hard-blowing brass players in the same room with strings and horns, while still maintaining enough separation to give us a usable multi-track tape when the mixdown was started. This, the brute-force approach would have been to stop the problem before it was presented to the room (studio) at full amplitude.

The brute force solution notwithstanding, we felt that studios could and should be designed to accommodate the kind of music the players wnated to create, without inhibition.

Still, there were difficulties on the other side of the window. We found producers had to virtually sit in the mixer's lap to hear the same tonal and musical balance. Again, we thought that the answer was in the design of the room. Moreover, we began to conceive of the control room as an extension of the monitor characteristics.

## AN EMERGING PHILOSOPHY OF ROOM DESIGN

Some of the significant characteristics of a monitor are its sound dispersion angles and frequency response, as measured in an anechoic chamber or out-of-doors. These *free air* curves are our guide to developing an *honest room*; one which allows the listener to hear the product with the same ratio, balance and timbre that are on the tape.

But obviously you wouldn't want a room with a total random sound field because you would then be hearing many times the echo effect that is actually in the program, even if you do maintain the free-air monitor curve at given points in the room.

To add to the difficulty, dispersion and frequency response of existing monitors were less than ideal when Westlake first began to assemble control rooms and studios. To build rooms that would faithfully reproduce the free-air curves of monitors was no guarantee these rooms would sound particularly good. It was especially rough to hold the same balance at both the producer's desk and the mixer's chair. Ultimately, we decided to design our own monitor system.

The control room and its monitors are *the* frame of reference for the mix. If you wouldn't accept a response characteristic of $\pm 8$ dB from your console, (and you shouldn't!) why should you be expected to accept it from your control room? Or worse yet should you be expected to begin your costly construction project without well defined acoustic performance specifications, *guaranteed*?

## THE WESTLAKE MONITOR

An engineer said to us: "I want a monitor that can push my stomach. I really want to feel the bottom end without hearing it break up." We interpreted the necessary maximum level to be in the vicinity of 120 dB to 126 dB SPL. The monitor was developed and first installed at the Record Plant, L.A. in 1969. Because we were working with a particular cubic footage and room design, we came up with a system that is generally easy to work with. It can produce 124 dB – 126 dB SPL from a pink noise source at a distance of 4 feet, over a power bandwidth of 50 Hz – 10 kHz in free air. A wide $120^{o}$ horizontal mid band dispersion seemed to eliminate the necessity for wrap-around monitors. In this particular system, the tweeter commenced at 5500 Hz and was usable to 16 kHz with $22^{o}$ dispersion from center. By the time you moved back 8 – 10 feet (mixers area), this was quite a good dispersion, and was achieved without resorting to the use of an acoustic lens. Critical listeners seemed to prefer the sound without a lens. We did extend the tapered throat of the tweeter just slightly by adding a metal plate to the top, a measure which helped the penetration and dispersion while maintaining the sound quality. The system is now known as the Westlake Monitor.

After installing that first Westlake Monitor, we did a thorough 1/3-octave analysis of the unequalized response, using B & K equipment for the source and measurements. We found that the tolerance of the monitors in the room was not as good as what we measured in a free air condition. I did a lot of thinking about it, and could see no reason why the performance of the room and monitor combined should not equal the free-air curve of the monitor, providing the room geometry, choice of materials, and integrated trap designs were correct.

Still, the materials and geometry are not something that can be precisely determined by consulting a textbook. The reflective surfaces affect mainly the mid band and high end. Various materials are hard reflective, medium reflective or nonreflective at various frequencies. At that time we weren't sure about the low end, knowing little about traps. However, we learned something on every job, each room allowing us to improve subsequent rooms. Through the experience gained from building over 62 studios and control rooms we have come up with definitive information. This is not to say that every room will surpass the preceding job. As a designer you can't always do everything you may want to because the client may impose limitations. To work within his framework of budget and space, we may have to compromise some of the known formulas for performance under optimum conditions.

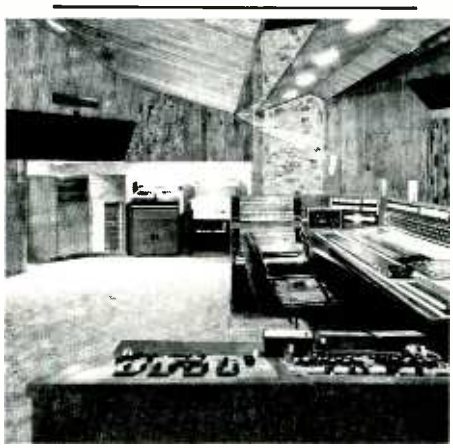


*Photo of Capricorn's Control room depicting: (1) recessed tape machine; (2) tier-drop ceiling above console; (3) symmetrical console wings; (4) left rear and corner of left front monitors, with varied wall surfaces in between.*

## ACHIEVING EVEN SOUND COVERAGE

To date, one of the finest control rooms we have completed is Capricorn studios in Macon, Ga. It is a good size control room, built within a 26' x 26' x 11'H shell. By the time you finish planning the geometry for the room, the more than 675 square feet shrink to around 420 square feet of floor space. That still provides quite a nice area behind the mixer where the producer's friends can listen. Also there is plenty of room near the window for the client's friends. It is interesting to compare the Capricorn room with our own Westlake room here in L.A. Our control room was completed 3 years ago and we have a horizontal coverage of 6½–7 feet at the console at 10kHz. At Capricorn and other rooms we're doing today, we have even coverage of 15 feet horizontally, $\pm 1½$dB at 10kHz. Even though the rooms look alike and have the same general geometry, there has been quite an evolution in performance in just the past 3 years.

Uniform horizontal dispersion isn't the only criteria we have to be concerned with. What about the mixer who is much shorter than the producer, or vice-versa? There may be a foot difference in their sitting height, and yet both should be hearing the same balance. The kind of even vertical dispersion needed to give them this balance has been more and more difficult to obtain than the horizontal dispersion. The mid band wasn't so much of a problem as the high end.

At Record Plant L.A. in 1969, we tried a new type of ceiling, a compression system. The ceiling would slope down toward the mixer. It might stop and slope up just ahead of him behind him, or right overhead. This was effective and gave us a useful vertical range of about 18 inches and it helped break up the floor to ceiling standing waves. But more was possible. We worked with designs for developing the desired acoustic condition forward of the mixer, again going for a natural dispersion from the monitor rather than using lenses or what have you. We tried this approach in Mexico City, using a new ceiling forward of the console. To our amazement the response was even, $\pm 2$dB at 10kHz from 6 inches above the console to 6 inches below the ceiling . . . Quite an improvement! This new ceiling is known as a tier drop ceiling.

To understand why the tier drop works so well, we fully analyzed drawings and measured curves of the Mexico City installation. With older designs some of the first reflections would be focused up on the ceiling and reflected down on the listening area. They would converge with the direct sound and cause areas of higher and lower levels, depending on the phase relationships. Now we have a really large random field up there. So the response characteristics become more uniform in that portion of the spectrum to the listening part of the room.

We have also found it is beneficial to develop a greater random field between the side walls and the listening area forward of the mixer for much the same reasons as the ceiling effect. This can be done with a combination of geometry and building materials. Hard woods, and in some cases hard glass, placed at particular angles can pick up the first and second cells of a horn and reflect them to the listening area

in a random pattern. We're also getting into the use of mason stone, whose very nature is one of diffusion and random splatter. We have tried the stone in several places, opposite the mixer's ears and forward near the monitors. We have focused the horn directly at the stone, and we have aimed it so the first cell hits the wood and the second hits the stone. All these arrangements produce different effects. But with five or six successful installations which utilize stone, we have come up with a positioning that we can be sure is most honest and beneficial to the acoustical properties of the room for a reference environment to mix in.

## USES AND ABUSES OF ROOM EQ

Since we believe that the monitor should dictate the sound of the room, an observer might ask why we are still selling electronic or passive room equalization. The primary reason is to correct for drift when loudspeakers begin to deviate from the original free-air response. Largely by accident, we learned that cold and warm air drafts and humidity fluctuations will invariably alter the response of a monitor, particularly the low frequency section. It may take three months, or longer, depending on the severity of the atmospheric changes. At first we were skeptical about this phenomenon, and there was no written manufacturing information to consult, just opinions. But we have verified this same kind of drift with loudspeakers made by four different manufacturers.

Drift isn't only caused by the breeze. Where the mid band and high frequency transducers are concerned, accidental trauma can be a problem. This might take the form of an extremely heavy turn-on or turn-off transient where the system is unprotected by slow rise and decay constants. More often than not, a recordist is fast winding a machine and presses a thumb on the tape to hear a cue. Or a power failure can slam the gate shut as the machine squeals to a stop. On some machines, like the Ampex 351, the gate can be shut inadvertently while the tape is fast winding. In any case, the tape comes down against the reproduce head and this can blast the monitors with tremendous level. It can instantly change the frequency response. Someone who is really attuned to the value of accurate monitors will call for a realignment when he can't do it himself. Some of our clients have actually gone to the expense of buying their own acoustical test equipment (B & K) so they can tune their systems. This is not to say that monitors won't last. Some of the original 375 or 2440 JBL midrange drivers are still in use at the Record Plant in Los Angeles after 5 years.

We use 1/3-octave equalization in the control room because this is where the critical decisions are made, where the implications of matching the tape are most important. The studio playback is usually not as critical. For one thing, studio monitors (as opposed to control room) are usually working into a much larger area, and for another, they're not usually scrutinized as closely. You also have inherent imbalance of the sound in a studio because it is designed to achieve different things. Studios have linear traps that are intended for sources in various points within the room, as opposed to the one focal area of a control room. So we will generally use one-octave equalization in the studio. We lightly trim the monitors with respect to a listening position about 2/3 of the way back, at or lower than ear level.

In both control and studio, drift and trauma are the major reasons we use equalization. But in a practical sense, there is a point of diminishing returns where the cost and time involved in adjusting the room to achieve the free-air response will be unreasonable. Faced with limitations of space, asthetics and budget, we will use some passive equalization to smooth out the response. But we never, never use equalization to make a monitor in one environment duplicate the response curve somewhere else.

## INTRODUCING THE TRAP

When we were working at the Record Plant to develop the monitor system, we had loudspeakers set up on the roof for free-air testing listening evaluation. Alan MacPherson, who is now with Warner Bros., was working with me at the time. During free time we would sit up on the roof and listen to music through the test speaker. It always sounded so good that we thought, "wouldn't it be nice if we could get this kind of environment in a control room." We listened to that out-of-door sound and found it is characteristic of that which enters the ear as it passes but doesn't bounce back again. There are reflections that comprise part of that sound, but they pass once and are gone.

Transposing this idea to the control room, we find that the blend of direct and random sound in mid and high end depends on the materials and geometry used throughout the mixer's area. The human ear becomes "confused" when a reflected sound arrives at the same time in an out-of-phase condition with a direct sound. The direct sound can be frontal and the reflected sound from the rear, yet "confusion" still exists. This is why the concept

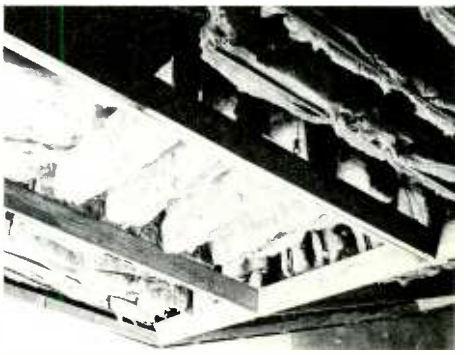


*Photo depicts typical trap construction above studio ceiling. Precise placement of baffles, volume, and angles are determined by many parameters, including room size, shape, trap entrance location, and desired cut-off frequency.*

of having the sound pass once and then dissappear is so significant to us.

In other control rooms, the sound might hit a reasonably blank surface on the rear wall, reflect back to the window, and come back to the mixer from the front. A compression ceiling and properly angled monitor axis help eliminate this kind of reflection problem, at least for the top end. The ceiling and monitors cause the top and mid band sound to hit the floor by the time it nears the back of the room. And a floor with dense carpet will attenuate these sounds sufficiently to prevent significant splashing. But the low end sound is a whole different can of worms. Regardless of the use of stone, wood, sheet rock, drapery or carpet, the low end just walks right through or around. This causes nulls and hot spots of low end around the room.

Eliminating these low end hot spots is where the trap comes in. A trap is a device that we use to figuratively "suck up" the low end and keep it from coming back into the room with any power. It is actually a large broad-banded absorber, somewhat analogous to a sound sponge. Traps function with the basic principle that at low frequencies, motion from power can be attenuated by acoustical resistance. Fins in the trap are usually placed at resistive angles to the incoming sound. This develops maximum air resistance and hence the most dissipation of energy. The traps may be located in the ceiling, walls, or both; it depends on the space available and the effect the client wants.

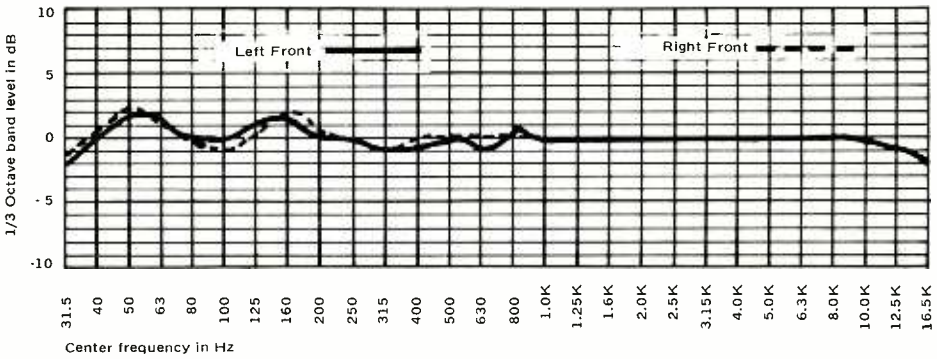
The effectiveness of a trap greatly depends on the entrance location with respect to the low frequency build-ups within the room. We have developed our own formulas for the geometry and cubic size. The trap may be designed to attenuate a broad band of sound down to a specific frequency. The choice of a cut-off low frequency for a trap depends on the maximum wave path you have designed for.

About the lowest conceivable fundamentals in the studio are created by a pipe organ or synthesizer placed on a long wall and playing directly into the room. Their fundamentals may range from 20 Hz to 30 Hz. If you preclude those low end sources, then the lowest frequencies you need to trap are frequencies corresponding to the bottom of a Hammond organ or a Fender bass. It is also unnecessary to build a trap capable of attenuating the full level present at the source. The Caribou Ranch studio is a good example. It has a completely active trap ceiling, tuned to below 40 Hz. If we place a 40 Hz source at 100 dB SPL at floor level, 40 dB of attenuation occurs by the time that sound reaches the trap ceiling (14' from floor). So at the entrance to the ceiling trap, about 10 to 14 feet from the source, the level is now only 60 dB SPL. If the trap absorbs only 20 dB, there will be no audible sound energy returned to the room. Effectively we have a free-air condition from 40 dB on up. It's like listening under the stars, but without the noise of the wind. The SPL mentioned above are B. & K. "linear" readings.

## REVISING THE TRAP FOR QUAD MIXING – (CONTROL ROOM)

Placing broad band traps behind the mixer did a fine job of keeping the low frequencies

*Photo of Kendun Recorders' mastering room depicts: (1) Angle between monitor (upper right) and stone wall; (2) Recessed tape machines for copies (master reproducer is adjacent to console); (3) Trap entrance behind curtain; (4) Compression ceiling.*




CAPRICORN STUDIO 1 FREQUENCY RESPONSE CURVES (4/13/74)

from bouncing around the room. But it began to create certain other problems. By that time we were into mixing quad, and suddenly the rear monitors didn't seem to have the same bottom end character as the front. The front would stay within tolerance down to 31Hz, but the rear would stop around 50Hz. As a result, when you panned a bass drum from front to back it sounded like two different instruments. While some mixers or producers would be content not to put a bass in the back of the room, the situation was totally unacceptable from a room design point of view. They may have cellos or an arco (bowed) bass to put in the back, and the rear of the room ought to have the same tonal characteristic as the front when measured at the listening area.

We tried an experiment in our own room. Hoping to obtain the desired balance without equalization, we installed rear monitors that were a few cubic feet larger than the front. It seemed to work, but we weren't really satisfied. The approach was too similar to brute force equalization. Besides, why should we need a third more cubic footage to develop the same energy? Instead we redesigned the control room traps to provide an equal acoustic condition from the front to the rear. But to test the new design, we really needed to build it into a studio.

One of our clients was about to start building, so we said to him, "look, we've got a real dilemma," and we explained it to him. "Here is the situation. You asked us to build a mastering room, and there are certain things we can do in there that we couldn't do in a control room. Since you have no windows or vocal booths, fewer tape machines than a studio, and just one entrance, we would like to try to build a 360° trapped room." We asked this client if we could experiment on him, and if it didn't work we would make it right to his satisfaction. We were anxious to use his job to test the trap design, not only because it was a mastering room, but because it was nearby where we could personally observe the construction every step of the way. The client was Kent Duncan of Kendun Recorders, and he agreed to go along with us.

The room was very unusual because when you walked in, there was no clue as to where the front or back was. Especially before the equipment was brought in, the 14-sided room was totally symmetrical on all vertical walls. When the installation was completed, the net result in performance was complete uniformity from front to rear monitors.

The Kendun success gave us a principle that we knew would work. We went ahead with plans to incorporate it in our control room designs. These designs can be seen at the Moody Blues' studio at Decca-London and others on the way. The measured response from all four monitors at Capricorn is identical. (See Chart No. 1) Trap openings are visible under the stone panels forward or just at the leading edge of the console. The traps themselves are located behind the stone. There are also traps under the studio/control room window and in the rear wall between the monitors. We couldn't achieve a true 360° trap due to the window and equipment requirements. But we have been able to make significantly more honest sounding rooms than ever before possible. (Clients say, "High level compression is gone, and ear fitague is down.")

## ADDITIONAL DESIGN CONSIDERATIONS

Any large objects placed in a room should be arranged symmetrically. The slightest departure from room symmetry can detract from uniform acoustic performance. The largest single piece of equipment in a control room is the mixing console. Sometimes the console is supplied by the manufacturer with a wing on one side, perhaps containing the patch bay. When this is the case we will build a similar wing on the other side, finish it to exactly match the rest of the console, and use it to house periphery equipment like limiters and equalizers. This approach has twin advantages; it makes the console symmetrical and it reduces the need for a large outboard equipment rack. Instead of having a walk-in rack that's higher than your ear and can splash sound back at the console, the auxiliary gear becomes part of the room. While it would be possible to build a large rack into the wall, the location would present logistical problems for the mixer. On the other hand, console-mounted equipment allows him to make adjustments from his chair, rather than having to walk eight feet during a session.

For much the same reason that we keep the console symmetrical, we also recess tape machines in the wall. Many studios will use around six machines on a day to day basis. By allocating space for them in the wall, the tape machines become an extension of the geometry of the room. (See Photo No. 3 Capricorn) In fact, if a machine is removed for any reason, the space should be filled with an empty box to maintain the optimum sound at the mixing position. In most of our rooms, the machines are placed behind the mixer, from 90° off his left or right ear and extending back in the room. A few rooms were specifically designed for forward placement of the machines. We have designs that easily accommodate six "built

continued on page 37

# Guaranteed Acoustical Performance Specifications ...from Westlake Audio "The Gold Record People."

Westlake Audio is the only studio designer-builder offering detailed, written guarantees of acoustical performance to clients who entrust Westlake with full responsibility for their projects — from acoustic design to downbeat. This guaranteed performance is one major reason why so many hundreds of Gold Records have been recorded in Westlake installations.

Westlake provides a complete "package" including unequalled skills and experience for turn-key "gold record" installations: pre-planning, site evaluation, acoustic design, construction, equipment selection and supply, financing, technical electronic interface, training of personnel and studio management consultation. From 2 to 24 track, for live recording, mix down, remote or mastering.

On the next two pages you will find the performance specifications which are guaranteed when Westlake assumes complete responsibility.


Westlake Audio

# Guarantee of Acoustical
# by Westl

| | |
|---|---|
| **I. Control Room** | **Acoustical and Geometric Design by Westlake Audio** |
| **A. Frequency Response** | ± 3 dB upon installation, 31Hz-16KHz measured with B & K, ⅓ octave, pink noise source. |
| **B. High Frequency Dispersion** | ± 2 dB maximum @ 10KHz across a minimum 10 foot horizontal plane at the console (from left of the mixer to the right of the producer or vice versa) **from any one of the four monitors,** measured with pink noise source. |
| | ± 2 dB maximum @ 10KHz across a minmum 5 foot horizontal plane front to back of the mixer or producer **from any one of the four monitors,** measured with pink noise source. |
| **C. Power** | 116 dB SPL minimum, linear scale, with broadband pink noise source from one monitor measured at the mixer's ear. The control room potential with four monitors is a minimum of 128 dB SPL. |

**What the above really means is that as the mix is being created, the mixer and producer will accurately hear the same music timbre balance.**

| | |
|---|---|
| **II. Studio** | **Acoustical and Geometric Design by Westlake Audio** |
| **A. Room Character** | The characteristic "room sound" which results from recording in a three dimensional area is eliminated by the utilization of an active ceiling providing a minimum of 50 dB attenuation @ 40Hz. This, in effect, produces an infinite third dimension such as would be present in an amphitheater. |
| **B. Decay Time** | Multiple decay times of various frequencies may be incorporated into the studio design. Thus a tight rhythm sound may be achieved in one area while a bright string sound is obtained in another. |

# Performance Specifications
# Lake Audio*

**C. Multi-track Separation**

Active traps are built into the studio walls which allow "in-studio" vocals, eliminating the usual need for vocal booths. 40 dB of isolation can be provided between the band and a vocalist only 10 feet away resulting in 40 dB of isolation @ 40Hz or tuned to selected frequencies.

**D. Drum Isolation**

A drum cage is provided, either built into the structure or on a movable platform. Again an infinite third dimension is achieved through an active ceiling design. The highest sound pressure level (SPL) are generated by the bass drum at 90Hz and the stick on the cymbal at 8KHz. These are attenuated a minimum of 24 dB measured one foot outside the drum cage. If desired, the cage may be built to project mid frequencies into the studio to give the musicians a better "feel." The "character" of the drum cage may also be designed for bright, dim or variable results.

**E. Bass Traps**

Bass guitar traps are incorporated into the design to provide 24 dB of attenuation at 40Hz with an SPL of 116 dB exciting the trap.

**F. Piano Trap**

A piano trap is also included for the purpose of rejecting unwanted sound from the studio to the piano microphones. The broadband rejection to the piano trap will be in excess of 20 dB.

## III. Live Quad Echo Chamber

**Acoustical and Geometric Design and Active Components by Westlake Audio**

**A. Timbre**

Variable control of low frequencies from section to section of the chamber.

**B. Decay**

Individual variable control of decays from all four chamber areas.

**C. Echo Mix**

Variable mix of echo content, parent to decay.

**D. Depth**

A three dimensional effect in echo content thru the use of two MS stereo return (4 channel).

**E. Stereo**

If stated prior to construction, the quad chamber may be used as two independent stereo echo chambers.

**Which other professional studio design company will guarantee in writing these features and specifications, prior to construction?**

*On all jobs commencing March 1974 or later.

**Kent R. Duncan, President, Kendun Recorders, Burbank, California:** "The new room has been in operation for six months now and our success is as much a tribute to Westlake Audio and Tom Hidley as it is to our long hours and attention to detail (and possibly some good engineering). Our Westlake room made us a 2 studio operation but instead of just doubling our gross, we went from $12,000 a month to $60,000 a month. The incredibly accurate planning of our Westlake turnkey installation resulted in completion exactly on time, response precisely as promised, all equipment functioning within one day of installation, and all within budget! In the past six months we have mastered such acts as Stevie Wonder, Bob Dylan, America, Buddy Miles, Fleetwood Mac, Rick Nelson, Tower of Power, Livingston Taylor, Isley Bros., Rod McKuen, Nitty Grity Dirt Band, Emitt Rhodes, Richard Greene, El Chicano, Nana Mouskouri, Cleo Laine, Bola Sete, San Sebastian Strings, Jo Stafford, Maxayn, Pharoah Sanders, Archie Shepp, Ballin' Jack, Vickie Lawrence, Maureen McCormick & Chris Knight, Don McLean, Vikki Carr, Bill Medley and even Rodney Allen Rippy. Over half these acts were recorded on Westlake monitors in various studios around the country, attesting to the fact that truly, you are *the* professional."

**Christopher Stone, President, Record Plant Recording Studios, Los Angeles:** "As you know, we have used Westlake Audio and yourself since the inception of the company for all of our studio design, construction, electrical interface and implementation. During the past four years you have designed and implemented eight studios for us in New York City, Los Angeles and Sausalito. Obviously we are known as a Westlake-designed operation. We have built our total reputation around your studio design and have always been happy with our decision to utilize you on an exclusive basis for all our acoustical requirements and equipment consultation. The success of your design speaks for itself in the form of our success as an independent studio operation."

**John Sandlin, Vice President A & R, Capricorn Records, Macon, Georgia:** "All of the work done was of a quality that is almost non-existent today. The people from Westlake *cared,* and saw to it that their work was of the highest standards. The carpentry work is incredible. The complete construction and equipment interfacing went more smoothly than can be expected in such a major undertaking. Westlake's delivery dates were either on time or before the time they were promised. The real test, however, is in the performance of the control room. Our room sounds great and objectively measures great. Also, the room is comfortable and easy to work in. It is really a pleasure to work with people of the integrity and abilities of Tom Hidley and Paul Ford and the rest of the Westlake personnel."

*Complete, unedited photocopies of these and many other testimonial letters are available on request from Westlake Audio.*
*Phone or write direct to Tom Hidley, President.*

**Michael Nemo, Independent Recording Engineer:** "My clients and I have found that the closest approach yet to a true standard is the integrated concept of speaker and room acoustic control found in studios built by Westlake Audio. What a pleasure to go from one Westlake installation to another and not have to be concerned about compensating for too much or too little bass, or high frequency response.

**John Boylan, John Boylan, Inc., Hollywood, California:** "First of all, this is my third project in a row to be mixed on your monitors and once again it looks like we have a winner — a record that sounds as good at home as it did in the control room. From a producer's nontechnical viewpoint, this ability to trust a studio monitor and come out with even results is extremely satisfying. Secondly, the Westlake Monitor never seems to vary in any substantial way from studio to studio, in the control rooms that you've designed. So I have no worries about consistency in today's widely dispersed recording scene."

**Edward J. Green, Director of Engineering/General Manager, MGM Recording Studios, Los Angeles, California:** "The studios and the control rooms have been completely successful for MGM Records from the time they were finished. Our mixers have, for the first time, the kinds of 'acoustical tools' that are needed for contemporary recording. That is, multitrack recording with all but complete isolation of elements whose parts can be later mixed or deleted and replaced. In the control room, the mixer and producer must be able to accurately monitor the recording so as to make technical and artistic judgements. Your booth design and particularly the Westlake monitors have proven themselves thoroughly workable and accurate. It is to your credit that these recording systems have withstood this test of time, particularly during the last three years, and that we wish to make no changes in studio or control room design in the immediate future."

**Robert M. MacLeod, Jr., Artisan Sound Recorders, Hollywood, California:** "Now that we have been in our new building for a couple of months, I thought you might like to know how it is working out. About all I can say is fantastic! We have had nothing but good reactions to the monitoring systems, and the acoustics of the mastering rooms are superb. Almost everyone who comes in comments on the quality of the workmanship. We have encountered no problems at all, and we find it a joy to cut records without the constant noise of the vacuum system in our ears. Producers seem to agree, and I am sure these beautiful new facilities will put us in a far stronger competitive position in the industry. In today's world of shoddy workmanship, it is really a delight to see the results of such painstaking care."


**Westlake Audio**

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Los Angeles, California 90048
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*continued from page 32*

in" 3M or Ampex machines, perhaps four Studers, in rooms ranging from 26' x 26' down to 20' x 20'.

In a multiple studio complex we usually try to retain identical control room characteristics. We advise this for a number of reasons wherever it is possible. You may be able to achieve the same response curve in different size rooms, but somehow the "timbre" will not match. Even the room color can affect the user, to a point. A bright red room and an identical pastel green room will seem different, even if that difference is entirely in the listener's mind. So we try to avoid this subjective problem by making the rooms similar, a precaution we have learned through experience.

Finally, we can't over emphasize that the choice of a monitor is the most important single consideration we use to design a room. We don't say it has to be our monitor, although we have a few reasons why we think ours should be used; but if a client wants to use a 604E system, we want to know that before we start on his room. The 604 will have different qualities that imply certain design factors, like low end and power handling capability that differs from the Westlake Monitor or someone else's monitor. We just finished a studio with Electro-Voice Sentry III's, and it sounds perfectly satisfactory.

## WHAT THE ACOUSTICAL CONSULTANT DOES

Most of the areas we have been discussing are where an acoustical consultant can provide valuable assistance to a studio, or a future studio owner. Anyone who is about to revise or build can benefit, whether it's a garage operation with construction costs of a few thousand dollars or a ground-up job that might be $200,000 or more.

In a garage situation, we might suggest a few angles and maybe a relief trap in the control room ceiling. If it were a 2-channel monitor, the trap might be augmented by a rear trap, depending on the available floor space. We assisted with one 16' x 16' room where the client just needed help in getting a tighter sound. He was doing the work himself. On the other hand, if a client is looking for a design where the complex is going to be a full custom studio, we will scrutinize every bit of the job very carefully. Because, even if we don't do the actual construction, it is more than likely going to be identified as a Westlake room, and we want it to sound like one. But regardless of the size of the budget, it doesn't cost anything for us to do a full proposal, which may run from two to thirty pages.

To handle the actual construction, we have our own crews and specially trained foremen. If overseas or out of town locations favor local labor, we will still supply a foreman to make sure the plans we draw are properly augmented. The hard costs for all internal shell studio and control room construction have risen markedly in the last three years. It used to run in the area of $27 – $28/ft. in Los Angeles, and the same work is now up in the middle $50's. This cost will vary in other parts of the country. For example, you find you can hire construction personnel for between $4 to $7 per hour in some States. Elsewhere, the same labor will run from $10 to $12.

When you go out of the country, costs vary even more. In Mexico City, where there is plenty of inexpensive labor, the largest problem is material availability. For the room we're doing in San Salvador, all the materials must be imported from Honduras, Costa Rica, etc. And, when you get into things like shipping and customs, your costs skyrocket. People may be standing around waiting for ten days until a shipment arrives from Guatemala City. In England, building is extremely costly right now; again, because of the material costs and availability. Even Hawaiian prices are up for the same reason. If you are building in Canada, the prices will run $7 to $10 higher than the same work in the United States. What it all boils down to is this: You've got to know where the studio is, how fast it must be built, and what the conditions are before you can nail down the price.

## HOW TO SAVE MONEY AND AVOID HEADACHES

There are several things that are easily avoidable but can quickly multiply the cost and aggravation of a job. A common error is that a client will lease or buy a building – or even the land – *before* running through an appropriate check list for his area. Such consulting service is one of the things a Studio Design organization can provide, and it can save as much as 30% to 40% in overall cost. But cost is just one savings.

If a client walks in and tells us he just acquired a building that has a 9' ceiling and he wants a studio built for 70 men, *he has a real problem*. Even if we can get around the obvious from the design standpoint, it's still a psychological disaster. And then there's the client who just rented a 10' x 10' room with an 8' ceiling. He wants us to design his quad control room. We can't move the walls out, and there are any number of reasons why that room just isn't going to work well. If you get help before you start, these and other situations can be prevented.

## DEFINING A ROOM

Any studio or control room is designed for a particular type of work and to please certain individual tastes. There is an area of compromise you enter with the so-called general purpose studio. But, usually people will ask for a particular sound. If they want a "tight" sound, it may mean many things. It may mean "dead" although most people unfortunately equate deadness with the mid band and top end. They'll walk in and say, "Oh, this is a dead room." Well, it may be dead in the mid band, but live as hell around 40Hz. So, when a Fender plays in there, suddenly 40Hz is coming through everybody's microphones. In other words, deadness must be localized in specific frequency bands. When you want a "hard" rhythm sound, you probably want a quarter-second or less decay time at 40Hz and up. You may ask for an auditorium sound in the mid band which isn't common, but can be easily done. In the end, it is the responsibility of the designer to provide what the client wants. And in order to do that, he must fully survey and interpret the client's tastes, and equate these to the design.

Probably the best way to assure the client will get the sound he wants is for him to have the future head of production on his payroll as early as possible, at least as a consultant. This should be done just as the land is purchased, or when the shell is about to be secured. By taking advantage of this timing, we can get definitive answers so the design can be nailed down right up front. In the end, there will be a more satisfactory product with less confusion and better client goodwill.

We will ask many questions to establish guidelines when the job involves remodeling an existing studio. Not all questions are technical, so you don't have to discuss the leakage, decay time, frequency dispersion and things of this nature. Instead, we may spend an hour subjectively asking, "What do you think of your drum sound? Has it got a good snap to it? Is it crisp? Or, is it soggy? Are your pianos constantly going out of tune? Do your string players complain? Are your brass people saying they can't hear themselves? Are your vocalists complaining because of confusion in what they hear? Can you develop the kind of balance you want on the cue bus, or are your acoustic impurities such that even the cue mixes are affected?" Often we ask a client to let us hear his favorite new record, with his comments. We use all this information to interpret the client's needs, and ultimately to shape the design and construction of his room.

## THE TOTAL PACKAGE

Westlake Audio can work from the conception of a studio to the downbeat. A studio owner can draw upon our experiences in design, construction, equipment selection, installation and system interfacing and, in the long run, save himself money by doing it correctly the first time. Westlake Audio has a vested interest in the acoustic and electronic performance and, ultimately, the profit performance of all Westlake facilities.

We have observed a steady flow of improvements in the techniques and hardware available to the recording industry. The microphone with flatter response, the console with automated functions, the control room with wide and even dispersion – – all of these have helped to make recording easier and better than ever before. Yet these improvements are of secondary importance when we consider the ultimate goal, the creation of entertainment.

Certainly it is true that more reliable equipment and more productive techniques are objectives that can save a lot of money for the studio, producer, artists and record company. And a hit record will undoubtedly fatten everybody's wallets. But financial reward alone can't motivate people to make a hit. Whether the music is classical, popular, folk or rock, real dedication and involvement are essential in every step toward that end product. The person who is content with his 8 to 5 work day is generally not the kind of person who will contribute to a hit.

At Westlake we share the dedication and involvement of all the people who are striving to make a hit: from the composer, to the songwriter, to the performers, to the producer, to the record company executive, to the mixing engineer, to the recordist, to the mastering engineer, to the plating and pressing people, and even the artist who designs the album jacket. We all go out of our way to perfect every detail of our jobs. So when these efforts magically blend to create a hit, we all feel the satisfaction of that achievement. More than anything else, this is what makes our work seem worthwhile.

*-END*

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|---|---|
| Type of System | 4-way |
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| Sensitivity (SPL at 30' lmW) | 46.5 dB |
| Power Output (SPL at 10 ft. in a room volume of 2000 cu. ft. with 1/2 rated power input —150 watts) | 110dB |
| Crossover Frequency | 250, 1100 and 9000 Hz |
| Size | 35"x48"x20" |
| Net Weight | 243 lbs (110 kg) |
| Configuration | Bi-amplification only |
| Price | Utility finish shown $1314<br>Walnut finish $1464 |

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| Frequency Response | 35 to 20,000 Hz ± 3dB | 35 to 20,000 Hz ± 3dB | 35 to 15,000 Hz ± 3dB |
| Sensitivity (SPL at 30' lmW) | 44dB | 44dB | 44dB |
| Power Output (SPL at 10 ft in a room volume of 2000 cu ft with 1/2 rated power input—37.5 watts) | 101dB | 101dB | 100.5dB |
| Crossover Frequency | 250, 1250 & 9500 Hz | 800 and 8500 Hz | 800 Hz |
| Size | 38"x24"x20" | 30"x24"x20" | 30"x24"x20" |
| Net Weight | 179 lbs (81 kg) | 121 lbs (55 kg) | 96 lbs (44 kg) |
| Configuration | for bi-amplification or with high level network | for bi-amplification or with high level network | for bi-amplification or with high level network |
| Price | to be announced | to be announced | to be announced |
| Availability | June 1974 | June 1974 | June 1974 |

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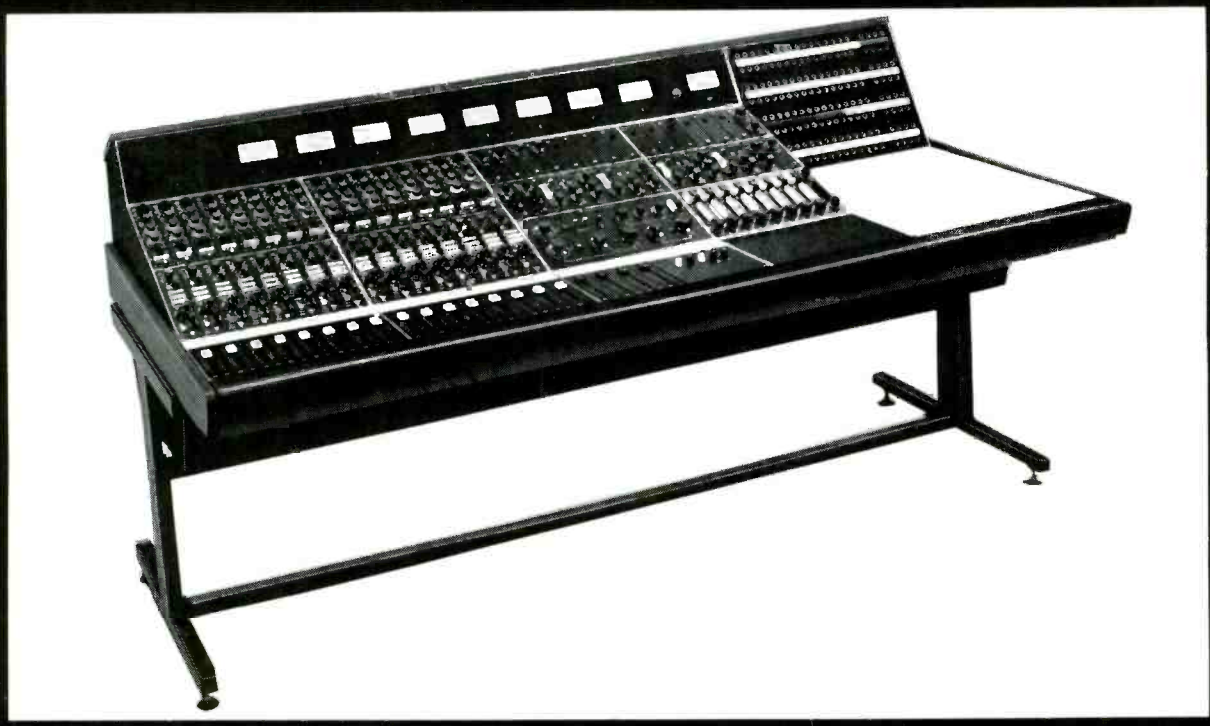

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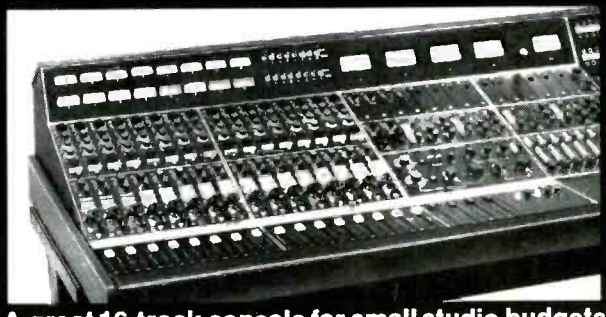

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*Re/p 40*

# AN ALBUM PRODUCTION ANALYSIS:


## AN IN-DEPTH STUDY OF THE ALBUM WITH COMMENTARY BY THE PRODUCER, DAVID BRIGGS AND ENGINEER, MARK RICHARDSON

BY
**PAUL LAURENCE**
*PRODUCER/GUITARIST and R-E/P CONTRIBUTOR*

Traditionally, records are analyzed along two general lines: artistry and commerciality. A record's artistic merit is of paramount concern to the critics, whose evaluations are duly heeded (or ignored) by members of the record-buying public. Conversely, a record's commercial potential is of singular interest to record company executives in their never-ending quest for Optimum Monetary Return. Unfortunately, both of these perspectives pretty much ignore the technical expertise involved in the making of a record. What about the *technicians* – those long-suffering producers and engineers who twiddle knobs, watch VU meters, and ride the mix down that long lonesome highway of much toil but little celebrity? Isn't there any formal vehicle for appraising their skills?

Moving ever onward, this is precisely the issue to which this article is addressed in being, to my knowledge, the prototypic foray into a whole new realm of critical awareness. This first-ever (?) *production analysis* will discuss a record's various "sounds" and techniques as they relate to its aural, visual [1], and emotional impact upon the listener. This being a technically-oriented study, I will try to deal with pure art (Art) only insofar as it relates to the technical end. Certainly though, a traditional review of this album could yield a discussion of comparable length and detail.

In considering the great number of excellently-produced records, I could think of none more worthy of an in-depth analysis than Neil Young's first album, entitled appropriately "Neil Young". "Why this one?" you ask?

A number of reasons. First of all, it is highly innovative, preceding by at least two years a number of trends – doing a "solo" album (an album by a member or ex-member of a recorded group), and using "Drop D" guitar tuning and a "soul sister" chorus.

It is also highly diverse, in both material and arrangement. Among the tunes (their arresting excellence aside) are a C&W instrumental, a piano/guitar suite, and a string quartet. The arrangements are equally eclectic, drawing from classical, contemporary, and electronic concepts.

Most important, it is a very visual album, possessing great beauty and form in its static and dynamic elements. With respect to the general principles of track placement, the positionings of the various tracks on the lengthwise axis approach the optimum. The vocals [2], bass, and drums all occupy the center spot in freeing the sides for interplay of like-textured tracks (the most frequent combinations being guitar-guitar, guitar-keyboard, and keyboard-strings).

A recording is very much like a dramatic production. The song is the play, with the tracks its characters. Ideally (in addition to whatever degree of technical expertise is required), the individual tracks have a definite "personality" in their own development, in their relationships to the other tracks, and to the song as a whole. The effectiveness of the song is therefore a product of the credibility and integrity of its components. The Rolling Stones have always been good at reaffirming their lyrics with convincing musical portrayals of bees, trains, stray cats, and whatnot. Similarly masterful is "Neil Young", but on an even more basic level. This album excels at *pure* musical imagery, not necessarily linked to anything that exists. Young himself (who with Jimi Hendrix must be regarded as the era's most creative multi-tracked guitar arranger) evokes a wide spectrum of images and feeling with at least seven different electric guitar sounds.

Not only are the album's tracks strong individually, but they consistently interact in dynamic and novel ways. Most dramatic among them is the juxtaposition of "moving" (playing a lot of chords, notes, riffs, etc.) to "unmoving" tracks. Also, there are many instances of "call-and-response" relationships between two or more tracks. Oftentimes, the melody itself is traded between instruments, usually accompanied by a corresponding track shift to restore visual balance.

Last but not least, "Neil Young" was recorded during an optimal time (as far as the state of the industry goes) for aural and visual clarity. It was done during the infancy of 16-track, before the advent of many of today's "modern" techniques (among them being "Vocal Soup", "Leakage City", and "Stereo Drums Freakout").

### GENERAL NOTES

**THE ALBUM:** "Neil Young" is a very clean and accessible record. Reverb is used sparingly, the "farthest back" tracks generally being the drums and the strings. Unlike many contemporary recordings, there is not much "studio presence" – that "depth" or "feel" resulting from a lot of leakage or miking of the studio itself [3].

**VOCALS:** The vocals are pretty natural, both in sound and size. They are generally given little reverb, and are consequently the album's most "up front" tracks. Likewise, there is not much reverb-riding [4]. By today's standards, the arrangements are sparse, there being usually just one harmony part (of similar EQ, echo, and limiting modifications).

**ACOUSTIC GUITAR:** Clearly a vintage instrument needing little modification. The tone is rich, sustaining, and with a crisp high end (new strings?)

**ELECTRIC GUITARS:** As there's such a wide variety of sounds, no generalizations can be made. Here is a partial list of the vari-

1. *The general principles for "looking at" a recording appeared in the last issue of "R-e/p" ("Seen Any Good Records Lately?", March/April 1974). Still, a brief recap might be helpful. The basic unit of auro-visual structure and function is the stereophonic spectrum. It has two dimensions, or axes along which a track may be moved: the left-right or lengthwise axis (a function of the panpots), and the front-back or depthwise axis (a function of volume, echo, and to a lesser extent midrange EQ). The individual tracks have visual characteristics as well: size (a function of volume, EQ, leakage, and degree of stereo dubdown), and texture (a translation to visual terms of the sum total of a track's aural properties, e.g. range, volume, timbre, etc.). Through their relative placement on the stereophonic spectrum, tracks can interact to create visual harmony (balance) or antagonism (occlusion).*

2. *The only exception being the background vocal (right) on "What Did You Do To My Life?"*

3. *The two (glaring) exceptions are "The Old Laughing Lady" and "I've Loved Her So Long", which have a great deal of "studio presence".*

4. *The exception being "The Last Trip To Tulsa".*

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ables which influenced this album's guitar sounds, plus their points of origin along the "Tonal Flow Chart" that begins with the instrument and ends as the signal leaves the board:

(Guitar): guitar, pickup, tone settings, vibrato tailpiece

(Effects): fuzz, phase-shifting, Leslie

(Amp/Speaker): volume, tone settings, reverb, speaker

(Board): EQ, limiting, reverb, tape delay

(In the interest of expediency, the term "guitar" will be used to mean an electric guitar unless otherwise stated.)

**KEYBOARDS**: Here again, a wide variety of sounds.

**BASS**: A standard range of sounds, probably a Fender Precision, knowing Young's preference for that instrument. No doubt a fair amount of limiting too.

**DRUMS**: A very versatile sound with a good balance of high and low end. The kit is mixed from mono to slightly stereo, with a fairly prominent bass drum.

**STRINGS**: One of the album's truly distinctive features, Jack Nitzxche's string arrangements are innovative in sound, look, and function.

Unlike his often-profligate mentor Phil Spector, Nitzsche tends toward understatement. His simple but elegant arrangements are composed of but one line played at different intervals simultaneously[5]. Far from "lush," they have a curious and highly effective "one-dimensional" quality. They are at once hauntingly sad and yet detached – a perfect foil for Young's searing lead guitar.

The parts are mixed monaurally, creating an entire string section that never appears at more than one of the three general placement points on the lengthwise axis at a given time.[5] Traditionally placed in the middle, the strings here are most often sent to a lateral position with no cross-side leakage.[6] Equally unorthodox, the mixers had no compunction about shifting them to another spot on the left-right axis, or even panning them all the way across for a special effect.

In most contemporary records, a string section doesn't function as a track to be "listened to" in the strict sense of the term. Rather it generates a "presence" to be felt, subtlely guiding the listener's emotions without his being aware of precisely why. This is not the case here. The strings are definitely a "track," possessing the aural and visual centrality of any other track. Aural centrality in being easily discernible (one line with no counter-melodies), and visual centrality in being easily localizable (occupying one distinct spot on the lengthwise axis). These strings don't showcase or "sweeten" a song, but act as a "voice" to echo its sentiments, only with a strange and beautiful retrospective quality.

5. *The exception being "The Loner", the second bridge of which has a second string part (middle) augmenting the original (left).*
6. *Of particular interest is the relationship between the strings and the organ. Through miking, effects, EQ, and mixing, the strings have been made less "dynamic" and the organ more "dynamic", to the point of being remarkably similar in texture (and therefore balanceable). For example, notice how much like a string section the pipe organ in "I've Been Waiting For You" sounds.*

*(note: the following conversation with producer David Briggs and engineer Mark Richardson has been interspersed with the author's original discussion)*

**DAVID BRIGGS**: This album was done just after the final demise of the Springfield. We were all living out in Topanga Canyon at that time. We started right after the big bust – Stephen, Neil, Clapton – everybody got it! That was my house. Crazy party. Anyway, it really *was* a travelling album – we moved around an awful lot.

**MARK RICHARDSON**: Yeah, I remember we bumped you a few times and you had to go to Wally Heider's.

**DAVID BRIGGS**: Still, it only took about two months. We did it on 8-track, and I must say it took a lot of juggling to get all the parts on.

*PAUL LAURENCE: How about all those different guitar sounds?*

**DAVID BRIGGS**: On this album, Neil used only Gibsons and Gretschs. You know, he's got a beautiful collection of vintage guitars and amplifiers. Within all that equipment, the tonal possibilities are enormous. His two main guitars are the Gretsch White Falcon and the one we call "Old Black" – a real old Les Paul. When he goes out with C,S,N & Y, he takes all his guitars, but just dinks with most of them. Since I've known him, he's been pretty much a Gibson/Gretsch player. It's only recently that he's gotten back into playing Fenders.

*PAUL LAURENCE: How about the other instruments?*

**DB**: Let's see, the drums were all on two tracks if I recall – one for the kick and all the rest on the other. Now I use a pretty full stereo spread for drums, but at the time we just didn't have enough tracks. You're absolutely right about the bass, it was a Fender Precision. Here, I did what I usually do: take two channels, one miked and the other direct, and combine them. The strings were dubbed down to one track, occasionally two. All the vocals were overdubbed, as Neil was still pretty shy about singing then.

Also, I should tell you that Neil and I are both tube freaks. They just sound so much better. This is one of the few things that turns me off about the newer equipment. A lot of these transistorized boards will distort the third harmonic, sometimes even down into the second! When this happens, you've got to keep adding more and more EQ to get that top end.

This goes for amps too. You can bring in

## HOW TO INTERPRET THE DEVELOPMENTAL SCHEMAS

**These are charts containing the basic information on the songs' technical, temporal, and visual aspects. Specifically they tell:**

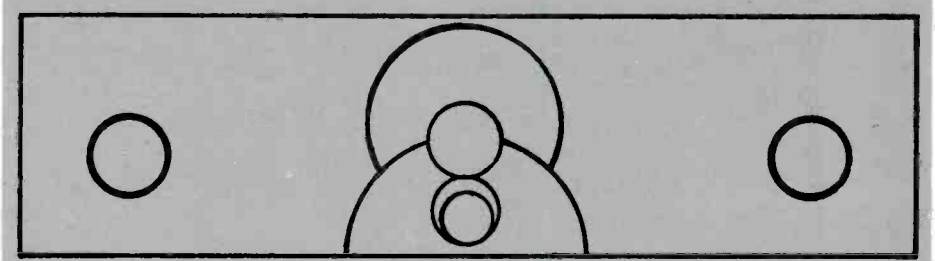
1) THE TOTAL NUMBER OF TRACKS. Each song's tracks are listed in the first vertical column. I am speaking of a "track" in its functional rather than absolute sense. If two or more actual tracks act as one (i.e. the same instrument doing the same arrangement or harmony thereto and sent to the same spot in the stereophonic spectrum), they are considered "one track." Examples of "one (functional) track" are strings, drums, background vocals, etc.

2) THE TRACKS' RELATIVE ENTRANCE ORDER. The order in which each track enters the song is indicated in the second vertical column. A number used for more than one track shows that those tracks entered the song simultaneously.

3) THE SONGS' BASIC STRUCTURE. The songs develop from left to right, and are broken down into their basic structural units (intro, verse, refrain, etc.). Each unit is further subdivided into two-bar subunits, the total number of bars per unit noted in parentheses. A jagged line at the end of a song indicates a fade-out.

4) THE TRACKS' PLACEMENT ALONG THE LENGTHWISE AXIS. By plotting the intersection of a "track" column with a "song unit" column, that track's placement on the left-right axis can be ascertained for that portion of the song. "L" represents the left position, "M" the middle, and "R" the right. "L-M-R" indicates that the track was panned to occupy all three positions. A blank space means the track was "out" during that segment. By using these developmental schemas, it is possible to create a visual schema for the album's songs at any and all stages of their development. For example, "The Emperor of Wyoming" would at one point look like this:

**Fig. 1 Visual Schema of "The Emperor of Wyoming" (at bars 9-16 of the refrain)**



the biggest Marshall and a Fender Deluxe that's this big, record both of them, and you'd swear that the Deluxe was the bigger amp. Tube amps don't chop off the harmonics.

Today's records really reflect the use of more transistorized equipment. Just compare them to records made in the late '50's. I've got this oldies album — 10 songs to a side. You play that, then drop on anybody's new record — Elton John, Led Zeppelin, whoever — and it'll be at a much lower level. Today's records just don't have the heat. We try to circumvent this by using a lot of tube equipment. All of our vocal mikes and most of our drum mikes are tube. Same with our guitar amps and limiters. The tube sound, especially for recording, is where it's at.

*PL: Why was the album re-mixed and re-mastered?*

**DB:** Mainly because it didn't sound much like it should have. It left the vocals buried, and generally changed things all around. As if your records don't sound different enough when you hear them over the radio!

**MR:** Yeah. When it was moved from 2-track to 1-track, one side was totally missing — half the song gone because we didn't mix it compatible for mono. Nowadays, there's a switch on almost every console that will show you a mono reading — you can switch to it and hear exactly what you've got. We mixed this record on a strictly stereo basis.

**DB:** Actually, we only remixed three or four things — "The Old Laughing Lady", "I've Been Waiting For You", "What Did You Do To My Life?", "Here We Are In The Years". "Here We Are In The Years" has got a real long version, even longer than the first mix. "The Loner's" got an ending on it that nobody's ever heard — a long, long jazz thing that is really great.

**MR:** There definitely was a time problem, especially in those days. They wanted to go on forever! "The Loner" started out as a jam session — it went for about 45 minutes before they even got to the part that was recorded!

**DB:** "I've Been Waiting For You" was originally a bit longer also. On the whole, though, Neil's pretty good about editing his songs down before we go in for the final recording. Saves us a lot of time with splicing.

THE EMPEROR OF WYOMING

| | | (4) | VERSE (12) | VERSE (12) | REFRAIN (4) | VERSE (8) |
|---|---|---|---|---|---|---|
| LEAD ACOUSTIC GUITAR | 1 | L | L | L | L | L |
| ANTHM ACOUSTIC GUITAR | 1 | M | M | M | M | M |
| LEAD GUITAR | 3 | | | | M | |
| ANTHM GUITAR | 1 | R | R | R | R | M R |
| BASS | 1 | M | M | M | M | M |
| DRUMS | 1 | M | M | M | M | M |
| STRINGS | 2 | | M | M | M | R M |

## SONG ANALYSES

### "THE EMPEROR OF WYOMING"

This is a fairly unusual tune — a country instrumental with strings. Though possibly not unknown in Nashville, this particular permutation is a rarity to the pop rock audience as a whole. It features a beautiful flatpicking acoustic guitar track (the likes of which Young had not shown on record before), which forms a dramatic contrast in movingness and texture to the string section. Also of interest is the lead guitar. When it comes in, the song seems to "open up" with a definite presence, seemingly more than just that of a highly-reverbed track. Possible explanations include 1) a punching in of a "studio" track, and 2) a combination of amp and board reverb.

This song has a great deal of melody-trading and track-shifting. Generally, the melody is carried by the strings. At the refrain, however, the lead guitar enters and assumes the melody, the strings dropping out for the first eight bars. This combination is extremely effective — the sudden intimacy of no strings plus the nostalgic "high school dance" sound and ambience of the lead guitar create the song's emotional high point. For the first half of the last verse (the lead guitar having dropped out for good), the rhythm guitar assumes the lead, in so doing moving from the right to the center position and losing reverb. Meanwhile, the strings have exchanged places with the rhythm guitar and are now on the right. Four bars of this, and the strings reclaim the melody and middle spot, the rhythm guitar returning to its original position.

(at this point, the record was put on)

*PL: Where did you get that title?*

**DB:** You know what? — that's *me*! We were all sitting around jiving one day, saying "I wanna be this, I wanna be that". I said that I just wanted to go home and be the Emperor of Wyoming — that's where I'm from. Neil loved the title and here it is.

That's the White Falcon on the right. The acoustic is the D-28. Nils Lofgren has that guitar now — Neil gave it to him as a present for doing "After the Gold Rush". This part where the guitar and strings change places really pisses me off. They didn't have any pans — just click switches. If you listen with phones on you can tell. They just don't have the smoothness of rotary pans.

**MR:** God, yes! It about drove us both crazy!

### "THE LONER"

A magnificently schizoid piece, this song is composed of two completely different musical sections. The verse and refrain are dominated by electric guitars (five in all, three of them fuzz), while the bridges feature two acoustic guitars and the strings. The organ is fairly large in size and has an "undercurrent" of movement, possibly from a bit of phase-shifting. During the refrain, there is a reversal of (this album's) usual roles, with the strings being the moving track, playing a glissando variation of the "bridge" motif while the bass and drums keep a steady and deliberate on-beat. Notice the strings' "watery" sound?

There are a number of call-and-response relationships among the song's tracks. In playing the fills, the laterally-placed fuzz guitars answer their rhythm guitar counterparts. During the bridges, the up front lead acoustic guitar is answered by the distant string section in the opposite channel. The last bridge has the centrally-placed string part answering the original one. Through precise panning, one of the fuzz guitars is made to answer its own fills in alternating sides during the last four bars of the bridges.

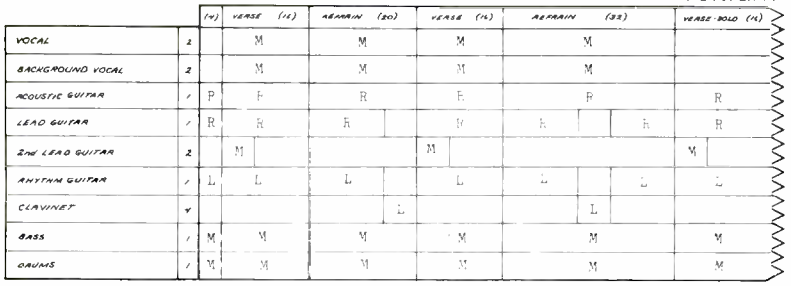
*PL: How did you get that organ sound?*

**DB:** If I had my notebook here, I could tell

| | | INTRO (8) | VERSE (24) | REFRAIN (16) | INTRO (8) | VERSE (24) | REFRAIN (16) | BRIDGE (24) | VERSE (24) | REFRAIN (16) | BRIDGE (24) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOCAL | 4 | | M | M | | M | M | | M | M | |
| BACKGROUND VOCAL | 8 | | | M | | | M | | | M | |
| LEAD ACOUSTIC GUITAR | 9 | | | | | | | R | | | R |
| ANTHM ACOUSTIC GUITAR | 1 | M | M | M | M | M | M | M | M | M | M |
| FUZZ GUITAR | 2 | R | R | R | R | R | | | R | | |
| FUZZ GUITAR | 2 | M | | | M | M | M R | R-M-L | M | R | R-M-L |
| FUZZ GUITAR | 6 | | L | | | L | | | L | | |
| ANTHM GUITAR | 5 | | L | | | L | | | L | | |
| ANTHM GUITAR | 5 | | R | | | R | | | R | | |
| ORGAN | 1 | L | | | L | | | | | | |
| BASS | 3 | M | M | M | M | M | M | M | M | M | M |
| DRUMS | 2 | M | M | M | M | M | M | M | M | M | M |
| STRINGS | 7 | | | L | | | L | L | | L | L |
| STRINGS | 10 | | | | | | | | | | M |

THE LONER

IF I COULD HAVE HER TONIGHT




you exactly what the organ settings were. It's a B-3. I sat down and played with the stops to get that sound. I think Neil ultimately played it though. Believe it or not, those fuzz guitars aren't even amplified — we ran them direct into the board at Sunset. That sound comes from driving the gain all the way up, with heavy limiting. I think we limited every single guitar on this album. On some of the electrics, we used two or three in series. I really swear by tube limiters, especially the old ones like Fairchilds and RCA's. I have a bunch of them that I bought from Columbia. You can't buy them anymore, but you can't beat them either.

I think we did the strings from that same little room at Sunset Sound.

## "IF I COULD HAVE HER TONIGHT"

This song showcases Neil Young's unique and diverse talents: his bittersweet perception, uncanny sense of melody and chording, and inventive arrangements. Here, he creates a soft and delicate aurovisual scene with (of all things) three electric guitars. Note especially the exquisite jazzy tone of the centrally-placed one. These are the album's largest vocals, having quite a bit of reverb and a decidedly dreamy sound. As he often does, Young has the song "get down" to a simpler instrumentation. Bars 14-20 of the refrain feature the clavinet, for which the electric guitars drop out completely.

**DB:** That's the Gretsch Horseshoe on rhythm. The White Falcon's playing the lead, not the stereo one though. I think that middle one's the Horseshoe as well. There are two vocals here — they split for the refrain and go back to track for the verse. That's me on clavinet — shades of Motown!

## "I'VE BEEN WAITING FOR YOU"

The album's most dramatic song, it counterposes Jim Messina's "climbing" bass to a thin veneer of pipe organ. The opening riff is pure Bach, the harmony fuzz guitars lending a surreal 1984-ish look and sound before receding into the distance. For the refrain, the Leslie'd guitar drops out, leaving the pipe organ, bass, and drums to underscore the lyrics' starkness.

Then there's the guitar solo, magnificent by any criteria you wish to impose. Through a series of effects (my guess being fuzz-Leslie-heavy limiting), Young's guitar was given a truly unique and expressive sound — like a terrified animal. It was engineered superbly as well. During the final mix, the solo was panned back and forth across the left-right axis at an increasingly faster speed, all the while varying slightly in tone quality (Leslie-riding?). The guitar's placement along the depthwise axis was continually modified as well — it moves away from the listener upon reaching the middle region. Though not a difficult effect per se, this particular instance seems to indicate a very novel means. A simple way to make a track "drop back" is by decreasing the volume, yet there is no perceivable change in volume here. Likewise with adding reverb, yet this guitar doesn't manifest the increase in "fuzziness" attendant to a reverb boost. If only by the process of elimination, the solo's depthwise movement seems to have been accomplished by riding the midrange EQ!

The sum total of the guitar's motions suggests a two-dimensional "Hula Hoop" type of path. All in all, this is about as sophisticated a track manipulation as can be effected in a stereo dubdown. (Young acknowledged this effort with characteristic modesty, saying "I was really into it that day").

**DB:** This is one of my favorites. The drums have a lot of punch. I compressed the kick, and limited the bass with a bit of filtering. Neil and I both like a lot of kick drum.

**MR:** Right! You can spend five hours on your bass/drums sound, and if you've got that together, you're well on your way. David's a real nut here. We've spent hours with carpeting, pillows, isolation booths — the works! He used to use 14 or 18 mikes alone on the drums. We miked everything that moved! That's why it took so long to dub all that down to two tracks — a lot of mikes.

*PL: How about the rhythm guitar here?*

**DB:** I think that's the Les Paul.

**MR:** Sounds to me like it was run through a Leslie with a tape slap. You send your signal into the echo chamber and bring it back up through the console, but instead of sending it to the speakers, you throw it to a tape machine as an input of the tape. That's your echo return. You can then VSO it to any speed you want, and send it back to the speakers. It's really reverberation as opposed to echo.

*PL: So are you combining the "slapped" and "un-slapped" channels?*

**MR:** Yes! You combine your original signal, your echo, and your slap return.

*PL: It sounds very "underwatery" to me.*

**MR:** With the proper kind of tape slap you can put *anything* underwater.

**DB:** For the solo, we took Neil's guitar through two fuzz tones, then into a Leslie miked with four mikes. Really, Paul, your guesses as to what we did are very accurate.

*PL: How were the mikes arranged?*

**MR:** Well, you know, a Leslie has vents on both sides — high range and low range. You mike the low with a ribbon microphone and use a high peak-out microphone for the high. You can't place the mikes equidistant around a Leslie speaker because if you mike the back, you get hum and too much of that "whuping" sound. What we did was bring the two pairs of mikes up to the proper perspective, got the thing going, and then re-EQ'ed for the "whuping" sound. As he was playing, we rode the faders, the whole thing going down on two tracks.

**DB:** I love the last note of the solo, right where it frets out. Offhand, I can't think of anyone else doing this kind of panning before this album.

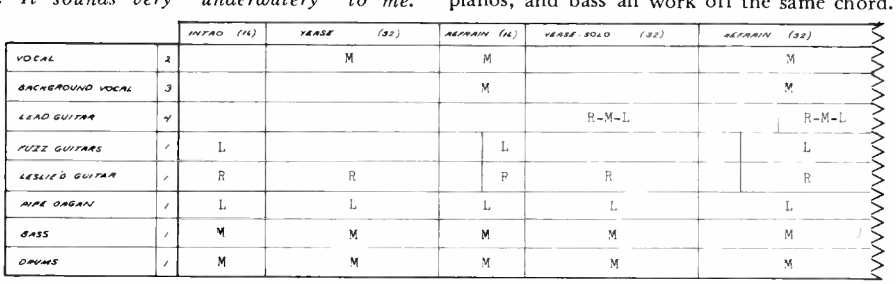
## "THE OLD LAUGHING LADY"

This is the album's biggest production number — a fascinating amalgam of seemingly disparate elements. It opens with the bass drum and string section, the latter sweeping across the lengthwise axis to settle in the right side. A startling tympani roll ushers out the strings and leads to a dark and impassive modal acoustic guitar. Either by intent or by accident, this song is highly evocative of American Indian imagery, the acoustic guitar being their droning chants, the omnipresent stereo tympani their "warpath" drums.

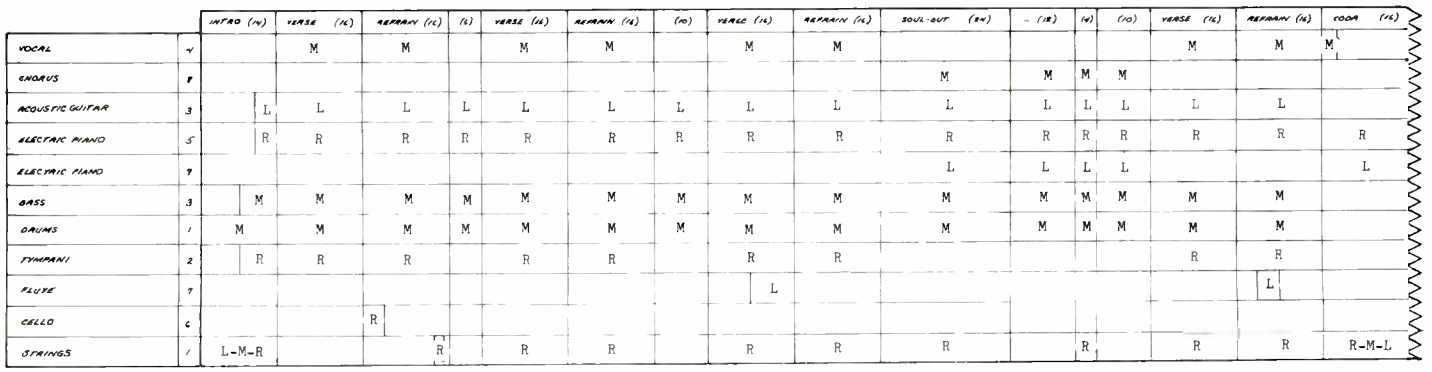
The element of tension (achieved through a variety of techniques) is used to great effectiveness. During the verses, the bass works solely off the tonic root while the acoustic guitar changes, giving the tune a definite "holding" sound. The drums contribute to this vaguely uncomfortable feeling by playing the off-beat. There is much relief for the first four bars of the refrain where the bass follows the acoustic guitar and the drums go to the on-beat.

In direct contrast to this generally monolithic state of affairs are a number of extremely melodic tracks. Of interest is the electric piano (right side), which answers the brooding monotones of the acoustic guitar with delicate "butterfly" riffs. During the first refrain, a cello comes in for a brief four bars to "fill out" the sound. Note especially the subtle descending flute during the second half of the third verse.

Most unexpected is the "soul-out," where again tension is very effectively created and manipulated. Here, the acoustic guitar, electric pianos, and bass all work off the same chord.




I'VE BEEN WAITING FOR YOU




Further tension is generated by the continually-ascending (and therefore non-resolving) strings, and the barely-contained frenzy of the chorus. After the "soul-out" finally ends, the last verse seems positively comfortable.

During that verse, notice that the strings are playing the same line that the flute did earlier. Into the fade, the strings once again swell and sweep across the lengthwise axis to disappear on the left where they originally entered. An important part of the fade's ambience is the (left-side) electric piano, which merely sustains the last chord.

**MR:** This is my favorite song on the album. It took me a long time to get behind it though – for the first run-throughs it was like a fogbank! I couldn't figure it out at all, and I think Neil was right behind me.

**DB:** There's a bass marimba on this. . . . .it's in there somewhere.

**MR:** Yeah, but that's not what it's called. I forget the name of it – barumba, kabunga – something like that. Huge instrument. You have to walk up the stairs to play it. Really – it's about 25 feet tall! I think there are only two guys in town who can play it.

**DB:** The part is very simple – he's just doubling some notes with the bass guitar. It's so low that you almost can't hear it. It just fattens up the sound. The bass and drums were both written parts, the piano too. Jack did the arrangements – fabulously talented guy. The girls worked out their own parts. If I recall correctly, the string part on this song became a melody for one of the songs on "Gold Rush".

## "STRING QUARTET FROM WHISKEY BOOT HILL"

**MR:** I think we actually had five or six pieces on this one.

*PL: What's that plucking sound?*

**DB:** Probably a viola. No, I know what that is. That's Neil's basic guitar track. I think he used a Martin 12-string with only six strings – the highest of each pair.

## "HERE WE ARE IN THE YEARS"

This is an elegant and masterful suite. It has seven different sections, each probably having been at one time or another an independently-conceived vignette.

Despite the melody being traded between the instruments a number of times, there are but two instances of track-shifting. The piano is initially sent to the left side to counterbalance the rhythm acoustic guitar on the right. For the song's second segment, the piano is moved to the middle and back, its former spot now occupied by the electric guitars. For the first bridge, the lead guitar is likewise moved to the middle, freeing that spot for the lead acoustic guitar. There is quite a bit of gain-riding on the piano. Notice how it is brought out during the fourth segment, especially on the fills.

In the sixth segment, Young once again displays his soft touch with a delicate passage of tailpiece-vibrato'ed guitar. The tailpiece is really an integral part of his style, giving his notes that empathic "talking" quality.

The coda features a time change to 3/4 for a somewhat dissonant "downer waltz". The pianos and guitars are eclipsed by a drone of guitar feedback before all recede into a premature fade. (The album's original mix had this song lasting another half-minute or so, ending with a heartbeat).

**DB:** This is my favorite song on the record. I have the very first tapes, just Neil and his guitar. There's more vocal here, but I prefer the original mix, really. The acoustic lead is the Martin 12-string with just six strings again. It's a teeny little guitar, heavily limited. You can hear the string section way back there before it really comes in.

*PL: What about the heartbeat in the original mix?*

**DB:** Ah, you know what that was? – it was a clock! We put it inside a cotton-filled box. After recording it at 15, we slowed it down to 1-7/8 and re-dubbed it. The end bit is Big Ben, that's the melody it plays. We duplicated it fairly well, although you could hear it better in the first version.

## "WHAT DID YOU DO TO MY LIFE?"

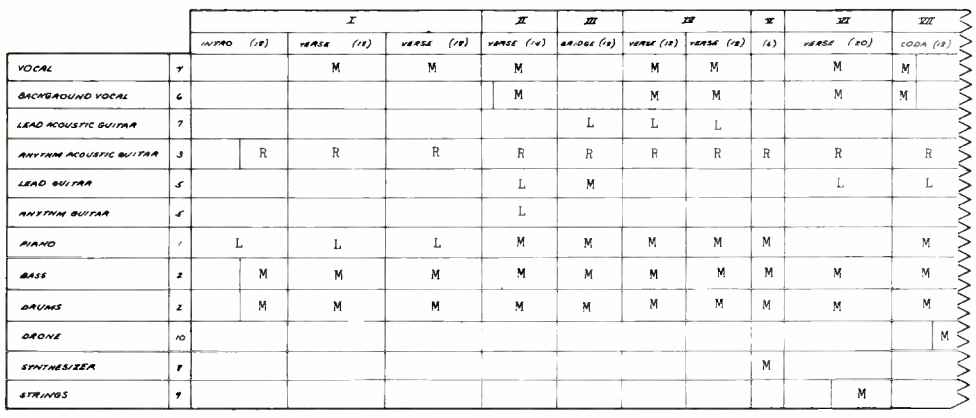
This is "Neil Young's" most demonic song. Like "I've Been Waiting For You". it begins with double-tracked fuzz guitars sent to the same spot on the lengthwise axis to function as a single track. (This is one of Young's pet techniques, and a highly effective one as well. When tightly-arranged fuzz guitars are combined, a curious synergistic effect is the result, where their individual identities are lost in the creation of a strange new entity). They are answered in the opposite side by a dark and primitive tremelo'ed guitar. This is a striking contrast, not only in sound, but in imagery as well – the futuristic (represented by the fuzz guitars) versus the primordial (the tremelo'ed guitar).

During the refrain, the sound changes dramatically. The song appears to "open up", possibly a result of the "studio" being punched in. Also, there seems to be a disturbing low-frequency rumble somewhere in the background. These two elements combined give the refrain a truly awesome, apocalyptic feel, like some doomsday machine gone wild. Likewise, its "dinosaur" imagery would make it ideal for "Fantasia's" terrifying journey into the prehistoric past.

The refrain also has the album's only laterally-placed vocal. It is large in size, haunting and translucent in quality. During the thundering chaos of the refrain, it remains detached, echoing the title like a lonely disembodied spirit.

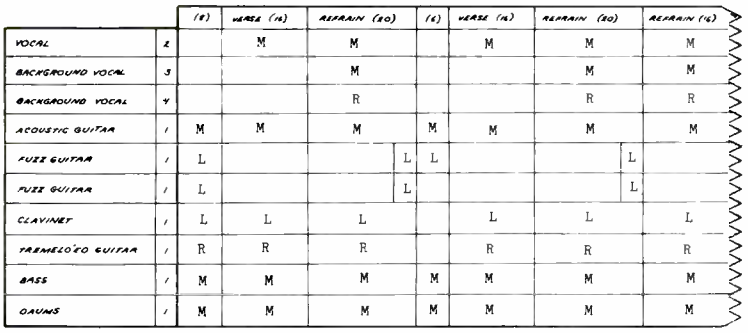
PL: Was this song upcut?

**DB:** No, I don't think so. I know what you mean, though. I noticed it too. I love that guitar sound – it has a definite visual quality. We took it straight through the board at Sunset Sound with heavy limiting. Neil and I both like a limited guitar sound. On this song especially you can tell – instead of your standard hard attack/quick decay, you hear almost no attack and a lot of swell.




HERE WE ARE IN THE YEARS

WHAT DID YOU DO TO MY LIFE



| | | (8) | VERSE (16) | REFRAIN (20) | (4) | VERSE (16) | REFRAIN (20) | REFRAIN (16) |
|---|---|---|---|---|---|---|---|---|
| VOCAL | 2 | | M | M | | M | M | M |
| BACKGROUND VOCAL | 3 | | | M | | | M | M |
| BACKGROUND VOCAL | 4 | | | R | | | R | R |
| ACOUSTIC GUITAR | 1 | M | M | M | M | M | M | M |
| FUZZ GUITAR | 1 | L | | | L L | | | L |
| FUZZ GUITAR | 1 | L | | | L | | | L |
| CLAVINET | 1 | L | L | L | | L | L | L |
| TREMELO'ED GUITAR | 1 | R | R | R | | R | R | R |
| BASS | 1 | M | M | M | M | M | M | M |
| DRUMS | 1 | M | M | M | M | M | M | M |

*PL: What's the advantage to using a number of limiters simultaneously on one signal?*

MR: For different attack and release times. It'll give you a sound fatter than all get-out.

*PL: How did you change the sound of the song during the refrain?*

DB: One of the things we did was get real good control over the vibrato, so the pulses are right in time. We did it by riding the volume at the amps. If you notice, both the guitar and the clavinet are "throbbing" together.

MR: Oh, I know what he's talking about! I just remembered myself. There was feedback on one of the master tapes, a mistake really. It was in key with the song, so we just punched it in for the refrains. I haven't thought about that in years.

*PL: How about the "answer" background vocal?*

DB: I think we used the Sunset Sound chamber for that one.

## "I'VE LOVED HER SO LONG"

This is the companion tune to "The Old Laughing Lady" in terms of production, personnel, and general sound. Part of its presence is due to a faint delay of the electric piano and drums in the right side, achieved through an actual tape delay or from miking the reverberations some distance away.

Throughout the song is a subtle marimba part. Notice how sparingly they are used, almost as the musical equivalent of punctuation.

The right track contains the reeds and strings, and an interesting musical metamorphosis. During the first verse, the five bars of flute are cleverly segued to two bars of oboe, which gives rise to the string section just in time for the refain.

Even the strings undergo a slight transformation. After four bars of the last refrain, they are joined by a very high harmony, lending that mercurial "starry skies" sound.

DB: I've always thought Joe Cocker should do this. We recorded this song and "The Old Laughing Lady" at Sunwest, the same day as a matter of fact. Surprisingly, Neil wrote this on guitar. All of these were guitar songs, as he was hardly playing piano at all in those days. He was a real banger, a real clunker-banger! I don't think he ever recorded piano on our records, except for maybe a little tiny keyboard part here and there, till "Gold Rush."

*PL: How did you get that delay in the right side?*

DB: That's a tape repeat of the snare and electric piano. Those little "ping"'s that you hear every once in a while are high notes on the bass marimba.

## "THE LAST TRIP TO TULSA"

DB: There's not a whole lot to say about this one, as it only has two tracks. The acoustic guitar was miked stereo. We also played with the echo a lot, especially where we wanted the lyric to sound really dramatic.

MR: All in all, this was really a stimulating project to work on. It was my first big record, David's first big record, Neil's first solo album. Even back then, Neil knew just what he wanted to say — really a man of conviction. It was a learning experience for all of us. I'm very proud to have been associated with it.

DB: It's true. Neil is really extremely talented, and in so many different areas. Just take his guitar playing. He's a great melodic player. Obviously, he's not like Clapton or Hendrix — you know, not a riffer. But he can play more with three or four notes than most people can with an entire scale. He also knows the value of "air" in the track — by that I mean not playing the obvious part. I wish he would do more overdubbing, though. This album was really a gas with all those different guitar textures. Who knows? — maybe he'll read this and get inspired!

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## ALBUM CREDITS

"Neil Young" (Reprise 6317) stereo original release January 1969 this version re-mixed and re-mastered

"THE EMPEROR OF WYOMING" (Neil Young)
Guitars: Neil Young
Bass: Jim Messina
Drums: George Grantham
Strings: arr. by David Blumberg
Engineering: Mark Richardson and Donn Landee (Sunwest Recording)
Production: David Briggs and Neil Young

"THE LONER" (Neil Young)
Vocals, Guitars, Organ: Neil Young
Bass: Jim Messina
Drums: George Grantham
Strings: arr. by David Blumberg
Engineering: Ami Hadani (T.T.G. Inc.)
Production: David Briggs and Neil Young

"IF I COULD HAVE HER TONIGHT" (Neil Young)
Vocals, Guitars: Neil Young
Clavinet: David Briggs
Bass: Jim Messina
Drums: George Grantham
Engineering: Ami Hadani (T.T.G. Inc.)
Production: David Briggs and Neil Young

"I'VE BEEN WAITING FOR YOU" (Neil Young)
Vocals, Guitars, Pipe Organ: Neil Young
Bass: Jim Messina
Drums: George Grantham
Engineering: Mark Richardson and Donn Landee (Sunwest Recording)
Production: David Briggs and Neil Young

"THE OLD LAUGHING LADY" (Neil Young)
Vocal, Guitar: Neil Young
Electric Pianos: Jack Nitzsche
Bass: Jerry Scheff
Drums: Earl Palmer Sr.
Strings, Reeds: arr. by Jack Nitzsche
Engineering: Mark Richardson and Donn Landee (Sunwest Recording)
Production: Jack Nitzsche, David Briggs, and Neil Young

"STRING QUARTET FROM WHISKEY BOOT HILL" (Jack Nitzsche) *
Strings: arr. by Jack Nitzsche
Engineering: Dale Batchelor (Sunset Sound Recorders)
Production: Jack Nitzsche, David Briggs, and Neil Young

"HERE WE ARE IN THE YEARS" (Neil Young)
Vocals, Guitars: Neil Young
Piano: Don Randi
Synthesizer: Paul Beaver
Bass: Jim Messina
Drums: George Grantham
Strings: arr. by David Blumberg
Engineering: Mark Richardson and Donn Landee (Sunwest Recording)
Production: David Briggs and Neil Young

"WHAT DID YOU DO TO MY LIFE?" (Neil Young)
Vocals, Guitars: Neil Young
Clavinet: David Briggs
Bass: Jim Messina
Drums: George Grantham
Engineering: Rick Pekkonen and Henry Sakowski (Wally Heider Recording)
Production: David Briggs and Neil Young

"I'VE LOVED HER SO LONG" (Neil Young)
Vocal: Neil Young
Electric Piano: Jack Nitzsche
Bass: Jerry Scheff
Drums: Earl Palmer Sr.
Strings, Reeds: arr. by Ry Cooder
Engineering: Mark Richardson and Donn Landee (Sunwest Recording)
Production: Jack Nitzsche, David Briggs, and Neil Young

"THE LAST TRIP TO TULSA" (Neil Young *
Vocal, Guitar: Neil Young
Engineering: Rick Pekkonen and Henry Sakowski (Wally Heider Recording)
Production: David Briggs and Neil Young

(* not discussed in this article)

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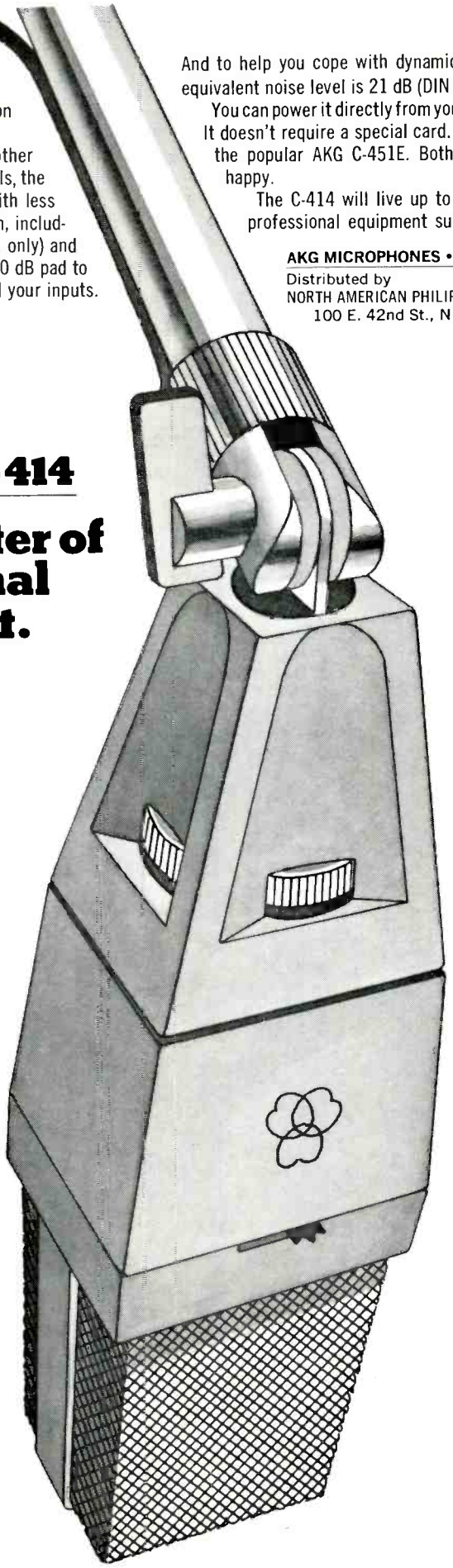



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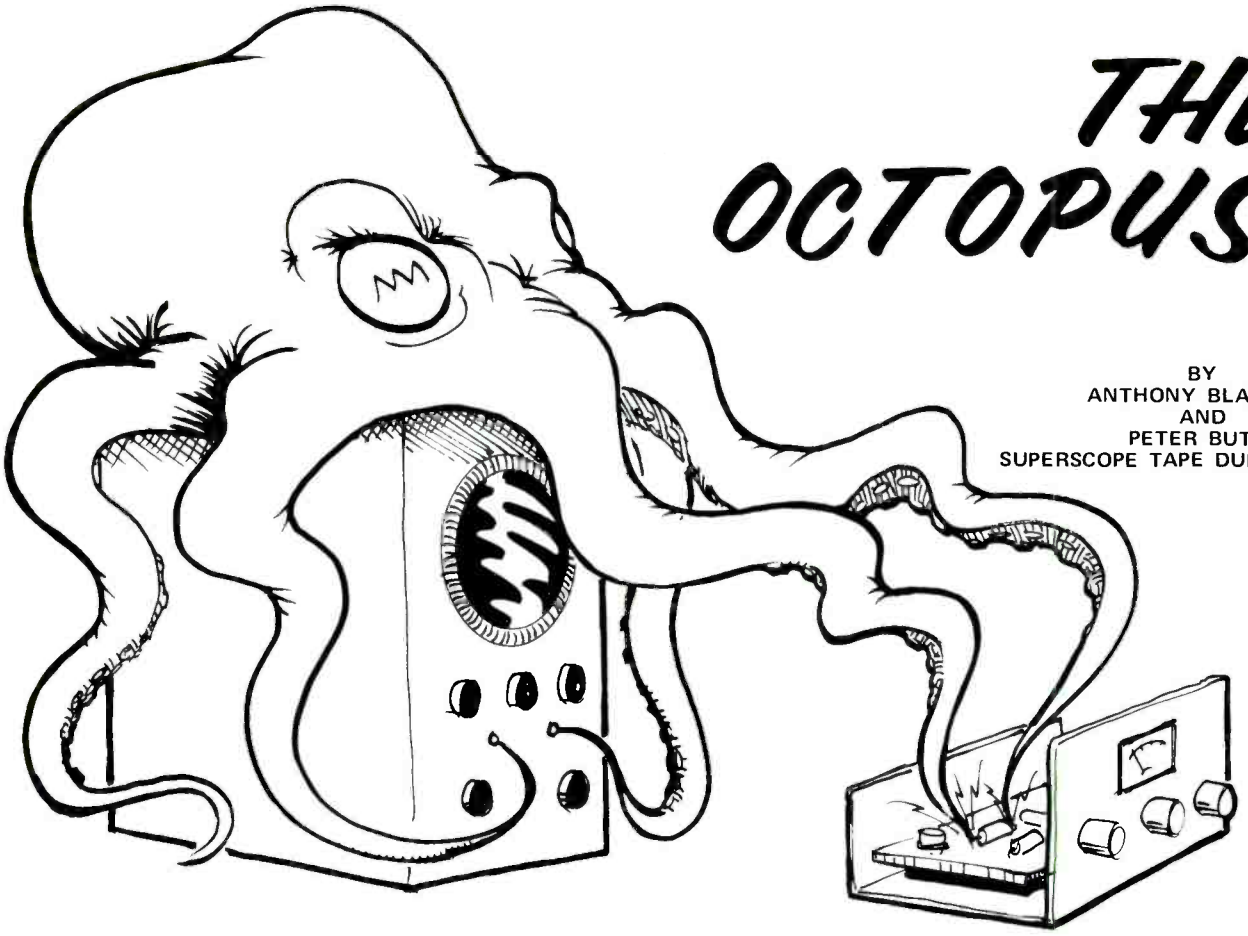
# THE OCTOPUS

BY
ANTHONY BLAZINA
AND
PETER BUTT
SUPERSCOPE TAPE DUPLICATING DIV.



From time to time, during the course of human events, just about all of us dedicated trouble-shooters are vexed by the problem of repairing solid-state equipment. How nice it would be if all we had to do was insert the offending assembly into a nice, well-designed test station and let Aristotelian Logic take its course. Alas, none of us ever has time or inclination to construct a complete set of testing devices for each of the miriad of circuit cards that make modern audio possible. At the times when the need for such luxuries makes itself most painfully apparent, nothing can be done to ease the twinge of good intentions lain fallow.

Over the last year or so, we've been using a dirty little box that permits direct A/B comparison between known functional circuit components and suspected faulty ones. Of uncertain and musty lineage, this little foundling was introduced to us as "The Octopus." It works in conjunction with any oscilloscope capable of Lissajous pattern display and having fairly high-impedance horizontal and vertical inputs. The basic circuit for the Octopus is shown in Figure 1. It's easy to build. Consisting of junk-box parts that just about everyone has lying around waiting for the Saviour to make His encore appearance, the cost is just about zero. We have had much success using the beast in its Figure 1 form and can recommend it highly to a candid world.

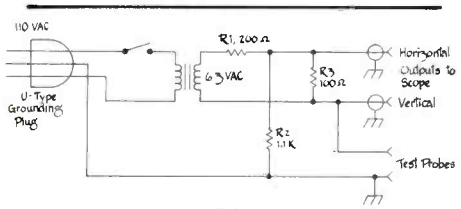



Figure 1 OCTOPUS

In theory, the Octopus represents a descent to technological pragmatism personified. It's just a 6 Volt 60Hz generator whose output can be shifted between the scope vertical and horizontal inputs by the conditions of circuit continuity, or lack thereof, between the test probes indicated at the bottom of the drawing. An open circuit is indicated by a straight, vertical line on the oscilloscope screen. Touching the probes together produces a short circuit and this is indicated by a straight horizontal line. In the case of a scope which deflects upward and to the right in response to positive inputs, a resistance between the probes would appear as a straight line whose negative slope is proportional to the probe resistance.

Not impressed, you say. It's not a big improvement over the time-honored battery and buzzer and there's no indication of resistance magnitude as easily readable as in the case of everyone's friend, the V O M. Well, yeah. To the man who doesn't already own one of these gizzies, it looks like we don't have a whole lot to brag about. But press on, gentle reader, and your persistance will be rewarded.

Being possessed of inquiring minds, let us insert a capacitance between our magical probes and turn our attention, once again, to the oscilloscope screen. We have an elipse with a vertical major axis. The magnitude of the minor axis is directly proportional to the magnitude of the capacitance in question. It seems that a circular pattern is achieved when the probe reactance equals the combined value or resistors R1 and R3, at the 60Hz power line frequency. Not bad, eh?

Stretching our fronteirs of knowledge still further, we shall now turn to the ubiquitous P-N junction as an object of emperical analysis. Placing a silicon rectifier between our probes, we observe that the scope shows us our familiar line, but with a 90-degree bend in the middle. Which way the bend goes as well as which half does the bending depends on the polarity of the rectifier with respect to the probes, of course.

We now repeat the experiment with a zener diode whose zener voltage is less than the peak value of our generator voltage (8 or 9 volts in our case). The foreward resistance of the zener can be

clearly seen and the sharpness and flatness of its zener characteristic can be inferred from the scope trace.

As most of us will likely recall, rectifiers aren't the only devices in Creation possessing P-N junctions. There are also a bunch of others, commonly known as transistors. Their P-N junctions can be checked in-circuit, it turns out, by merely touching the Octopus probes to the transistor leads. One probe to the base and the other to the collector and emitter, in turn, gives us a fair idea of how those respective junctions faired, whatever misfortunes may have befallen them. As our piece de resistance, we shall check for emitter-collector breakdown by probing those respective terminals. With any kind of luck, we should see a straight vertical line if the transistor is in good shape and some other kind of pattern if it isn't. How 'bout that?

Well, you say you want more for your money. You say you're not satisfied? Just step a little closer, friends. We have depicted in Figure 2 an Octopus upon which all the power of Darwinian influences have been unleashed. The casual observor will note the addition of several components. The new, improved version also sports a set of resistor values about an order of magnitude greater than those of its progenitor. A word of explanation is in order.

First, experience with the Octopus led to the realization of its limitations as originally configured. Most prominent among these is the rather limited range of resistances causing readable trace-slope deflections and secondly, the restriction of test frequency to 60Hz made the readable range of reactances limited. Raising the value of the resistance network provided remedy for the first of these shortcomings. The second found succor in the addition of an audio transformer in such a way as to permit it to be substituted for the 6 Volt 60Hz secondary at will. The transformer chosen, or more correctly, settled for, was a copy of the famous U.T.C. 0-8 plate-to-line transformer, driven backwards. The 0-8 permits an external variable frequency oscillator signal to be introduced into the network for the purpose of checking response of circuit components at frequencies other than 60Hz. The zener diodes in the secondary of the 0-8 are there to limit the absolute magnitude of the secondary voltage to about 10 or 11 Volts to avoid risk of damage to base-emitter junctions whose maximum reverse ratings seldom exceed 5 or 6 Volts absolute. The zeners settled for in our case are 1N3021B's.

As far as drive requirements of the circuit go, any oscillator capable of 1.5 Volts or more into a 600 Ohm load will likely suffice. Need we mention that a sinusoid is to be preferred.

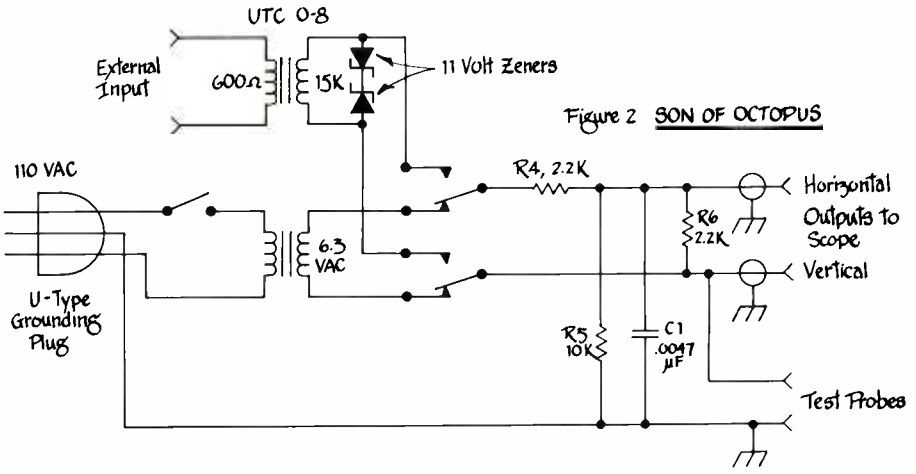



Figure 2 SON OF OCTOPUS

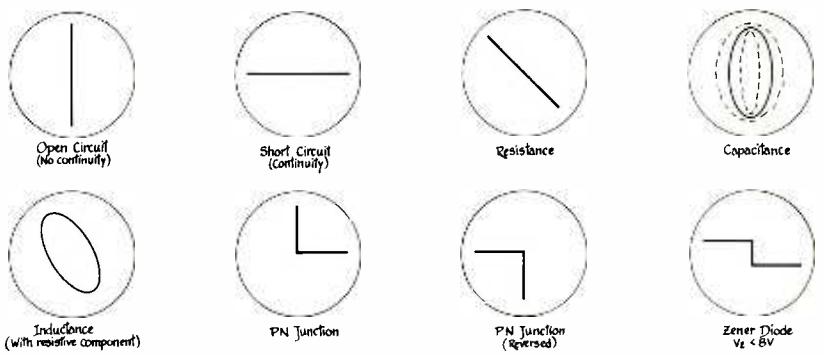



Figure 3 OCTOPUS 'SCOPE TRACES

The nit-pickers among us will perhaps question the presence of C1 in the second generation circuit. Then again, they may not. However, the rationale behind it is to compensate for stray capacitance over the 20kHz frequency range of the circuit. If you don't put something like that in there, your shorts and opens show up as elipses and are easily confused with reactances.

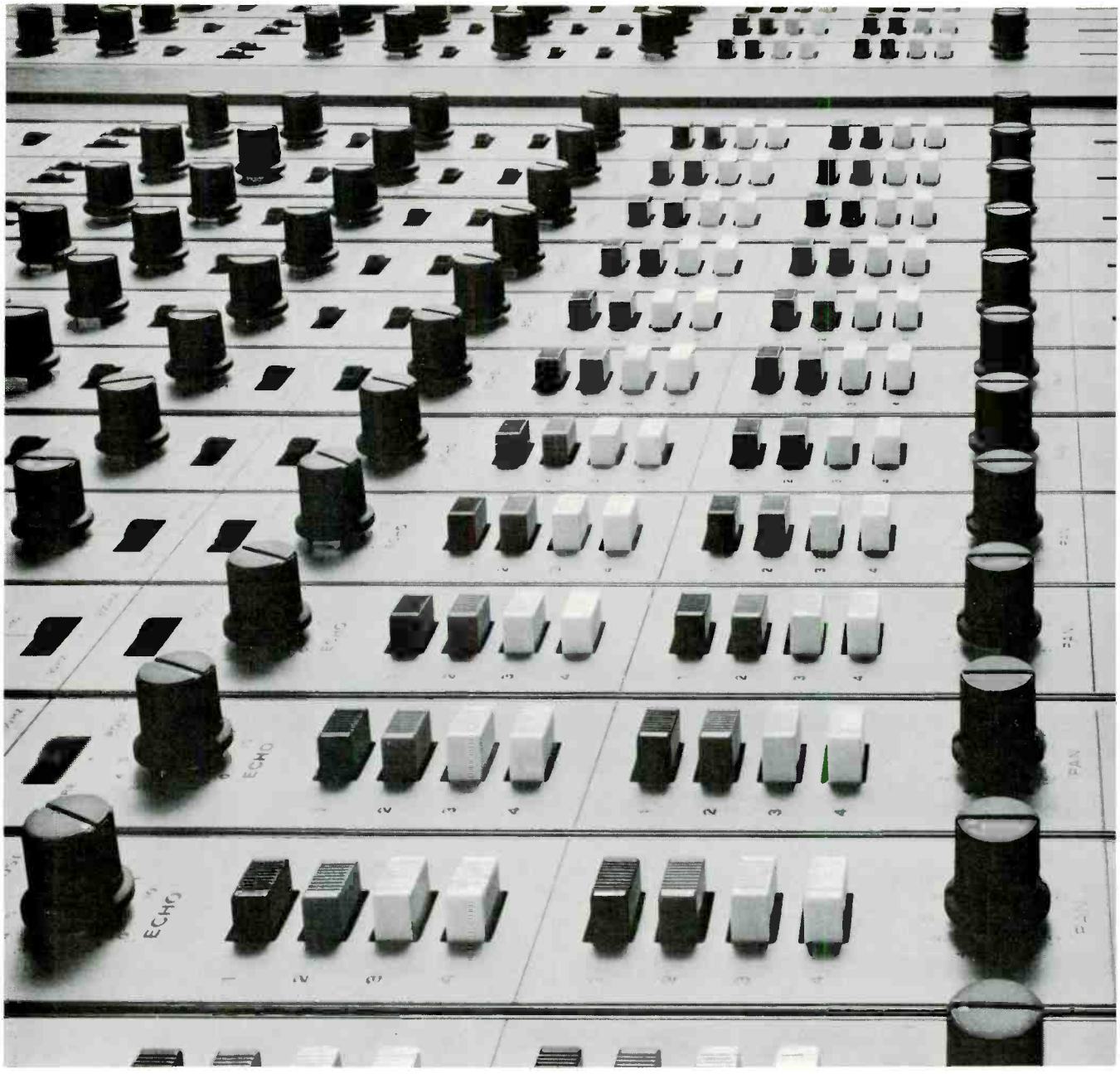
"Enough of this palaver," the critical reader may say. "How do I use this jewel to sniff out smokey transistors and the like in my mundane, day-to-day conflict with the relentless forces of a hostile universe?" A question well put, critical reader. One to which this article was duly dedicated.

In this world of multi-track consoles and tape machines, of quadrophonic and stereo sound, it is a rare sound facility that possesses only one of a given kind of audio circuitry. In view of this fact, and the rather low probability of all representatives of a given species of circuitry failing in an identical manner, simultaneously, it can be seen that those circuit failures will very likely be unique at any given point in time. Therefore, the Octopus and scope combination can be used to directly check and compare the malfunctioning circuit board against a specimen known to be functioning properly in a direct A/B manner. All this is possible without the need to resort to external power supplies, extender cards, or proper loads or stimuli. The variable frequency capability of the later-generation Octopus make it possible to troubleshoot circuitry as complex as the Dolby Cat. No. 22 processor board that is difficult to assess, even with an extender board and world enough and time. The whole process can be completed in minutes even for a very complicated board, and suspect components can be marked for replacement or closer scrutiny.

Although not easily recognizable to a casual observor, a major *McLUHANesque* side-effect of this little boon to mankind is its ability to preserve the wide-spread human capacity for ignorance. Clearly, any soul gifted with the sight in one eye and a couple of functional digits can isolate faulty components given only a good circuit board for A-B comparison. Theoretical insight is strictly not a prerequisite to successful fault isolation. Imagine, then, the power of this device in the hands of the knowledgable.

Lest even the critical reader be misled, our purpose here is not to offer a substitute for the American preoccupations with sexual intercourse (slightly ahead of baseball) and beer consumption, but to merely render those ideals a bit more accessable to realization on a wide scale by relieving the average transistor snatcher of some of his or her more worldly cares.

In closing, we would like to acknowledge the suggestions and comments regarding this article given by Jack Williams of Pacific Recorders and Engineering Corporation, San Diego.

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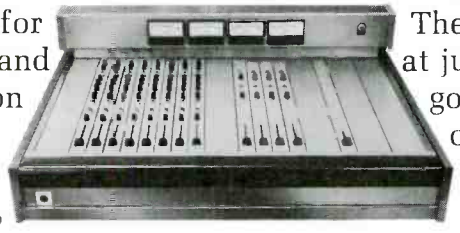

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# TYCOBRAHE Sound Co.

# AND

# 'THE CALIFORNIA JAM'

BY WAYNE YENTIS

Shortly after one o'clock in the morning on April 6, 1974 young people from throughout the West started snaking through the gates of the Ontario Motor Speedway in Ontario, California. By two A.M. over 15,000 people were bedding down on the grassy infield and at sunrise the crowd was well over 150,000. At ten A.M. over 200,000 rock fans began shouting their approval as Rare Earth opened THE CALIFORNIA JAM, a twelve hour rock concert produced by the American Broadcasting Company and Pacific Presentations. In a motel a mile away seven other groups were standing by to be flown by helicopter into the backstage compound at the speedway. They had come from around the world.

Months of careful planning had proceeded the Jam and the on-site construction and installation was started weeks in advance. Miles of chain link fence had been installed. Thousands of drinking fountains and portable toilets were in place. A 45-bed hospital had been constructed in the infield. A six hundred foot length of railroad track was laid across the front of the staging area. Dubbed, "The Grand Funk Railroad," the track supported three moveable stages constructed on railroad tracks. One stage was to be permanently set for the closing act, Emerson, Lake and Palmer. The other groups would alternate between the remaining two stages. While one act performed equipment would be set up and checked out on the remaining stage for the following group. The plan was to cut the set-up time between acts to almost nothing.

The concert was to be recorded for commercial album release and videotaped by ABC-TV as material for future "In Concert" programs. To knit the entire project together the producers needed a sound reinforcement company with the know-how and equipment to saturate the broad expanse of infield, provide two channel monitor to the stages and feed signal to the recording vans (Wally Heider Recording) and the television audio trucks. They called in TYCOBRAHE SOUND COMPANY of Hermosa Beach, California. Tycobrahe had provided both equipment and technicians for most of the groups on previous tours and had developed a very sizeable inventory of high power sound reinforcement gear.

In the early stages the Jam producers were estimating an attendance of approximately 60,000, and the initial objective was to provide coverage only to a distance of 1,000 feet from the stage.

One of the first factors considered was the placement of the staging area within the infield to take advantage of the prevailing winds. The stage was set on the western quadrant of the field so the prevailing westerly winds would carry the sound eastward across the audience area. "We were lucky," said Jim Gamble, Tycobrahe Vice President and Director of Engineering, "The wind blew just the way it was supposed to all day long. If it didn't, there would be nothing we could have done to compensate . . . nothing."

The amount of power required to cover the area to the 1,000 foot perimeter was swiftly determined. According to the company's V.P. and Director of Marketing, Ralph Morris, "We rate our standard arena system as adequate for 10,000 people in an outdoor situation. That's a 6,000 watt system. We use that formula and add in multiples thereof. Of course, it's only a rule of thumb because the sound doesn't just go out so far and then stop. But the formula works."

Some days before the concert it became apparent that the attendance would almost certainly surpass the 200,000 mark and appropriately the capability of the reinforcement system was upgraded. An additional array of speakers was added on towers at the 1,000 foot mark. These speakers were faced outward and fed through an 859 millisecond delay.

All the basic hardware used by Tycobrahe was designed and built by them and carries their brand name. The company began manufacturing its own equipment when it recognized the need for a specialized sound reinforcing mixer. The specifications established by their engineering team called for a mixer that was simple and straightforward, highly ruggedized and portable.

The Tycobrahe Model MX24-4 input mixer has stereo main and monitor outputs, with separate panpots on each input. It was designed solely for sound reinforcement and can accommodate the "screaming microphone levels which would clip the inputs on most studio consoles." Each input has 3 band equalizers with 3 selectable frequencies in each band. There is no EQ on the outputs so that inexperienced, or overzealous mixers cannot get into too much trouble with a single EQ control. Overall EQ is available for the monitor mix, but those controls are included in the monitor power amp circuitry. Dual band limiters are in the outputs of the mixer which limits about a half a dB from the clipping point of the power amps. They are similar to Altec dual band limiters, with a crossover frequency of 250 Hz. 250 was chosen because that frequency is just about the dividing point between vocals and bass. Dual band limiting is necessary, according to chief engineer Jim Gamble, to

*view from the mixing tower . . .*
*looking toward the stage . . .*

prevent pumping the midrange and highs during those very heavy bass parts.

The amplifiers used at the Jam were also Tycobrahe products, their 2,000 Watt BFA 2000 bi-amplifiers. Like the mixers, the amplifiers were designed specifically for location sound reinforcement applications. The low frequency section of the amp delivers 1,500 Watts, and the high frequency channel delivers 500 Watts. The crossover frequency is at 800 Hz. The units are packaged in a rugged portable case, and are mounted in drawers for easy access. The electronics for both amps are mounted on a single, fan cooled, heat sink which can be unplugged and instantly replaced in case of failure. The raw power supply transformer, rectifier and filter capacitors are mounted separately in the drawer, although the voltage regulators are mounted on the heat sink assembly.

According to Gamble, "Each of the amplifiers has its own voltage regulator, although they are fed from a common raw supply. This is necessary because of the very heavy power demands, especially from the bass amplifiers. Often the demands are so heavy that the AC supply for the entire concert site fluctuates up and down with the music, dropping from 120 volts to as low as 90 volts. We feed the voltage regulators from a $\pm$ 75 VDC raw supply and regulate down to $\pm$ 55 volts. This allows for nearly a 30% reduction of input voltage before the amplifiers will fall out of regulation.

The monitor amps are packaged similarly; the electronics are mounted on a replaceable fan cooled heat sink, installed in a separate drawer in the same cabinet with the bi-amp unit. A six band graphic equalizer is included for the monitor amps to counter feedback problems that arise on stage due to the proximity of the monitor speakers.

The Tycobrahe loudspeaker units are the result of several years of research. In explaining the reasons behind selecting the elements of the Tycobrahe system, Gamble says, "bass horns are the most efficient, but there is a tendency to produce peaks and nodes as you walk across in front of the speakers, differences in levels of as much as 10 dB. The infinite baffle, is of course, the flattest, but it is really inefficient. The bass reflex has the next flattest response, and is more efficient. If you stack a lot of them together in the right configuration to get good bass coupling, you get a very flat response without those peaks and nodes, as you move through the audience. That is why we use, mainly, the bass reflex enclosure. We have tried all sizes from 7 to 30 cubic feet and there was a point where more cabinet volume didn't make any difference. That was around 10 cubic feet. Our enclosures are 10½ cubic feet and have 2 JBL 2220A's, a 2482 driver with midrange horn and 2 075's tweeters in them."

To support the speaker arrays and amplifiers two, fifty-four foot, six level towers were installed, one on each side of the stage. The first level was a utilitarian platform left empty. On the second level of each tower were two eight foot bass horns driven by 18-inch woofers. Seven smaller rear loaded horns were mounted on the third level. The upper three sections of each tower supported fifty Tycobrahe bass reflex cabinets. Care was taken to construct the towers and mount the loudspeakers so the speaker elements were directly over each other in a vertical line to keep the system in phase.

Following a standard company procedure, speaker lines are run individually to each woofer in the bass reflex enclosures because, as Jim Gamble pointed out, "If you put the two woofers in parallel across one line, there's a chance that they won't react exactly the same and you get a reflected impedence back across the speaker lines. Also, two speakers in parallel present twice as much of a load in series with the speaker cables. Any resistance in the cables will then become twice as significant and more power will be dissipated in the cables. It's a matter of maintaining as much efficiency in power transmission as possible.

Gamble went on to talk to R-e/p about the sound dispersion: "A lot of people told us our bass was going to roll off. They said we were just going to have a hell of a time getting bass way out there. I said that's just not true. The air disperses high end, not low end. And I was right. We found we had to really crank up the high end to get the tweeters out over that broad an area. We had about 225 tweeters in the system but what was really predominant was the bass. It was solid and it sounded good.

"If you put enough speakers together you get a big, wide plane to project off of and that acts as a huge coupling board and that's what we were depending on – that coupling. With that much coupling you can really project it out there. A lot of people say if you don't have a horn you can't get the bass out there. Well, that's not true. We even found that the horns we did use contributed very little to the bass level."

"The system developed 54,000 watts RMS and we measured 105 dB SPL at a point one mile distant from the stage. At the mixing tower we measured 120 – 126 dB, and that was about 160 feet from the stage. We were originally told to put the mixing towers up 50 feet from the stage, but no way were we going to be that close."

The amplifiers were installed on the towers with standby units in place and a compliment of spare components handy. Each bank of amplifiers was manned by a technician who monitored the meters and was ready to exchange any amps that failed. A complete lab and repair station in a Tycobrahe van was located in the backstage compound.

Two Tycobrahe mixers fed the main system. They were installed on a tower in the audience area 160 feet from the stage. The cabling between the mixing tower and the amplifiers was redundant. A spare line was available to each tower and the tower technicians had the ability to switch lines instantly in the event of a failure by using specially constructed switchboxes.

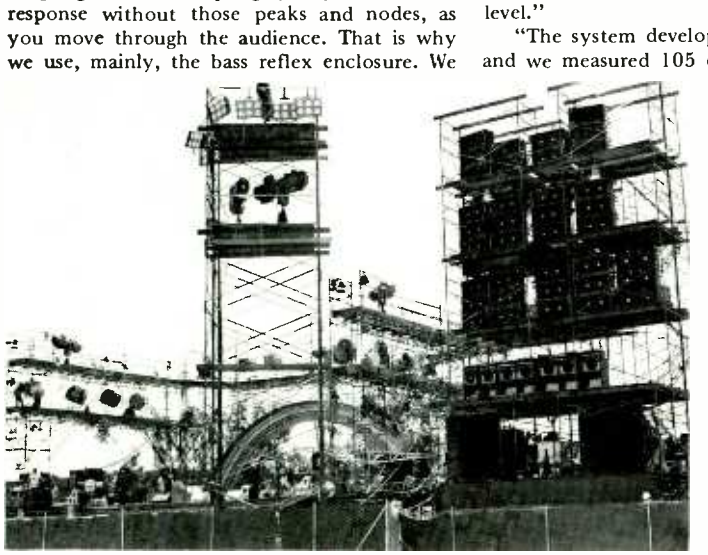
One main system mixer was assigned to each of the two stages for which Tycobrahe was responsible. (The Emerson, Lake and Palmer set-up on the third stage was mixed by their own personnel.)

Two additional MX24-4 mixers were used to feed the on-stage monitor systems. One was installed on each stage behind the acts so the monitor mix was completely independent of the main system feed.

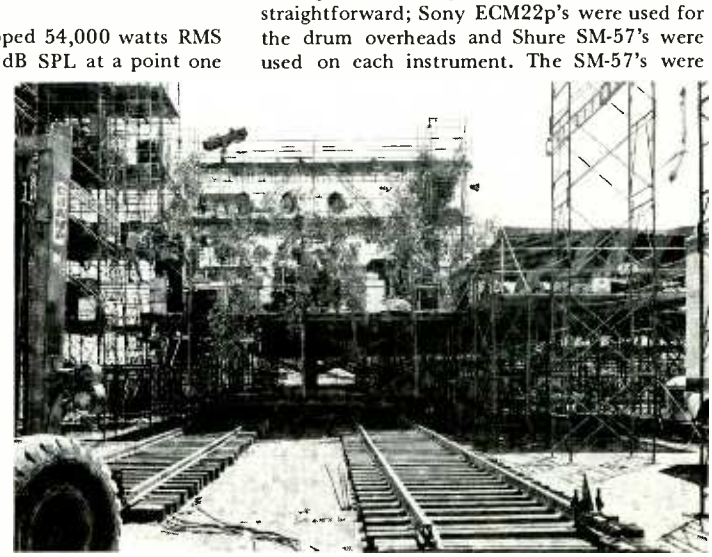
The delay in the system that fed the auxiliary speakers at the 1,000 foot distance was accomplished by using tape delay recorders augmented by an Eventide Clockwork digital delay unit. It was found, however, that the delay system and auxiliary speakers were not necessary. The primary on-stage amplifier-speaker array was sufficient to cover the entire area. Although the delay arrangement was stipulated in the contractual arrangements if the attendance estimates approached the 200,000 mark, the Tycobrahe people were confident that the on-stage system was adequate and the company is philosophically opposed to delay.

The effectiveness of the reinforcement system was checked prior to the Jam by simply driving to all points in the infield while recorded music was fed through the system.

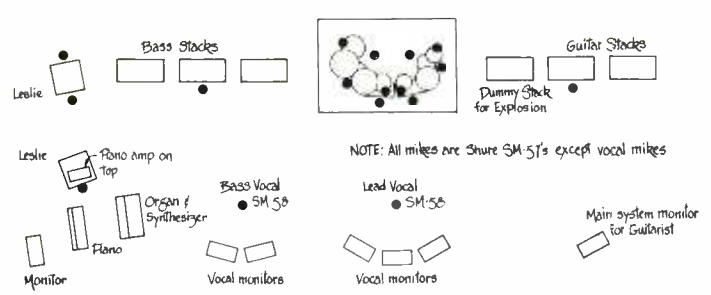
A three-man Tycobrahe crew was assigned to each of the two stages for set-up and miking. The microphone selection was very straightforward; Sony ECM22p's were used for the drum overheads and Shure SM-57's were used on each instrument. The SM-57's were



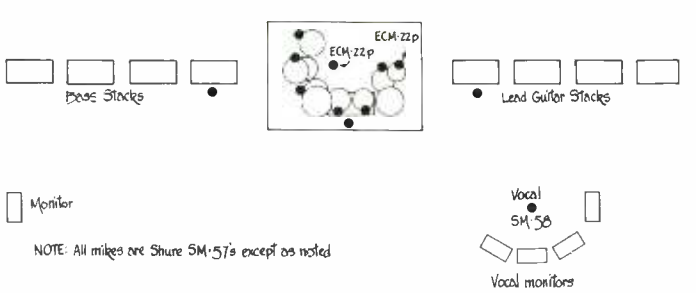
*detailed view of one (right) of the main speaker towers . . .*



*"The Grand Funk Railroad" . . . side view of the moveable stages . . .*




STAGE SETUP FOR DEEP PURPLE




STAGE SETUP FOR BLACK SABBATH

chosen because, according to Jim Chase, Tycobrahe's director of operations, "You have to use a real close-pattern cardioid dynamic microphone on any instrument that is going to be put through the monitor system. Other people use a lot of wide-pattern stuff, even good cardioid patterns, but not good enough. There's only one mike that works for us and that's a Shure SM-57."

Everything on stage was miked except the bass, which was also taken direct, so as to deliver through the system the distortion and other effects created in the guitar amplifiers. As Chase points out, "We don't much get into studio techniques in terms of miking or direct instrument feeds. The groups are looking for a sound and they want to be in control of that sound. They don't want us to color it or change it. We'd make it clean if we had our choice. If we were to take the instruments direct we wouldn't get the musician's tube amplifier mushing and his power supply saturating and the speakers moving to maximum excursion, and all the other things that create the particular noises that you can get out of a guitar amplifier. The talent wants that and they want us to simply reinforce it."

At the Jam the signal from each mike on stage had to feed four separate and distinctly different entities; the main Tycobrahe sound system, the Tycobrahe monitor system, the Wally Heider 24-track recording vans and the ABC-TV videotape trucks. Two vans were used by Heider, one for each stage, and it was determined that the Heider mixers would feed the signal to the ABC-TV mix. From the early planning stages the interfacing of the four systems was considered one of the primary potential trouble areas. As Ralph Morris stated it, "The equipment was all different and the concepts were all different. And, of course, each group of engineers had different points of view. We anticipated ground problems as with any interconnected system so we left plenty of time to work them out. Sure enough, when we plugged it all in, it *hummed*!"

In considering how to isolate the various signal feeds from each microphone any resistive method was quickly discarded because of the substantial gain loss that would occur. Instead, each microphone fed a separate four-winding transformer. The transformers were special-ordered from Sescom and mounted in boxes with ground-release switches.

The installation of equipment began on the Tuesday before the Jam with Wednesday and Thursday devoted to the set-up of speakers and electronic hardware and the check-out of each individual system. On Friday morning the main system, monitor system, recording and TV systems were interconnected for the first time. It was then a question of methodically going through the systems and eliminating the ground loops. Ralph Morris told the story of one potential trouble area:

"At one point we found we were still picking up an additional ground on some channels which was then not an overall problem. So we started going through them and found one connector with the shell wired to ground. Some manufacturers make them that way and they have to be disconnected. At that time our chief engineer said, 'Oh, my God, we're going to have to go through 180 connectors and clip the grounds on all the shell connections!' But most professional audio engineers will remove the case ground if they use that brand of connector so as it turned out, that was the only connector in the system that was causing the problem.

"Our MX24-4 mixers are wired with all internal grounds returned directly to the center tap of the power supply secondary. If a mike cable with the connector shell wired to the shield is plugged in, this creates an exaggerated ground loop and a lot of hum, even if the input is turned down. We did this on purpose so we could instantly recognize an improperly wired cable."

Another interesting point was the special attention paid to the delivery of power to the site. Separate mains were run to accommodate the Tycobrahe equipment and isolate it from the power source feeding the on-stage equipment of the groups. Otherwise, as Jim Gamble pointed out, "We'd have had the whole band playing and sucking up the A.C., especially on the bass notes. The power gets eaten up by the low end instruments. Consequently the AC starts dropping on every low note. It can drop from 120 volts down to as low as 90 volts. Instead of more power when you need it most, we'd get less."

All-in-all the problems involved with bringing 12 hours of an ultra high level of audio entertainment to a potentially volitile audience of over 200,000 supercharged rock fans — seemed to be very few . . . Very few, indeed, as typified by the comparative brevity of what the producers and their sound contractor had to say about *problems*.

Perhaps a statement from one of the producers summed it all up: "We were delighted to do without any *lurid* post concert headlines."

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The JH-110 Series from MCI is designed for greater accessibility, with a pullout rack for the electronics and transport swivels. The quarter– and half-inch recorder has an all-steel cabinet, with casters and handles.

All DC–operated internally, it will operate anywhere in the world, from 100 to 220 volts, or 50 or 60 Hz.

The JH–110 has three speeds (7-1/2, 15, 30 ips) with three-speed reproduce and record equalizers and three-speed bias adjustments. Other features: internally selected CCIR or NAB recording curve; phase-lock capstan servo drive with vari speed and external lockup; constant-tension play and spooling. Convertible from quarter inch to half inch by replacing guides and heads.

**MCI, 4007 N.E. 6th AVENUE, FT. LAUDERDALE, FL. 33308.**

*Circle No. 127*

**FREQUENCY SHIFTER ANNOUNCED BY 360 SYSTEMS**

Designed for studio applications and the professional musician, Model 20/20 Frequency Shifter provides the ability to "tune" instruments either up or down. The Frequency Shifter produces a new family of timbres with overtones unrelated to the original harmonics. Additional effects that may be produced include phasing, vibrato, tremolo, pseudo-stereo and ring modulation.


Model 20/20 Frequency Shifter features response from 20Hz to 20kHz, outstanding suppression of unwanted products, and an additive shift capability from 0.5Hz to 5,000Hz. Upper and lower sidebands are available simultaneously at both line level (with tip-ring-sleeve jacks) and at "guitar amp" levels. Complete specifications are available from the manufacturer.

Price: $495.00

**360 SYSTEMS, 2825 HYANS STREET, LOS ANGELES, CA 90026**

*Circle No. 128*

**SHURE ADDS VOICE–ACTIVATED GAIN CONTROLLER TO CIRCUITRY LINE**

This new unit, from Shure, called the Model M625 Voicegate, is a voice-activated microphone gain controller with a response-shaped "voice-frequency" sensor.

Functioning between the microphone and the mixer, the Voicegate attenuates the microphone output signal by approximately 16 dB – until the microphone is excited by a voice. The Voicegate then removes the attenuation almost instantaneously, allowing the unattenuated microphone signals to enter the mixer. Thus, it allows all microphones in a multi-microphone installation to be "on" when required – without ambient noise pickup, without feedback danger, and without the need for a sound engineer to monitor and control microphone gain.


The Voicegate is designed especially for improving the combined output from sound reinforcement systems employing multiple microphones, particularly when recorders are used in the system. It is also ideal for other applications in which a microphone must be voice-activated, and a high-quality output is required, such as in tape recording, dictation, dispatching, studio control room talk-back, paging systems, and radio and television talk shows.

Important new functional capabilities make the Shure Voicegate superior to conventional voice-operated switches. It is able to: (1) distinguish between human voices and unwanted background noise outside the voice spectrum, (2) depress microphone channel gain below unity as long as the input signal remains below a pre-determined "trigger level," (3) turn "on" virtually instantaneously to capture initial sounds without clicks, pops or switching transients and (4) hold microphone channel gain at unity for any pre-determined period from under 1/2 second to over 30 seconds following the final voice sound.

The Shure Voicegate is available in two models. The Model M625 is AC-powered and can also be powered by a 9– and 30-volt external DC source. The Model M625AM is a "modular" unit which takes its power from the M625. One M625 can power three M625AM units for a total of four gain controllers; the four units can then be mounted in a custom rack panel (available separately as Model A62R) and stacked to match the four inputs of a Shure M67 or M68 Series mixer. Also available separately is a 46cm (18") output cable (Model A53C) which allows fast connection of Voicegates to amplifier, console or mixer inputs.

Professional net price of the Shure Model M625 Voicegate is $120.00; the Model M625AM $97.50.

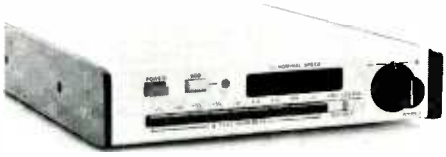
**SHURE BROTHERS INC., 222 HARTREY AVE., EVANSTON, IL. 60204.**

*Circle No. 129*

**AMPEX VS-10 VARIABLE SPEED OSCILLATOR**

Available with a four-digit electronic display for exact speed accuracy, the VS-10 is specifically designed for use with the Ampex MM-1100 and AG-440 Series of capstan servoed professional audio recorder/reproducers.

Charles A. Steinberg, vice president – general manager of the Ampex audio-video systems division, said the VS-10 variable speed oscillator features a range of ±1 full tone in quarter-tone steps and a coarse/fine variable speed adjustment.



"The VS-10 weighs only 2.5 pounds and will drive up to three recorders with unmatched accuracy and resetability," Steinberg said. "It is the most compact, reliable and economical system of speed variation available to users of the Ampex AG-440 and MM-1100 Series recorders.

"The Ampex VS-10 offers the user additional variations in broadcast running time, phasing and delay effects, off-speed

# Series 70 Recorder/Reproducers

# When you've got more talent than money

TASCAM Series 70 recorder/reproducers were designed for people who've outgrown high-end consumer audio products but can't afford full professional studio gear.

Whether you need single, two or four channels, you define the Series 70...it doesn't define you. Your choices are expanded instead of restricted without paying a performance penalty.

The versatile Series 70 electronics come in two versions, one for direct recording and one for use with a mixing console like our Model 10. Either way you'll find uncommon quality and reliability.

Series 70 recorder/reproducers. When you've got more talent than money.

**TASCAM CORPORATION**

5440 McConnell Avenue
Los Angeles, Calif. 90066

*Circle No. 130*

compensation, controlled double tracking and special effects capabilities – all at an economical price."

Both versions of the VS-10 are self-contained, identical in size and may be either rack or shelf mounted. The display module contains its own power supply. The oscillator is powered by the capstan servo of the recorder via a single cable.

The readout display (110/220 vac, 50/60Hz) may be operated either in percent of nominal speed or in frequency (50 to 60Hz center frequency) of the associated recorder. The readout utilizes the servo's crystal reference for control.

Prices are $795 with the optional digital readout display; $395 without.

**AMPEX CORP., 401 BROADWAY, REDWOOD CITY, CA 94063**

*Circle No. 131*

**ALTEC SHOWS NEW DRIVER LOUDSPEAKERS**

According to Mark Engebretson, marketing manager for industrial/professional products, Models 288-8G/288-16G for eight-and-16-ohm use, respectively, replace Altec's model 288; Model 290-4G replaces the 290, providing a minimum impedance of four-ohms and 291-16B replaces model 291 for 16-ohm applications.

Model 288-8G/288-16G is available for full-range sound reproduction in the largest motion picture theatres and auditoriums. They can be employed with Altec multicellular or sectoral horns to provide smooth response from 500 to 15,000Hz.

This driver requires less wattage from the driving amplifiers due to the low mass of the diaphragm/voice coil assembly and the increased size of the magnet structure. This results in response improvements above 10kHz and 2dB greater pressure sensitivity than provided by earlier models.

The 290-4G, another "super" driver from Altec, has exceptionally high power-handling capacity and efficiency. Like its predecessor, the 290, it will be used most often in large outdoor systems ranging from ball parks to race tracks and is ideal for voice warning systems.

Improvements in the top plate and phasing plug designs allow the 190-4G to exhibit a more uniform and extended response characteristic over the 500-7000 Hz band and 2dB greater pressure sensitivity than provided by earlier 290 models.

These drivers feature a weatherproof cover on the rear of the speaker for trouble-free outdoor use.

Altec's 291-16B compression driver loudspeaker is for use in high-level, high quality sound systems. When used with Altec multicellular or sectoral horns, it provides smooth response from 500 to 13,000Hz.

When the 291-16B driver is employed with a matching low-frequency Altec speaker, it provides excellent results for live sound reinforcement and rock music in the largest theatre or auditorium.

Design improvements allow the speaker to produce smoother and extended response over the 8-15kHz band, and 2dB greater pressure sensitivity than provided by earlier models.

**ALTEC CORPORATION, 1515 S. MANCHESTER, ANAHEIM, CA 92803**

*Circle No. 132*

**LOW COST AUDIO FLUTTER METER AVAILABLE FROM 3M COMPANY**

An inexpensive audio flutter meter that complies with the IEEE and DIN recommended standards is now available from 3M Company's Mincom division.

Designed to sell for $395, the Model 8160 is the third in the 3M Brand Industrial Instrumentation line of audio flutter meters.


The unit meets the test standards established by the industry and conforms to the IEEE and DIN standards for pulse response, 3M said.

**3M COMPANY, P.O. BOX 33600, ST. PAUL, MN. 55133,**

*Circle No. 133*

**REVOX 3500 MICROPHONE**

Revox Corporation now have available their new 3500 dynamic unidirectional moving coil microphone. This microphone features wide, flat frequency range, high output and true cardioid characteristics and has been designed for the most exacting use. Its outstanding performance in relation to its small size has been achieved by the development of a specially constructed pressure gradient transducer. Despite the small size of the diaphragm, sensitivity is maintained at a high level by means of a highly efficient magnetic circuit.

The 3500 is ideally suited to recording applications, where good intelligibility and full range ability is required. The unique construction of the 3500 housing reduces handling noise to a minimum and the microphone may be used either stand mounted or handheld. Overall dimensions are 6.3" long by 0.945" diameter.

The 3500 comes complete with colored windshield, clamp, table stand and presentation case; termination is cannon XLR type; impedance: 600 ohms.

Each microphone comes with its own frequency response curv. Frequency response: 40–18000 Hz.

Price: $165.00.

**REVOX CORPORATION, 155 MICHAEL DRIVE, SYOSSET, NY 11791.**

*Circle No. 134*

**UREI BROADCAST LIMITER PREVENTS OVERMODULATION WITHOUT CLIPPING**

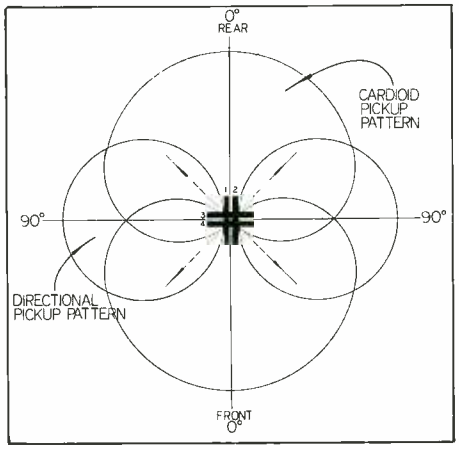
From hard rock to classical, the new UREI Teletronix BL-40 MODULIMITER provides the AM broadcaster with independent adjustment of RMS compression and peak limiting to prevent overmodulation without clipping. It gives continuously variable symmetrical or asymmetrical limiting; constant 95%+ modulation or a more conservative dynamic approach. MODULIMITER maximizes transmitter power and extends coverage.

MODULIMITER uses a patented electro-optical attenuator which offers exceptionally smooth RMS compression characteristics, and a new F.E.T. peak limiting section with instantaneous attack and triggered release to provide

## A QUADRIPHONIC MICROPHONE SYSTEM
for live recording

TECHNICAL APPLICATION MEMO

In June of 1970, when quadriphonic sound was only a minor irritation to the status quo, we took delivery from Countryman Associates of the Q 4. This microphone system was designed primarily for remote location recording, and eliminated the necessity of using four independent mikes, or two stereo ones. The Q 4 accurately reproduces the totality of the environment.




Four precision mike elements are employed in one capsule head. The outputs are combined to generate information from 360 sound sources with no dips. Measured separation between opposite channels is better than 30 db; adjacent channels measure better than 10 db. The Q 4 system emulates the human hearing condition better than any other method of recording the environment.

All sound recorded for The Mystic Moods series on Warner Bros., and future sound tracks for the Reuben H. Fleet Space Theater, San Diego, utilize recordings made with the Q 4 mike system.

The Q 4 is completely compatible with all recording consoles and tape decks. I recommend that the system be employed as a genuine recording/mixing 4-channel aid, rather than as a total substitute for conventional mike placement and multi-channel live recording. The Q 4 system needs to occupy only four of your sixteen or twenty four channels. You mike the date as you normally would, occupying the remaining twelve or twenty channels (tracks).

When the time comes to prepare your quadriphonic master mix, the four tracks that are occupied with the Q 4 system signals, become your mixing guides, your sound foundation. The additional tracks become your sound reinforcement tracks for individual instruments, voices or effects.

Reprints of a technical article from R-e/p are available upon request.

Rental quotations available upon request.

Brad Miller

mobile fidelity
productions, inc.

BOX 2157, OLYMPIC VALLEY, CA. 95730

*Circle No. 135*

protection from overmodulation without clipping or distortion.

Frequency response is ±.25 dB 30 Hz - 15 kHz, ±.5 dB 20-30 Hz and 15-20 kHz. Distortion: less than .5% T.H.D. 30 Hz to 15 kHz. Signal-to-noise ratio is better than 70 dB at threshold or RMS limiting. Attack time: (RMS section), signal dependent, 500 microseconds to 10 milliseconds; (Peak section), less than 5 microseconds for 10 dB limiting. Release time: (RMS section), signal dependent, 50 milliseconds to 2 seconds depending on duration of compression; (Peak section), approximately 100 milliseconds full recovery from 10 dB limiting. Unique release characteristic prevents distortion of low frequencies.

**UREI, 11922 VALERIO ST., NORTH HOLLYWOOD, CA. 91605.**

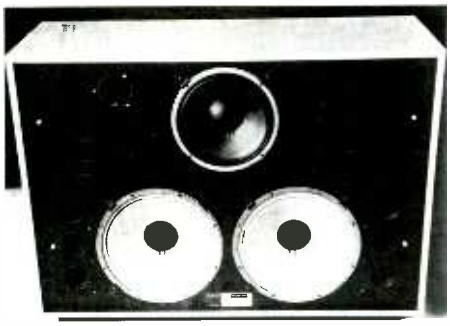
*Circle No. 136*

## JBL INTRODUCES A NEW MONITOR FAMILY

Following within a year of the debut of its 4350 studio monitor, James B. Lansing Sound, Inc., has announced the introduction of three new monitors with virtually the same sound characteristics.

The new products enable JBL to offer a "family" of four monitors which, according to JBL spokesman, provide the most accurate point of subjective reference now available.

"The sound reproduction quality of our new family of monitors is as nearly matched as technology will allow," states William L. Cara, Manager of JBL's Professional Division, adding that the units differ primarily in acoustic output, size and cost.



"The new monitors are an ideal complement to our 4350." Cara Says. "JBL now makes it possible for recording studios and other users of critical sound equipment to have what amounts to a matched set. It is possible to record on one, playback on a second, mix on a third and master on a fourth, in different locations, yet be assured of retaining the same sound quality."

Ranged in order of size, the newest additions to JBL's family are: The 4330/31, a two-way system with a frequency response of from 35 to 15,000 Hz ±3 db. Power output (SPL at 10 ft. in a room volume of 2000 cu. ft. with 1/2 rated power input - 35.7 watts) is 100.5 db. The unit's size is 30" x 24" x 20"; its weight is 96 lbs.

The 4332/33, a three-way version of the 4330/31 introducing into the system, an ultra-high frequency transducer that extends frequency response from 35 to 20,000 Hz ± 3 db. The power output (using the same criteria for the 4330/31) is 101 db. Size is 30" x 24" x 20".

The 4340/41, a four-way system, is a scaled down version of the larger 4350. Frequency response is from 35 to 20,000 Hz ±3 db, and the power output (again, using 4330/31 criteria) is 101 db. Size is 38" x 24" x 20".

The three new monitors are available for bi-amplification with JBL's 5231/32 Electronic Crossover or with high level passive crossover networks. All three monitors are scheduled for full production in June.

**JAMES B. LANSING SOUND, INC., 3249 CASITAS AVE., LOS ANGELES, CA. 90039.**

*Circle No. 137*

## PK14/PK16 PEAK PROGRAM METERS

Quad-Eight Electronics has introduced their all solid-state Peak Program Meters, the PK-14 and PK-16.

Both PPM's give precise visual level indication via sequentially lighted L.E.D. readouts of true signal levels. A 14 or 16 green and red segmented readout will

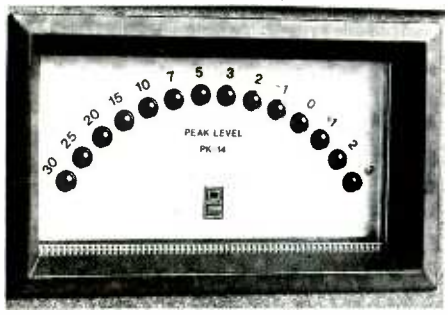
Sphere ELECTRONICS

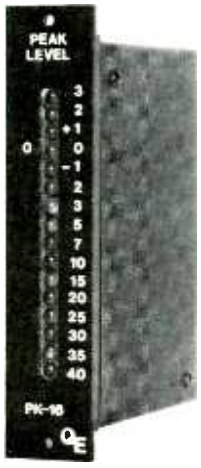
THE CONSOLE COMPANY

Los Angeles (213) 349-4747
(213) 845-9661
Nashville (615) 794-0155

*Circle No. 138*

monitor standard VU or Peak Level program content depending upon the user's preference in selecting its alternate mode operation by a front panel control setting.




Additional features of either meter configuration include: L.E.D. brightness control (light intensity), integration and decay time (fall-back) adjustment, input level scaling, constant current consumption, simple power supply requirements.

Integration time specifications conform to European DIN 45406 for peak reading and USA C16.5 – 1954 for VU characteristics.

The PK-14 arc-scale meter is designed to retrofit into existing 3-1/2" meter installations, while the vertical scale PK-16 will offer new monitoring capabilities in updated or custom designed control consoles.

Intended for use in all phases of record recording, disc cutting and broadcast monitoring, the Quad-Eight Electronics PPM's will allow increases in dynamic range for recording in addition to the benefits of the ergonomic design of L.E.D. indicating meters.

Delivery from stock will be made approximately July 1.

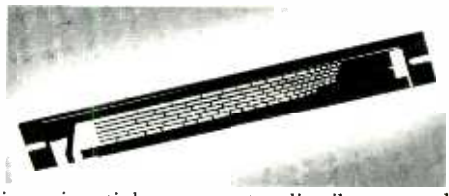
QUAD/EIGHT ELECTRONICS, 11929 VOSE ST., NORTH HOLLYWOOD, CA. 91605.

Circle No. 139

**COMPUTER INSTRUMENTS POTENTIOMETRIC FUNCTION ELEMENTS ANNOUNCED**

A line of infinite resolution, sine-cosine potentiometer element cards for use in quadrasonic panners for studio recording equipment has been developed by Computer Instruments Corporation.

Measuring 2.5" x 1.2" these flat cards contain independent sine and cosine outputs of 0° to 90° over 60° mechanical travel. Three of these cards can be used in a joystick panner to distribute total power input for quadrasonic recording.



Available resistance range is 1K to 50K with useful lifes to 5 million cycles.

Another announced CIC product is a line of audio output taper potentiometer elements for use in audio faders.

Featuring useable outputs to almost 90 dB with collector bars, these elements can be furnished in strokes up to 6"

with terminal resistance of 600 ohms through 10K and accuracies to ± 1 dB.

Infinite resolution and superior output smoothness make these units suitable for high performance studio recording and broadcast equipment.

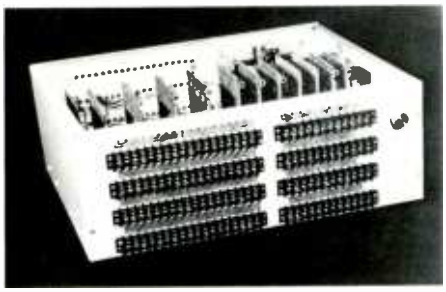
**COMPUTER INSTRUMENTS CORPORATION, 92 MADISON AVE., HEMPSTEAD, NY 11550.**

*Circle No. 143*

## RAMKO SERIES 35 AUDIO CONTROLLER

Ramko Research's new Series 35 Audio Controller introduces a new concept in sound mixing. The Series 35 is designed to allow separation of the control circuitry from the basic audio electronics.

Controls can be placed in any convenient location in the studio, while the electronics are mounted in a rack for easy maintenance. There is no undesired effect on the audio signal by the separation of the audio circuit from the controls.



This versatility gives the user a custom-designed console at a standard production model cost. The Series 35 Audio Controller can be ordered for rack, cabinet or custom applications; with the user's choices of rotary, slide or push-button mixers; for automated or manual mixing; and in any mode.

Features of the Series 35 include 8 channels; mono, dual mono, stereo, dual stereo, or combinations; quadrasonic capability; fail-safe internal power supply; and plug-in interchangeable cards.

Performance specifications for the Series 35 are: 0.1% or less distortion; 126 dBm equivalent noise; 25W power consumption; low crosstalk; balanced bridging/matching inputs; and response within 1/2 dB, 20 Hz to 20 kHz.

**RAMKO RESEARCH, 3516–B LA GRANDE BLVD., SACRAMENTO, CA. 95860.**

*Circle No. 144*

## ACOUSTIC RESPONSE ANALYZER FROM COMMUNICATIONS COMPANY

A new instrument which will convert almost any oscilloscope into a real time audio analyzer, has been introduced by Communications Company, Inc. of San Diego, California. Designated the ARA-412 Audio Response Analyzer, successor to the popular ARA-411, this device covers the audio frequency range from 40 Hz to 16 kHz with 27 parallel bandpass filters. Although it is not an impulse analyzer, it can be used to analyze all types of sound which have a less significant time framework.


The ARA-412 has an input impedance of 100,000 ohms high level and 250 ohms microphone level. It requires power input of 120V ac, 50/60 Hz. The outputs are vertical to 150 Mv dc and horizontal to 500 Mv dc external sweep input to any scope.

Dimensions of the ARA-412 enclosure are: 9" H x 6-3/8" W x 16-1/4" D.

Priced for resale at $1295.00 F.O.B. San Diego, California.

**COMMUNICATIONS COMPANY, INC., 3490 NOELL STREET, SAN DIEGO, CALIFORNIA 92110.**

*Circle No. 145*

## INOVONICS INTRODUCES AUDIO LEVEL OPTIMIZER

Inovonics' Model 220 Audio Level Optimizer provides a substantial increase in average program level without "pumping" or "swishing" noise during pauses in the program.

The Model 220 is an automatic gain control device for AM, FM, and TV broadcasting. It features selectable peak limiting and average compression functions. A frequency selective limiter function is optional.

A unique gating circuit inhibits compression release in the absence of an input signal. This feature permits a high degree of compression without the usual upsurge of background noise experienced

with conventional limiters.

For dealing with extended program interruptions, the user may elect to have the Model 220 hold gain indefinitely at the previously compressed value, hold gain for 10 seconds and release, or hold gain for 10 seconds and fade. Resumption of program restores normal operation.

Controls include Input Gain (Compression), Output Level, Gating Threshold, Peak Limit Release. One function switch controls Gating Off, Hold Gain, Delay and Fade, Delay and Release. A second function switch is used for selecting Power Off, Peak Limit, and Peak Limit and Average Compression.

Panel indicators include Gate Open, Peak Reduction, and Average Level Compression lights as well as a meter that shows compression in dB. A remote-mounted compression meter is optional.

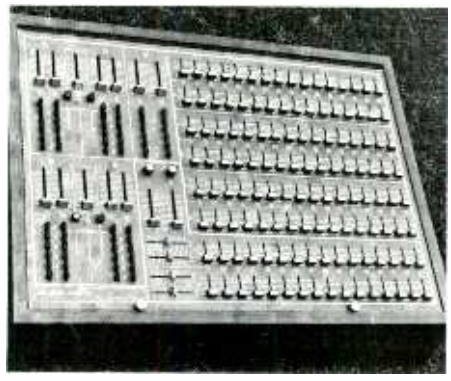
The Audio Level Optimizer is priced at $680.

**INOVONICS INCORPORATED, 1630 DELL AVE., CAMPBELL, CA. 95008.**

*Circle No. 146*

**RICHMOND SOUND DESIGN THEATRICAL CONSOLE**

The Model 816 Theatrical Sound Console is a newly designed stock unit which will fill the sound control requirements for most small — and medium-sized theatres. With a total of 8 inputs and 16 outputs it provides maximum flexibility with minimum control manipulation, coordinating all sound sources and sound outlets, providing complete control of all reproduced sound and music in the theatre or concert hall according to the requirements of the user.



Applications include: Control of sound effect and music playback, live sound reinforcement and distribution, recorded sound and music production.

Features include: AUTO—PAN (TM reg., Pat. Pend.) facilities, with which all volume and speaker changes may be done automatically, with the flip of a switch effectively operating over one hundred controls. Full portability, with all connections made through standard professional audio connectors, allowing complete installation in a matter of minutes. Solid panel of eighth-inch aluminum for absolute rigidity, with all labeling permanently etched on an attractive anodised aluminum skin. Fully shielded cabinet, preventing any external electrical interference from disturbing the normally quiet operation of the unit. Active circuitry on plug in modules employing the highest grade components and plug-in type integrated circuits throughout. Calibrated sliding volume and tone controls.

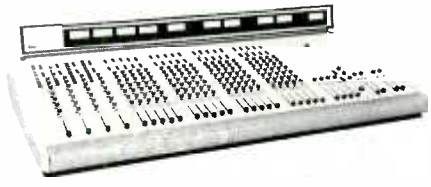
**RICHMOND SOUND DESIGN LTD., P.O. BOX 65507, VANCOUVER, BRITISH COLUMBIA CANADA V5N 5K5**

*Circle No. 147*

**CETEC "LIVE MEDIA" AUDIO CONTROL CONSOLE, SERIES 20 LM.**

Input module functions include; 4 inputs, 4 pre-settable mute controls, phase switching mic and line switches and attenuation, 3-knob EQ, Stereo Pan Pat, all with In-Out switching. Two foldback and an echo send control are provided with in/out switching and pre-post fader select. Conductive plastic slide attenuation, monitor solo function and on/off switch with LED indicator are included.

Stock model includes 16 inputs (expandable to 32 inputs). Quad outputs with a Mono Bus, Stereo Buses, 2 foldback, and 1 echo send bus.



The computer ribbon cable organization of the Series 20 LM permits input and output panels to be located in any board position. The geography of the input and output modules permit the addition of a multitude of options, both stock and custom.

The standard 16 x 4 (with 6 sub-buses) including Bi-Polar power supply is $11,500.00 with a cost of $375.00 for each additional input module.

**CETEC, INC., 13035 SATICOY STREET NO. HOLLYWOOD, CA 91605.**

*Circle No. 148*

**AMPEX "GRAND MASTER" TAPE INTRODUCED**

Ampex Corporation has announced the development of a super-oxide tape

for professional audio mastering studios which, it is said, sets the highest standards in the industry for performance and quality. According to John L. Porter, Vice President — general manager of the Ampex magnetic tape division, this superoxide audio mastering tape achieves the lowest level of distortion, plus the maximum in saturation capacity and output capabilities.

Porter said Ampex Grand Master tape will be a premium priced product, with pricing to be established. It is available in quarter-inch and two-inch configurations.

**AMPEX CORPORATION, 401 BROADWAY, REDWOOD CITY, CA. 94063.**

*Circle No. 154*

## CLASSIFIED ADVERTISING RATES

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One column inch (1" x 2¼") ... $20.00
½ column inch (½" x 2¼") ..... 14.00
*(If billing is required add 20%.)

## SERVICES

**LOCATION RECORDING:** up to 16 tr. 300' mike lines; Video/talkback & Stereo playback systems. Separate Quad wet monitoring w/4310 JBL's. MCI 16 tr or 8 tr; Tascam boards. **CALL: LEE HAZEN, (615) 824-2311, OR WRITE TO RT 2, HENDERSONVILLE, TN. 37075.**

Recording and duplicating services for radio commercials, live recording, on location recording, studio and equipment rentals and demos. **WESTFIELD STUDIOS, 780 WESTFIELD AVE., BRIDGEPORT, CT. 06606, (203) 371-0151.**

## EQUIPMENT

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BOTTOM LINE ORIENTED
**F. T. C. BREWER COMPANY**
P. O. Box 8057, Pensacola, Florida, 32505

SPLICE FASTER, BETTER BY SHEARING REPLACES RAZOR. Has attached splicing tape dispenser. Professional quality. Specify 1/4 inch or cassette groove. Price: $24.95 plus $1.00 for handling. Distributors wanted. Details: NRPR, BOX 289, MCLEAN, VA. 22101

**FOR SALE:** New 14" NAB Ampex aluminum flanges have never been removed from original box. Package of 10 — $8.00 prepaid. **SOUNDD INVESTMENT CO., POB 338, DUNWOODY, GA. 30338.**

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(213) 934-3566

*Circle No. 152*

**MULTI-TRACK**
**8 and 16**
**TRACK RECORDING CONSOLES**
**THE SOUNDEST DOLLAR SPENT IN PRO AUDIO TODAY**
1965 CHEREMOYA AVE.,
HOLLYWOOD, CALIF. 90028
P.O. Box 3187, Hollywood, CA. 90028
(213) 467-7890

*Circle No. 153*

**FOR SALE:** 16 like new ITI Parametric Equalizers, free power supplies & custom formica equipment cabinet with purchase of all sixteen. Also available, one MCI JH-16 16-track recorder with auto-locator, mint condition. **Contact: ALAN KUBICKA, P.O. BOX 556, MEDINAH, IL. 60157, PHONE: (312) 529-1001.**

**WANTED FOR PURCHASE**
8 track recorder in excellent condition. Send photo, description, type electronics and asking price. **WRITE: P. FRANK, 177 RT. 304, NEW CITY, NY 10956, (914) 634-5101 after 8 PM**

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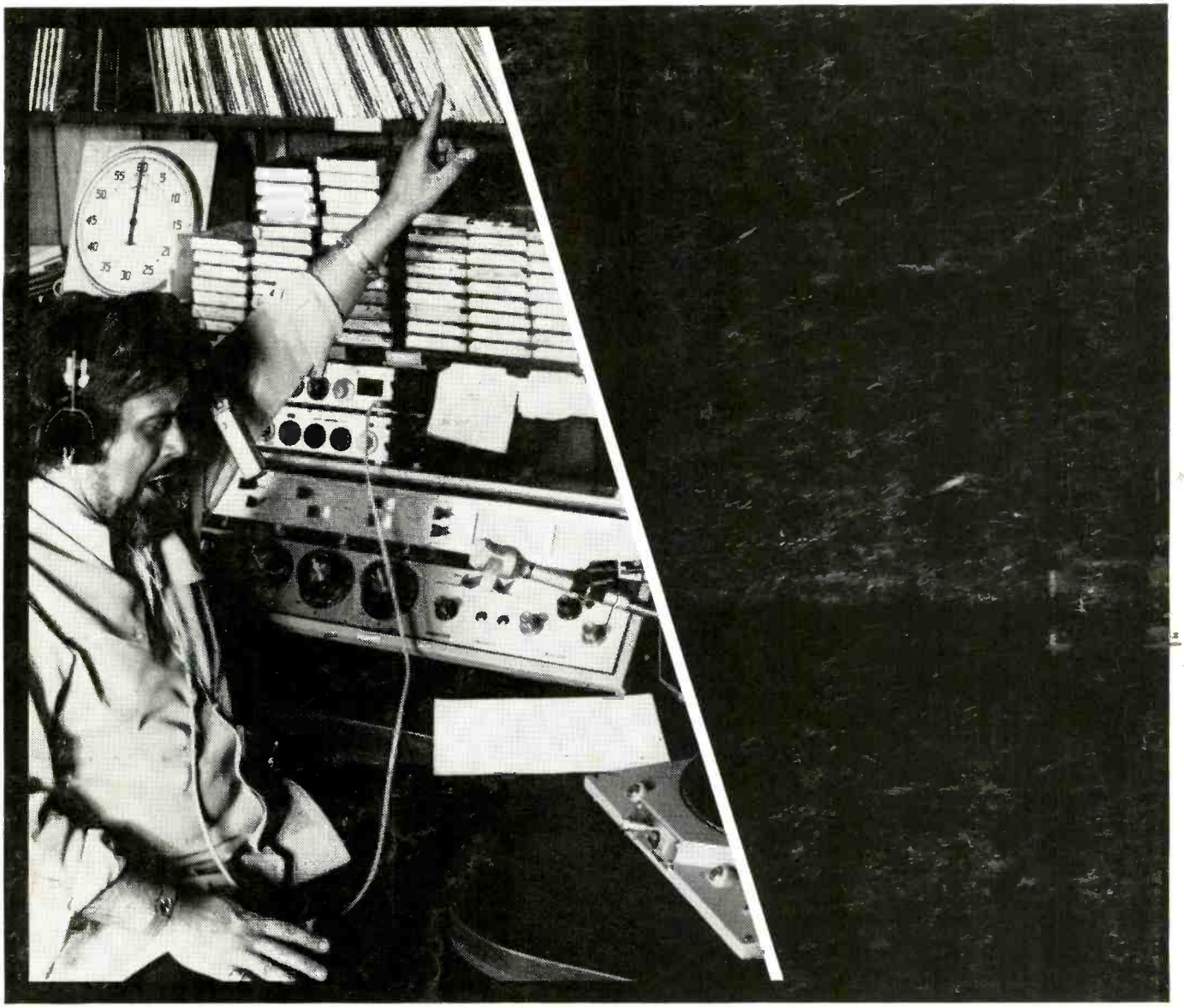

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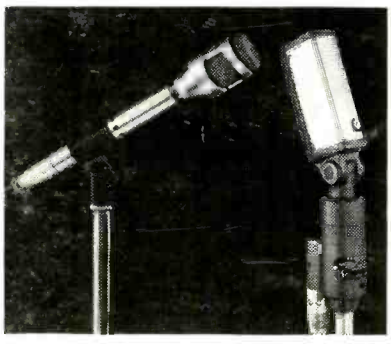

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