THE SOUND ENGINEERING MAGAZINE

MAY 1980
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db

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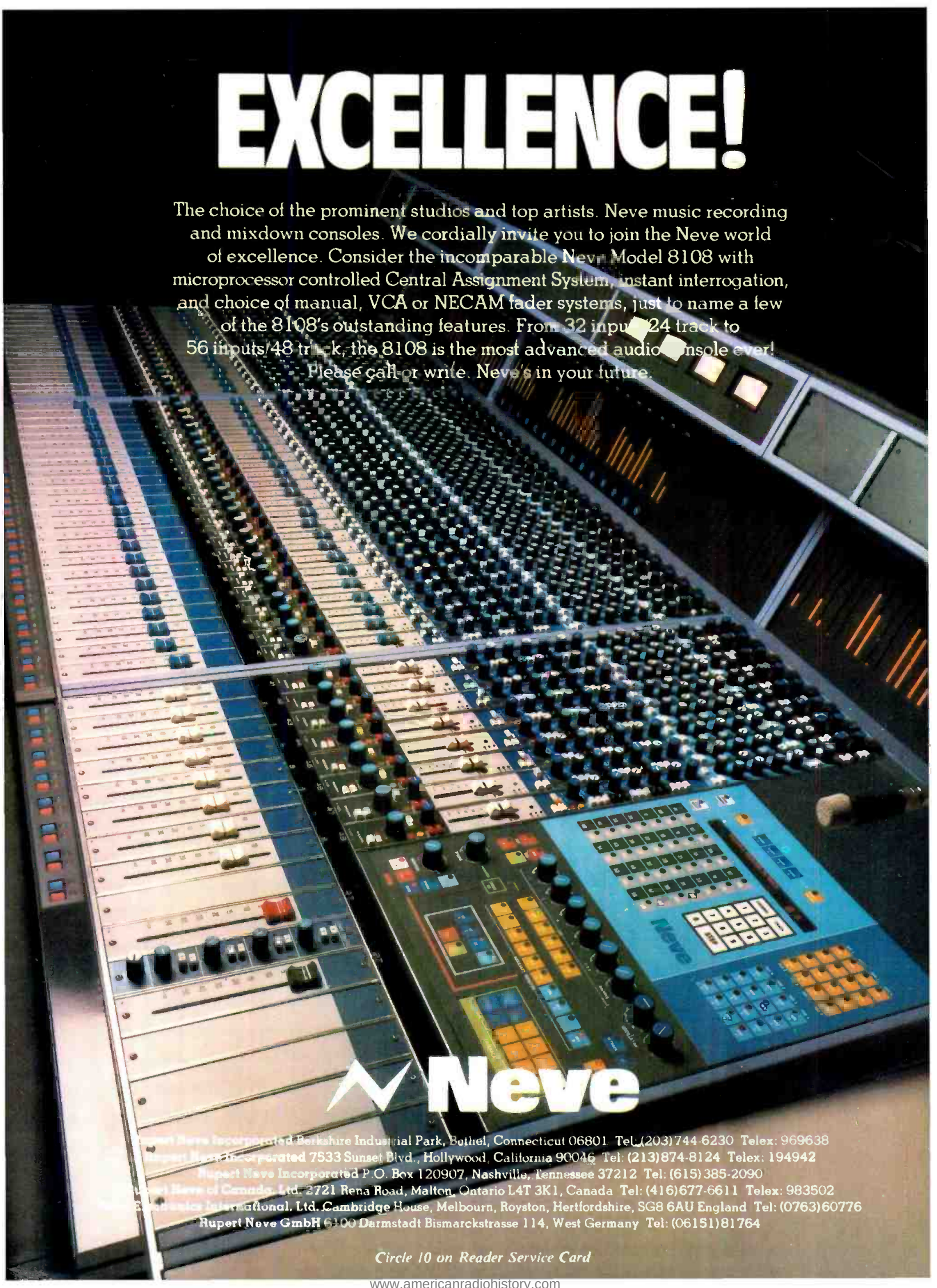

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Coming Next Month

• The June issue of db begins our three-part series on Radio and Recording, with our initial focus on architectural acoustics. Included in this month's features is an article by Don and Carolyn Davis on time, energy, and frequency measurements. Also, Norman Crowhurst continues his discussion on the intracacies of human hearing in "Systems: People and Machines." Be sure to make time for next month's edition of **db—The Sound Engineering Magazine.**

About The Cover

• A view of the Universal Studios Amphitheatre, Universal City, California depicting the stage layout and scenery. For more information see Michael Rettinger's article entitled, "Sound Reinforcement Systems in Amphitheatres" on page 42. And now—sit back, relax and enjoy!

db

THE SOUND ENGINEERING MAGAZINE

MAY 1980 VOLUME 14, NUMBER 5

db is listed in **Current Contents: Engineering and Technology**

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db Letters

TO THE EDITOR:

In response to the letters you have received regarding standards for "XLR" type microphone connectors, the following may be of interest to your readers.

The EIA standard RS-221-A, August 1979, Polarity or Phase of Microphones for Broadcasting, Recording and Sound Reinforcement, was revised to delete the wiring of the "UA" connector and show the "XLR" connector. In brief, this standard calls for:

Out-Of-Phase Terminal	3
In Phase	2
Ground Terminal	1

You will note that pin 1 is always used for the ground connection as the "XLR" female No. 1 socket is designed to mate first, before No. 2 and No. 3 mate. Note, the ground pin on the "UA" connector is marked G and the other pins are 1 and 2.

This standard further states that, "On microphones without a connector, but with a permanently affixed cable, the inphase terminal shall be the red (or other than the black) conductor, the out-of-phase terminal shall be the black conductor." ("Inphase" is the terminal with positive voltage caused by positive pressure on the diaphragm.)

When the work was done on this standard, it was hoped that RS-297B would be completed at about the same time. Hence, the reference to the "connector...in the latest issue of EIA Standard RS-297" was intended to mean the "XLR" in issue B.

The work on Standard RS-297(B), Cable Connectors...,should result in an agreement between the several manufacturers of the 3-pin connectors ("XLR type") so they will be mechanically and electrically interchangeable. The application wiring section will probably be removed and refer back to RS-221 latest issue.

I am happy to report the International Standards, IEC 268-12 and 268-4 agree with the wiring and polarity in EIA RS-221-A.

The IEC Standard 268-12 further describes a 5-pin arrangement for a stereo microphone, with pins 2 and 3 as the left channel, and pins 4 and 5 as the right channel. Pin 1 is the ground, of

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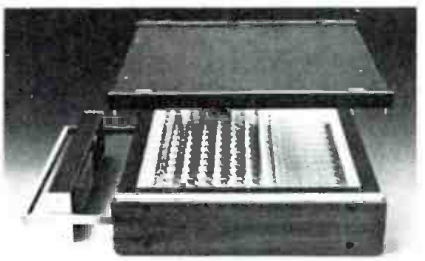

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course. In this arrangement, pins 2 and 4 are the inphase terminals.

In conclusion, to my knowledge, all microphone manufacturers agree with RS-221-A for low-impedance balanced 3-pin ("XLR") microphones with a built-in connector.

Since high-impedance microphones generally use only two of the three pins, one being the ground pin No. 1, they obviously do not fit these standards.

I also want to assure the owners of *all* Shure low-impedance balanced microphones with a built-in 3-pin "XLR" professional audio connector that their microphones are built to agree with the above standards (pin No. 2 is In Phase).

DONALD L. PATTEN
Manager, Engineering Services and Specifications Control
Shure Brothers, Inc.
Evanston, Illinois

TO THE EDITOR:

Although ac bias in tape recording was correctly explained as early as 1944, there is still a classic mis-explanation that has appeared in a number of books and articles, the latest being Dave Rubenstein's article in **db** (October 1979). If one were to believe his FIGURE 5 a doubled-valued magnetization appears on the tape under the guise of "undistorted audio output." Apparently this misconception is copied by one author from another without consulting any of the dozens of published articles which correctly explain this rather interesting phenomenon of anhysteretic magnetization.

I hope that you will set your readers straight on this as soon as possible. I would consider writing an article on this subject if you wish, but there are any number of other engineers and physicists in the field who understand ferromagnetism who could do so, also.

THOMAS ROSSING
Professor of Physics

TO THE EDITOR:

It is with much sadness that I inform you of the death of Ray Ambrose, agency account executive for the Jensen Car Audio Components Group account, and a valued member of our firm.

Effective immediately, Kathy Cap and I will be handling public relations activities on behalf of the Jensen Car Audio Component Group. We look forward to working with you.

JIM MCELVEEN
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db Calendar

MAY

6-7 **B&K Measurement Seminar—Audiometer Calibration.** B&K Instruments, Inc., 5111 W. 164th St., Cleveland, Ohio 44142. Telephone: (216) 267-4800.

6-9 **AES 66th Convention (Los Angeles).** Los Angeles Hilton, Los Angeles, California. For more information contact: Audio Engineering Society, 60 E. 42nd St., Room 449, New York, NY 10017.

13 **Classes in Recording Engineering,** held twice weekly for eight weeks at Oval Productions, 2429 Cheremoya Avenue, Hollywood, California. (213) 465-9456.

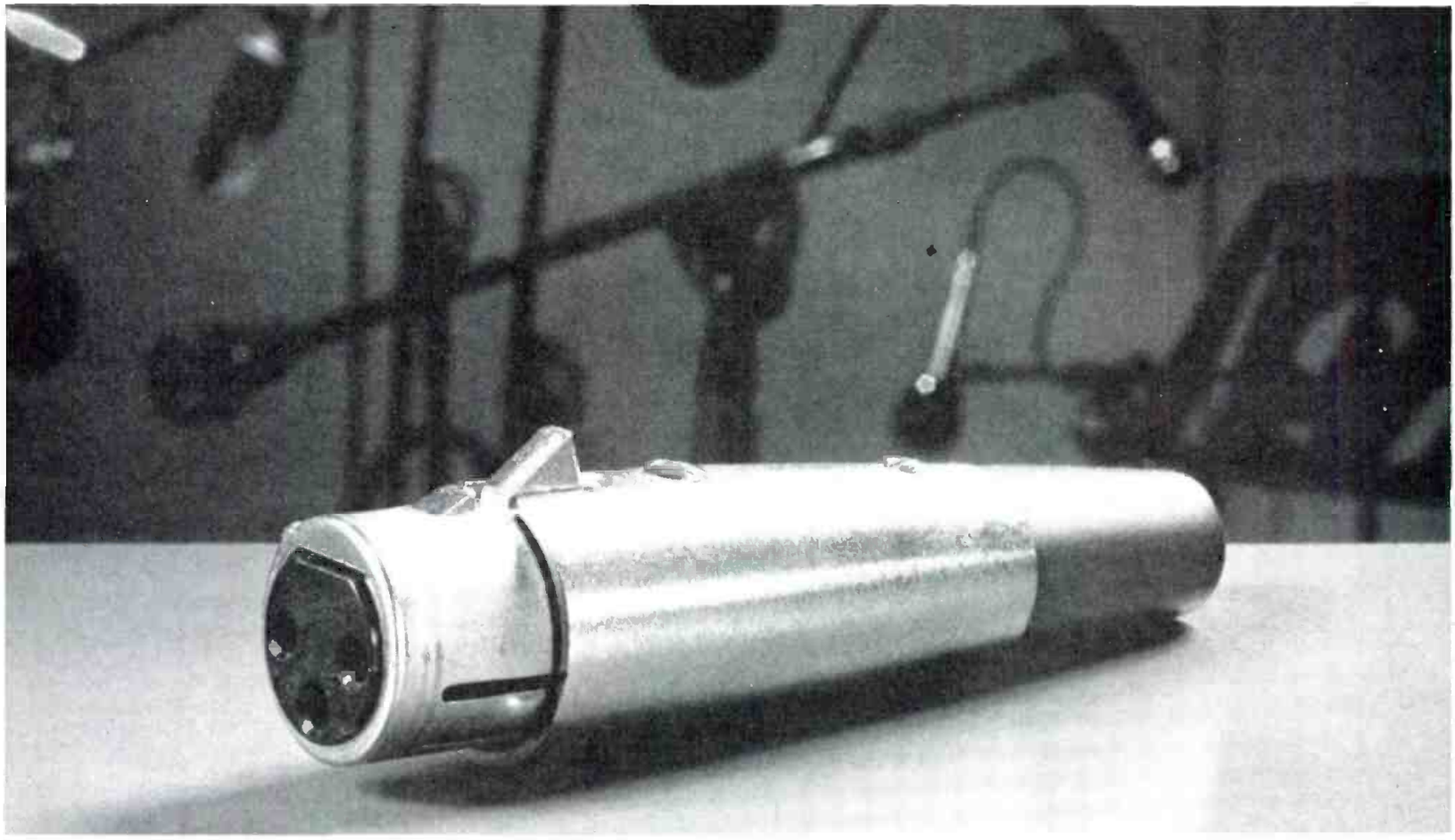
27-30 **B&K Measurement Seminar—Quiet Product design.** B&K Instruments, Inc., 5111 W. 164th St., Cleveland, Ohio 44142. Telephone: (216) 267-4800.

JUNE

15-18 **1980 International Summer Consumer Electronics Show (CES),** Chicago, IL. McCormick Place, McCormick Inn, and Pick-Congress Hotel. For more information contact: William T. Glasgow, Vice President, Consumer Electronics Shows, Two Illinois Center—Suite 1607, 233 N. Michigan Avenue, Chicago, Illinois 60601 (312) 861-1040.

15-18 **Annual Consumer Electronics Design and Engineering Exhibition;** held concurrently with the **1980 International Summer Consumer Electronics Show** at the McCormick Place/McCormick Inn/Pick-Congress Hotel in Chicago. For more information contact: Electronics Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006. (202) 457-4992.

19-20 **APRS '80** International Exhibition of Professional Recording Equipment, Connaught Rooms, London, England. For more information contact: British Information Services, 845 Third Avenue, New York, NY 10022. (212) 752-8400.



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23-27 **B&K Measurement Seminar—Industrial Noise Control I.** B&K Instruments, Inc., 5111 W. 164th St., Cleveland, Ohio 44142. Telephone: (216) 267-4800.

30 **The New England Conservatory of Music** opens its summer session highlighting workshops, courses, and master classes. Various guest lecturers will also be featured during the session. For more information contact the New England Conservatory of Music, 290 Huntington Avenue, Boston, Mass. 02115, (617) 262-1120.

JULY

1-3 **Transducer and Temperature Control Exhibition** will be held at Wembley Conference Center, London, England. For more information contact: British Information Services, 845 Third Avenue, New York, NY 10022, (212) 752-8400.

25-27 **American Radio Relay League 26th Convention,** Seattle, Washington. Registration and program information may be obtained by writing 1980 ARRL National Convention Committee, P.O. Box 58534, Seattle, Washington 98168.

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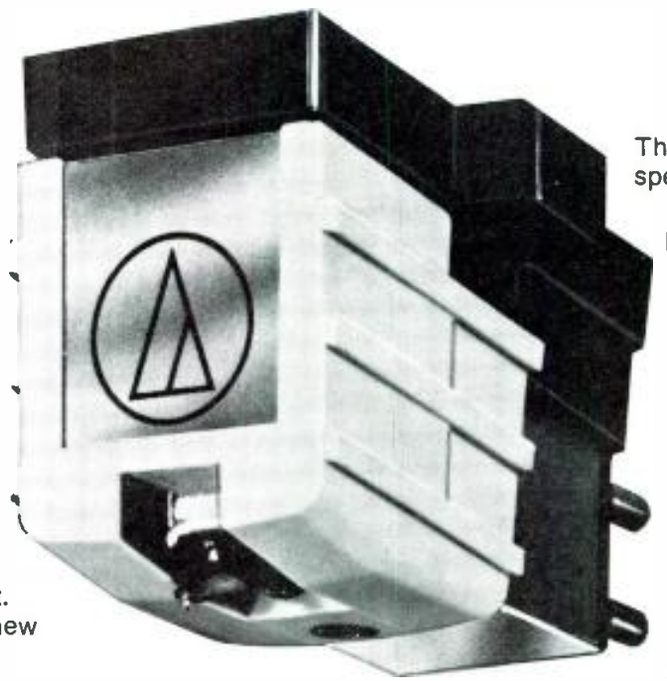

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NORMAN H. CROWHURST

db Theory & Practice

Toward Realism In Reproduction

• With last month's discussion of the nature of hearing as introduction, we will move on to the progress in technology, since man first started creating reproduced sound. It becomes more meaningful, when you begin to understand how hearing functions. Let us start at the Paris Exposition—just about a century ago—when binaural "reproduction" was first demonstrated.

EARLY REPRODUCTION

Speaking tubes had been in use for quite a while, as a convenience in answering the door, or calling for maid service. But this demonstration showed what then was the unbelievable realism achieved when sound was "piped" into both ears, from a source that simulated the position of a person's ears in real life. It showed that our depth perception and, more than that, our ability to separate individual sounds that might contain overlapping frequencies, depends on "information" received by both ears.

Whether all that was realized at the time is questionable. In saying that, we are interpreting the result of the experiment, in the light of what we know now. Then came radio and the phonograph, which for a long while were regarded as competing forms of entertainment, one of which would eventually defeat the other by its superiority.

Of course, that argument did not foresee electrical reproduction of recorded program. Phonograph records were acoustically cut and reproduced in those days. Artists crowded round the mouth of a horn that collected their sound, condensed it down to drive the cutting stylus that made the record. By today's standards such acoustic recordings seem noticeably crude.

But that was not the way it seemed when electrical recording first "came in." True, the extended frequency range was noticeable, as an improvement. But a lot of people contended that the old acoustic recordings were "clearer." How could that be? Surely transmitting more "information," in the form of a wider frequency range, improved the clarity—or should do so. Yet for the time it had to be conceded that it did and it didn't!

THE ELECTRICAL AGE BRINGS CHANGE

Distortion levels of electrical reproduction were what we would call high in those days. It was a struggle to get distorion down to 5 per cent which for some quite arbitrary reason—no, maybe it wasn't arbitrary, but it seems so now—was regarded as an acceptable level. In those days, some realized, or suspected that distortion was the reason that electrical reproduction lacked some of the clarity possessed by acoustic recordings, unbelievable as that may seem today.

So they ran some checks to see how much distortion could be detected by human hearing. And the answer came up that we could not detect distortion if it was less than 5 per cent. Unbelievable? Remember that they ran the test on a single tone, so they were listening to just 2nd harmonic riding on fundamental; and that they were listening to it with "good" loudspeakers of the day—and nobody had found out yet how to mea-

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sure the distortion the loudspeaker contributes.

So what their tests really meant was that when you reduced amplifier distortion to less than 5 per cent, it was swamped by the distortion in the loudspeaker, so that lower than that, you could not hear the difference. Now, if you think about what reproduction with some 5 per cent harmonic distortion would do in the way of various forms of intermodulation distortion (which they had never heard about) you may understand why such reproduction lacked clarity, even compared with acoustic recording.

Development for the next few decades took the form of chasing down one source of distortion after another. Once they realized that the major source of distortion in those original tests was in the loudspeaker used to listen with, loudspeaker designers went about making "cleaner" loudspeakers; then that showed up distortion elsewhere, which someone else went to work on, until we were enjoying very low orders of distortion in monophonic reproduction—single channel.

BINAURAL VS. STEREO

The experience of the Paris Exposition was never completely forgotten, although with time there came to be very few people who had heard that first hand. But the result was that a handful of forward-looking people realized that something they called "stereo" was necessary to realism. It was years before someone began to emphasize the difference between "stereo" and "binaural." In fact, the way "stereo" and "quadraphonic" are bandied about, I wonder if the distinction is yet realized—by many.

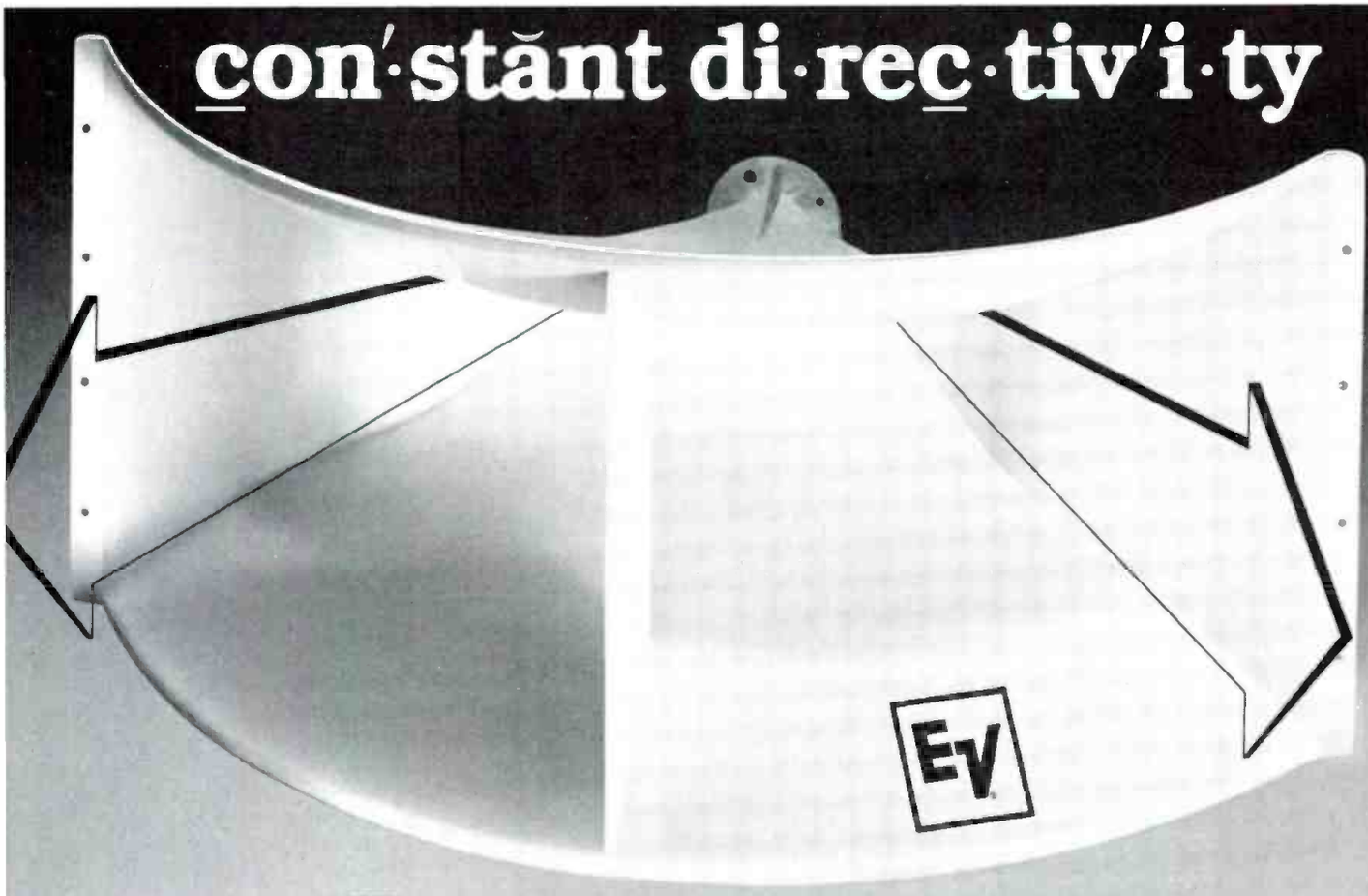
"Binaural" applies to the way our hearing interprets what we hear, by means of samplings of the sound field, picked up by each of two ears. "Stereo" literally means "solid" or 3-dimensional, and thus applies to the recreation of a 3-dimensional sound field that closely simulates the original.

Now there gets to be the real question, on which a lot of energy has been spent. How do you go about recreating the original sound field, or how close do you have to come, to be successful? The simple fact is, you never can, completely. So, next question, what is it you have to do, to make the illusion as impressive as real?

Go back to the earlier experiences and maybe you have part of the answer. The electrical reproducer gave us wider frequency range, but acoustical reproduction seemed to have better clarity, in some senses, notably lower non-linear distortion. That seems simple enough, but we need to complete the picture by seeing how our hearing utilized those differences.

The extended frequency range gave

con·stănt di·rec·tiv'i·ty



The characteristic of a horn that directs all of the frequencies where you want them to go.

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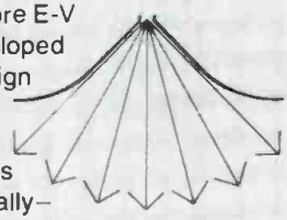

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[1] U.S. Patent Number 4071112

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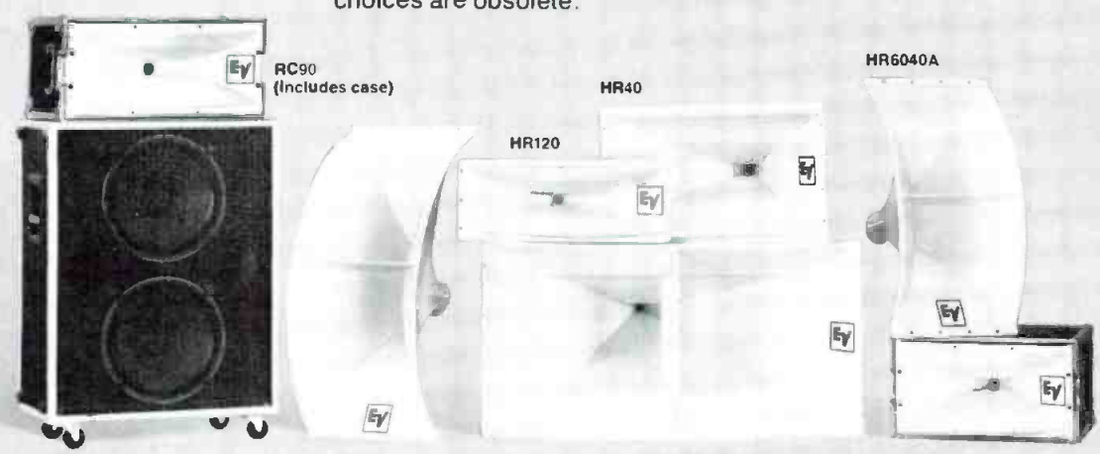

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the impression that, in some senses, the system was "letting more through." A wider range of auditory nerves were stimulated, and we heard more in that sense. But at the same time, the distortion meant that our hearing faculty found it virtually impossible to separate sounds coming from different original instrumental sources, unless they were separated in time.

Accurate, distortion-free, binaurally introduced reproduction enables the interpretative faculty of our brain to assign frequencies perceived to their various separate sources so we hear, not a mass of sound, but a collection of individual instruments, playing. And the more skillful engineers eliminated waveform distortion from the monophonic chain, the clearer things became, the more readily could our hearing faculty identify the components present, in terms of musical instruments, or whatever.

Then came the early stereo. One of the earliest was Disney's Fantasia, which was far more than 2-track sound, and he used enough recording media to do it with pretty low distortion (for those days) so that the realism was impressive, to the listener seated in the theater. That fired the imagination of motion picture sound people, who were not satisfied until they came up with some "passable" imitations that were less costly to install.

And the availability of "stereo" in the theater made producers of reproduction for the "home" market all the more anxious to deliver something similar, that people could listen to in their own home. Experimenters could be classified in two groups. There were those who wanted to "do it right," no matter what it cost. And there were those who realized that, to get a wide selection of program choice, we needed a mass market, so it must also be simple and inexpensive, and show a significant improvement over what they had—monophonic.

STEREO'S "PING PONG" EFFECT

It took a long while for this transition to happen and, in retrospect, that is no wonder: maybe it's a wonder it happened at all. For what sold stereo to most people (except the perfectionists) in the early days, was what was described as the "ping pong" effect. Many believed that separation necessitated being able to "tell" precisely where each instrument in the orchestra was. That might have been possible, had the distortion been lower. But to get 2-tracks or channels of sound, in the same space that one formerly occupied, and thus making it "compatible" (whether by phonograph or radio), necessitated, at the beginning at least, some sacrifice in quality—freedom from distortion.

So in those days it was, as mother used to say, "six of one to half a dozen of the other." Monophonic remained 'way

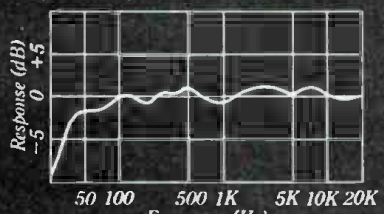
WHY JBL FLATTENS THE COMPETITION.

INTRODUCING THE 4313.

Flat frequency response. It means accuracy. Naturalness. Reality.

JBL gives it to you without the bigger box that you'd expect along with it, since the 4313 only measures about 23" by 14" x 10"!

This new, compact professional monitor produces deep, distortion-free bass. And does it with a newly developed 10" driver. Its massive magnet structure and voice coil are equivalent to most 12" or 15" speakers. Yet it delivers heavy-duty power handling and



On-axis frequency response, 4313 monitor.

a smoother transition to the midrange than most larger-cone speakers.

The 4313's edge-wound voice coil midrange accurately reproduces strong, natural vocals and powerful transients.

Up top, a dome radiator provides high acoustic output with extreme clarity and wide dispersion. A large 1" voice coil gives it the ruggedness needed in professional use.

Working together, these precision-matched speakers offer superb stereo imaging, powerful sound levels and wide dynamic range.

Audition the 4313 soon.

We think you'll agree that its combination of flat response, power and moderate size flattens the competition.

James B. Lansing Sound, Inc., 8500 Balboa Boulevard, Northridge, California 91329.

FIRST WITH THE PROS.

Circle 22 on Reader Service Card

ahead, as regards freedom from distortion. Stereo had to show something monophonic could not do, at least obviously, and the only way to do that was with the ping pong effect. You know, trumpets play a piece from the left speaker, then saxophones play an answering piece from the right speaker. When everything played at once, it was extremely difficult, in those days, to know which was better: monophonic or stereo.

There was a difference, it was true: if you "A-Bd" between mono and stereo, you could hear the difference, but you really had to kid yourself a little bit, to say that stereo was better, except for this ping pong effect which, of course, mono could not do at all.

But the same care and persistence that had gotten monophonic distortion to such a low level, was applied to stereo, until both channels of stereo could reproduce with distortion levels comparable with, and finally better than monophonic had ever done. That was when stereo really came into its own. Then several improvements could be noticed that had not been noticeable before.

STEREO SOUNDS LOUDER, BUT...

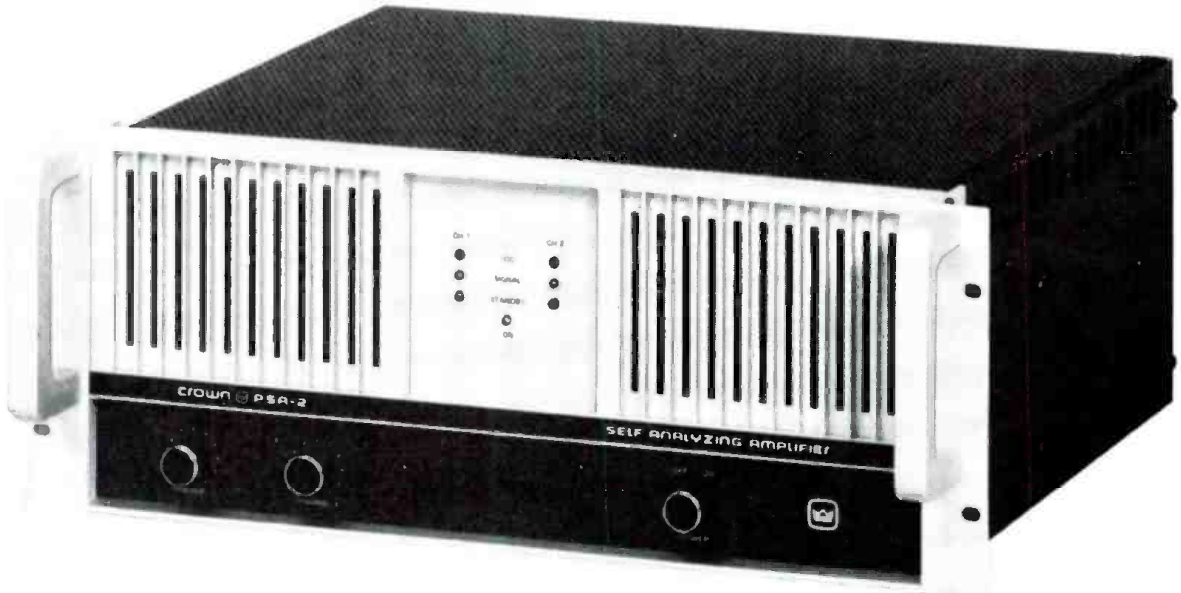
One thing was that stereo reproduction seems louder, for the same total radiated audio power, than monophonic. If you don't believe that, and your system has a stereo-mono switch, just switch to mono when stereo is playing. It is still radiating the *same* amount of power, but you'd never believe it!

But the main gain is in clarity—at least to 2-eared listeners. People who have only one functioning ear will not hear the difference. We remember being commissioned to write a practical article on selecting a stereo system, for which the publisher wanted us to visit a stereo "salon," and have the assistant help us, just as an ordinary customer would. Would you believe, the salon we selected (being nearest to home) had an assistant who was deaf in one ear, and could not tell whether both speakers were playing or not: we had to help him fault trace speakers that were not playing, before we could audition what he had available!

Now, what can quadraphonic add, since none of us has four ears? We have heard that question asked. The real point is that quadraphonic can get us a little closer to true stereo, if it is properly used. We have been through all that in a column not too long ago. But thinking about it, in terms of how our hearing interprets what we hear, helps us to understand it.

It also explains why so-called "perfect" reproduction—by which we mean reproducing an exact replica of what the listener would have heard, had he attended the original performance, is not necessary. What is important is the reproduction of all the right frequencies, with the right timing, and close to the correct sense of direction—but that is not critical, so long as stereo (however many channels) is used to improve separation capability as we listen—with an *absolute minimum* of distortion, any of which muddies the scene, by creating spurious frequencies, or spurious components in those present.

That is true, as of this writing. Please don't take that as final. What does it presuppose? For one thing, that the sound must go through the whole of our present auditory process, the analog part of the middle ear, as well as the digitalizing part of the inner ear. Those hard of hearing have already been aided to hear what had previously been a silent world to them, by bone conduction techniques. Who knows, we may learn something from that, to enable us to by-pass the analog portion altogether, and transmit digital information to the hearing interpretive faculty of the brain? Nothing is impossible, when you know how to go about doing it. ■



This amp isn't getting a lot of attention...it doesn't need it.

The Crown PSA-2 is the most reliable high-power professional power amplifier you can buy at any price. One reviewer described it as "indestructible," since the PSA-2 accepts seemingly impossible loads, and unlike many other amp designs, will continue to produce useable output power.

PROOF OF PERFORMANCE

Crown engineers devised a simple test to show how the PSA-2 operates. Two flat metal bars are wired into the output circuit of one channel of the amp, with a music signal input. The other input is connected to a 1½ volt battery, requiring the PSA-2 to deal also with a DC signal. A heavy round steel bar is laid across the speaker leads. The amp *continues* to produce useable power, and the metal bar becomes a transducer, producing small sounds from the output signal!

ON-BOARD COMPUTING

The PSA-2 uses its built-in computer logic and unique sensing systems to determine the limits of the safe operating area of the output transistors. The PSA-2 does not just thermal out or shut down as other designs tend to do under strange loads. It computes the level of output power at which it can continue to operate, and then orders itself to do that.

Under normal load conditions, this on-board computing makes it possible for the PSA-2 to use its output transistors more efficiently than any other protection system. There are no arbitrary cut-off points, but a continuous computing of the conditions of the output devices, and an adjustment of output to the maximum comfortable level for the amp.

NEW CONVENIENCE

Versions of the PSA-2 are now available with a choice of front and rear panel configurations. Users can select a model with on/off LED indicators for overload, signal and standby; or they can select the version equipped with the Crown "Dynamic Range Indicator," an LED array that displays peak/hold and instantaneous output for both channels. For the rear panel, a balanced input module (including variable gain and switchable hi/low Butterworth filters) is available, or unbalanced input only.

FIELD TESTED

The Crown PSA-2 amp has already proven its ability to require very little attention after it's been set up in the field. The PSA-2 has provided trouble-free power for several major touring setups, and it is now installed in a number of top-flight recording studios and auditoriums.*

TOP QUALITY SOUND

A bonus for users of the PSA-2 is its excellent sound quality. The amp proves that sonic quality, ruggedness and reliability *can* be combined in one amp.

If you haven't already considered the PSA-2 for the systems you are currently designing, write to Crown today. We'll send you a fully descriptive brochure and reprints of several reviews. They're worth your full attention.

*Names on request.

crown

See the PSA-2 in action at Booth 76, AES Convention, Los Angeles, May 6-9, 1980.

1718 W. Mishawaka Road, Elkhart, Indiana 46514

Innovation. High technology. American. That's Crown.

MARTIN DICKSTEIN

More Organizations and Conferences

• Since we did start to talk about conferences in the last few times we got together, there are just a couple of more things we thought you might like to know.

VIDEO EXPO/'80

During the middle of February, there was Video Expo/San Francisco '80, held at the Civic Auditorium. Sponsored again by Knowledge Industry Publications, it ran for three days. There were forty seminars, all aimed at expanding video capabilities. Nine of them were for beginners, thirteen for those who have had some experience with video but want to use video more effectively, and eighteen were advanced sessions for those who were in management communications and wanted to learn new skills and techniques for advanced applications and planning in the video field.

TOPICS OF DISCUSSION

Each of the three days also had a general session and a large exhibit. The general session on the first day was called "Innovations in Private Television." This meeting covered innovative uses for non-broadcast television. Some of the questions discussed dealt with computer interactive video, video conferencing in corporate communications, animatics, and how today's experiments will lead to applications tomorrow.

On the second day, the general session covered the subject of "Delivering on Video's Promise For Training." This meeting discussed how and why video programs have succeeded and failed, and the gap between the potential and reality of video for training. The third day, the meeting devoted itself to "The Mini-Cam and the Revolution in On-Location Shooting." There were demonstrations, and some video tapes were played to show a few of the capabilities of this latest breakthrough in video recording.

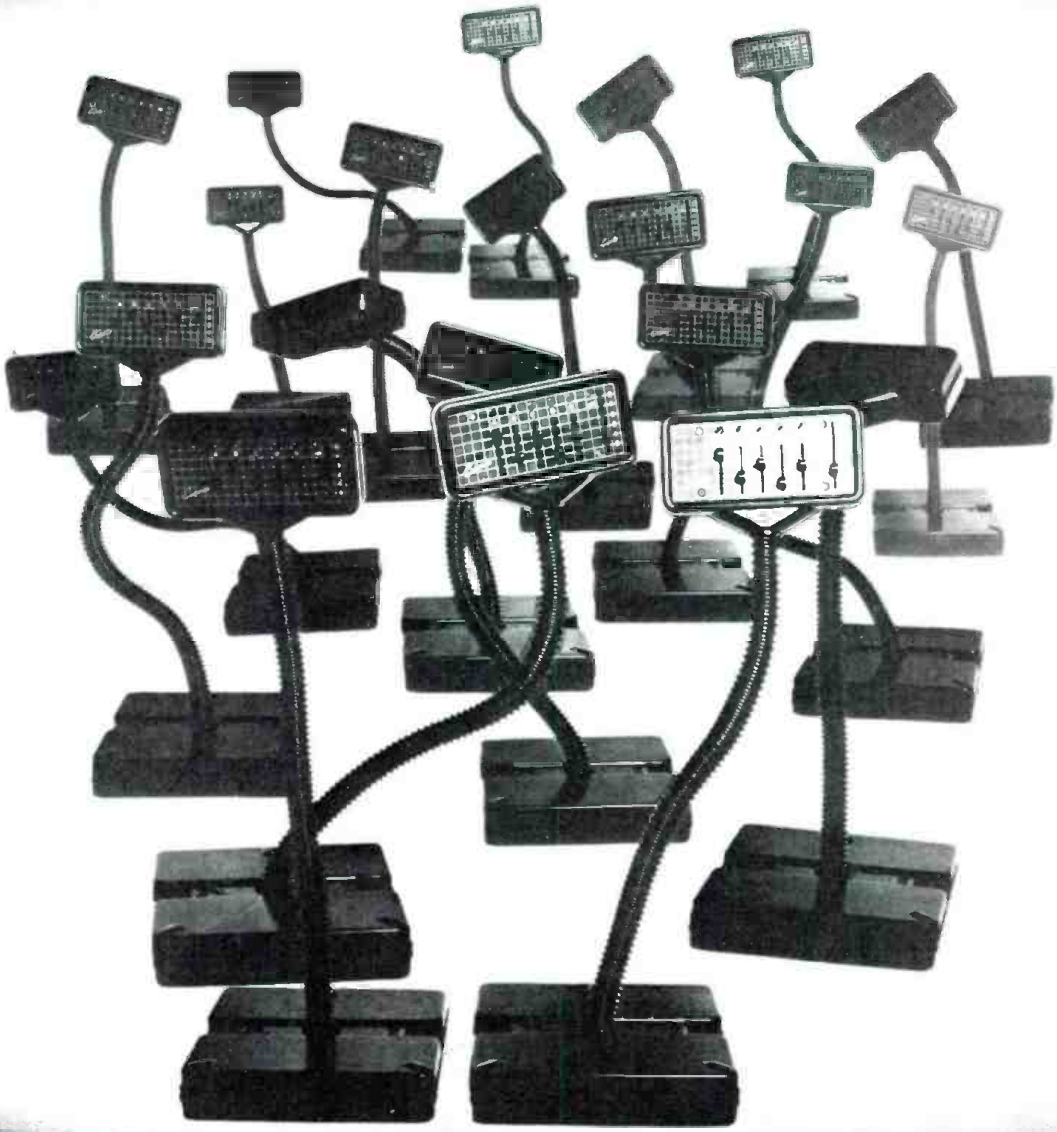
The exhibit displayed the latest in cameras, tape recorders, video projectors, monitors, editing equipment, portapaks, duplicating systems, programming and production services, production supplies, accessories, and much more. Some of the exhibitors were Maxell, 3M, Dynair, NEC, Clear-Com Intercom Systems, Ampex, Toshiba, Philips, Tentel, Digital Video Systems, Hitachi, Sony, Ikegami, Sanyo, Inovision, International Video, and US Video. There were many more.

INTO THE 80's

The seminars, three full days of them, delved into the basics of electronic editing, audio methods and techniques for video productions, lighting techniques, and guidelines for location and studio production, with others.

Among the more advanced sessions were such subjects as video disc technology, applied aesthetics of video, evaluating color cameras of the 80's, satellite video networking, evaluating

THEY'RE OUT!



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MAY 6-9

vtr's of the 80's, video management update, video editing systems update, advanced electronic graphics for video, and video communications for the 80's and beyond, among many more.

The training application meetings featured such topics as planning a multi-program series and advanced-training script writing were covered.

EFFECTIVE COMMUNICATIONS

In the audio-visual field, NAVA and Indiana University teamed up to offer the 24th Audio Visual Institute for Effective Communications. This was during the early part of March, and was held at the Bloomington Campus of the University. (In case you missed it, there will be another one just like it during the middle of October, held at the same place.)

This conference ran a full week, and covered a multitude of interesting subjects to people in the AV business. Some of the topics were "A-V Facilities Design," "Design and Production of Graphic Materials," "Motion Picture Production," Video Communications," and the "Production of Sound for Use With Visuals." Also covered were "Multi-Image Presentations," "Production of Slides and Filmstrips," "Managing a Media Center," and "Scripting Techniques." There were many other subjects as well.

Just to give you an idea of some of the depth to which the courses went, the "Media Medic" course discussed preventive maintenance on such equipment as slide projectors, trays, slide mounts, dissolve controls, and accessories, 16mm and super-8 projectors as well as overheads, and tape cassettes. This was an operator-oriented diagnostic course for all users of A-V equipment.

AAVT AND ITS SERVICES

Now we'd like to tell you about an organization with which you may not be familiar. It's the Association of Audio Visual Technicians, with headquarters in Denver. The AAVT was set up as a non-profit professional association designed to keep its members informed on all areas of the audio visual field. It actually is a central clearing house for information and communications between members and the rest of the industry.

By working closely with manufacturers, members are kept up-to-date on modifications, problems, and solutions. AAVT has a lending library of audio-visual programs of interest to AV technicians and is available to members. The members of the organization come from schools, service centers and companies, industry, and many other operations that use audio visual equipment.

The monthly publication of the AAVT is called "Fast Foreward," and is aimed at all those involved with operation, service, and management of audio visual equipment. It contains information on such items as tools, ideas, modifications, repair techniques, and methods used by other members. It also contains a "Job Market" column of technician positions.

The AAVT has also published a Parts and Services Directory of Audio Visual Equipment (in cooperation with EPIE, another non-profit organization we have written about in this column in the past). This publication contains parts sources for more than 1,000 brand names, many of which are no longer available from the original manufacturer.

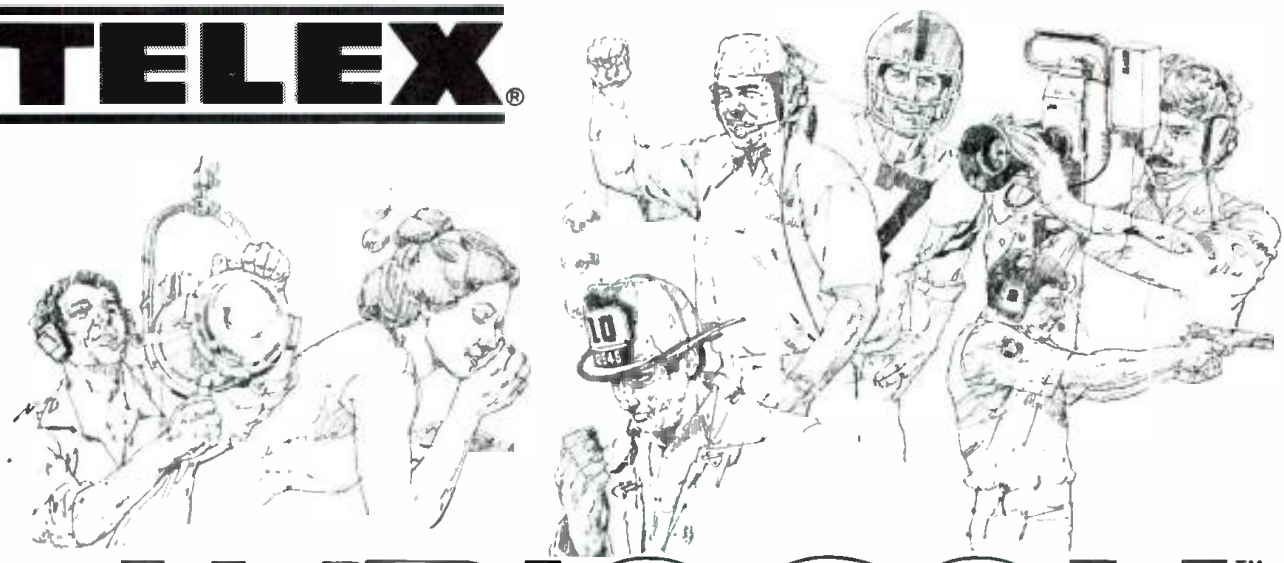
IN REVIEW

The issue I received from AAVT discusses their creating a library for old manuals, an update on manufacturers, a list of stolen video equipment (by model, serial number, and manufacturer) to alert potential buyers to beware, a report on a bearing problem with a slide projector unit, and a full description and circuit diagram (with parts list) of a delay unit t be used in conjunction with a particular dissolve unit. There had been a problem in the operation of a system using this dissolver, and the delay was built by one of the members to correct the problem. There were brief discussions about a power dissipation resistor circuit with diagram and parts list and the replacement of an internal fuse in a filmstrip projector.

AAVT runs its annual seminars in conjunction with Video Expo, and, of course was at the San Francisco '80 convention we wrote about at the beginning of this column. At this year's seminar, the topic was Sony U-Matics, and the discussions included head replacement and adjustment, belt replacement and tensions, and "do's and don'ts" of maintenance.

Now that you know of some of the conferences available to you to learn more of the video field and the audio visual business, as well as an organization you might want to join, the rest is up to you. At least we tried to help. Remember...you can lead a horse to water, but.... ■

TELEX®

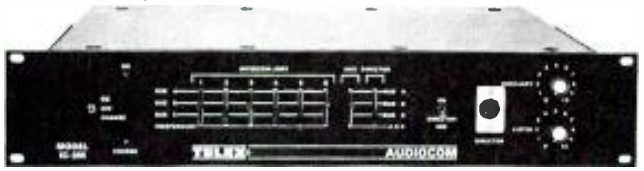


AUDIOCOM™

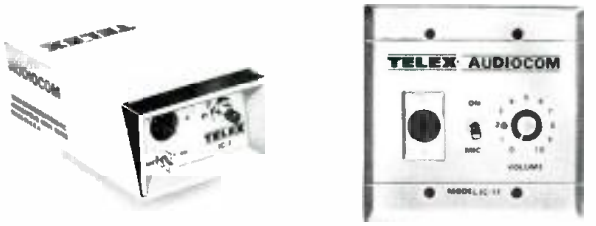
THE INTERCOM SYSTEM

A closed circuit headset intercom system for small, large, portable or fixed installations. AUDIOCOM, for concerts, stage productions, film or TV studios, sports stadium and race track, industrial, military or public safety applications.

AUDIOCOM, for short or long distance (over five miles), requires only simple wiring and readily interfaces with other sound systems including telephone circuits. Options include tone or light signaling, paging, program feed and rechargeable battery packs in case of power failure.



AUDIOCOM SWITCHBOARD, portable or rack mount, segregates six external intercom lines into three separate non-interfacing circuits; or stage, lighting and sound crews can communicate independently, jointly, or may be mixed. Contains 24 Vdc power supply with optional, rechargeable battery pack. Smaller power supplies also available.



AUDIOCOM INTERCOM STATIONS, belt pack or wall mount, can be "daisy-chained" by the dozens without degradation in signal quality or strength. Listening control and mike switch included. Unused inputs mute automatically to prevent system noise.

AUDIOCOM PAGING SPEAKERS, portable or wall mount, feature volume level switch. Also serves as a paging station.

AUDIOCOM ACCESSORIES. Noise cancelling boom mike headsets or hand mike, even for high noise environments. Interface unit adapts to 2, 3 or 4 wire systems with balanced or unbalanced circuitry.

Cables, extension cords and "T" connectors for convenient, virtually limitless system layout.

Quality products for the audio professional

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db New Products & Services

STRESSOR

• The model VS-2 AM Stressor features the combination of a peak limiter, multi-ratio compressor, and expander along with a loudness contour switch which introduces a dynamic equalization network (to increase density and intelligibility of modulation) without adding fatiguing side effects. There is also a positive peak assymetry control which provides optimum modulation. The VS-2 features 30 Hz-30 kHz frequency response, 97 db signal/noise, and less than 0.1 per cent thd.

Mfr: Orange County Electronics
Price: $976.
Circle 65 on Reader Service Card

CARTRIDGE SYSTEM

• The 1K Cartridge System will be displayed for the first time at the 1980 NAB. The 1K is a computerized system that receives, stores, moves and plays up to 1024 tape cartridges in any pre-programmed format.

Mfr: International Tapetronics Corporation
Circle 66 on Reader Service Card

HEADPHONE AMPLIFIERS

• Two new professional headphone amplifiers, the HA 100 eight-stereo channel and AP 10 four-stereo channel models can be used with a combination of 8 to 2000 ohm headphones. These units, in addition to having a flat frequency response, have less than 0.1 per cent thd and an A-weighted signal-to-noise ratio of -101 dB. Both will enhance the studio, audiophile system, instore headphone demonstration, and any A-V system. Units can be desktop or rack mounted.

Mfr: Edcor Inc.
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Six Ways To Make Your Sound Sound Better

111B Dual Spring Reverb
A professional reverb with an excellent price/performance ratio

245E Stereo Synthesizer
Creates a seductive, mono-compatible pseudo-stereo effect from mono sources

418A Stereo Compressor/Limiter
For smooth, undetectable level and high frequency control in recording

526A Dynamic Sibilance Controller
Clean, inaudible de-essing of vocals with consistent action regardless of levels

622B Dual Channel Parametric EQ
Constant-Q design makes it an exceptionally versatile EQ

672A Equalizer
A Parametric EQ with graphic controls, including variable high and low-pass filters usable as an electronic crossover

AES BOOTH 62

All products are sold through authorized Orban professional audio dealers worldwide.
Call or write for the name of the dealer nearest you.

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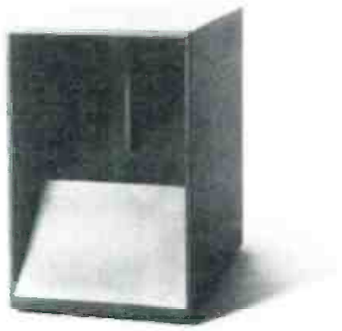
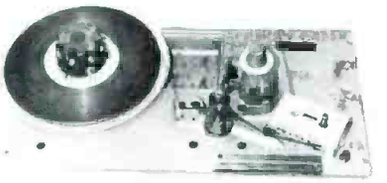
Orban Associates Inc., 645 Bryant Street, San Francisco, CA 94107 (415) 957-1067

SPEAKERS



• The L-36JE is a deep bass speaker system designed to be arrayed in groups or clusters on the floor, near corners or walls to increase output. The unit is designed specifically for permanent installation in entertainment clubs. The speakers will handle up to 300 watts rms with a frequency response of 32 Hz to 400 Hz driven into 8 ohms.
Mfr: Cerwin-Vega
Price: $650
Circle 68 on Reader Service Card

CASSETTE LOADER



• The Model 751 loads blank or prerecorded tape to exact lengths and maintains accuracy to within two inches per 100 feet of tape. The 751 speeds along at 135 ips, but thanks to a DC braking system, does no damage to the tape. The unit loads a C-60 in 25 seconds, depending on the buyer's choice of tape and empty cassette, can load a quality C-60 for approximately 36c including labor. The counter reads in minutes and seconds so no conversion is needed.
Mfr: Audico, Ltd.
Circle 69 on Reader Service Card

VOLT-OHM-MILLIAMMETERS

• A new line of milliammeters, the 260 Series, was recently introduced offering new reverse, recessed, insulated panel connectors with matching safety-engineered test leads that reduce the possibility of a shock hazard in the event a connector is inadvertently pulled out of the instrument jack. In addition, the doubly-fused protection network is conveniently located in the directly accessible battery-and-fuse compartment. The 260-7 measures AC DC voltage, direct current, resistance, dB and output voltage (the AC component of a mixture of AC and DC voltage with 27 most-popular ranges and DC sensitivity of 20,000 ohms per volt.
Mfr: Simpson Electric Company
Price: $103 (options available)
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AUDICON MARKETING GROUP

Proudly Announces Exclusive U.S. and Canadian Sales and Marketing For:

Raindirk Audio Consoles

BRITIANIA SERIES

RAINDIRK's premier 40 input/32 output master recording/mixing console features in-line design, master status logic control with PROM controlled signal switching, six band fully parametric equalization on each input, balanced inputs and outputs, transformerless high slew-rate electronics design, full +24 dbm output levels, and elaborate patching facilities including provisions for the connection of two multitrack recorders. Each input module may select from microphone or either of two line inputs. Options include VCA grouping using ALLISON VCAs, ALLISON FADEX automation, PARAM computer assisted, centrally controlled equalization and routing.

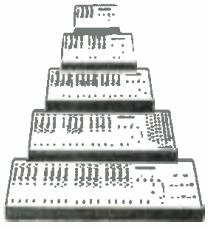
RAINDIRK also manufacturers SERIES III, a modular multitrack recording/mixing console series of separate input and monitor section design. RAINDIRK is also skilled at implimenting custom console requirements for film and video production.

Eela Audio Mixers

CONCORDE S2000

The CONCORDE S2000 is available in 20 or 28 channel mainframes. The combination input/output/monitor module is equipped with a four band sweep equalizer and 24 track assignment with buss panning. Master PROM programmed status switching controls solid state switches eliminating relays instatus switching. Each module has individual status switches which overide the master status commands. The CONCORDE S2000 has four sends which may be utilized for echo, cue, or special effects. The CONCORDE S2000 is available as a basic desktop unit or as a complete system with a pedistal base, producer's desk and full patchbay. Conductive plastic faders, lighted VU meters, and wood end and meter trim are standard equipment.

EELA SYSTEM 100 STEREO MIXERS



The EELA SYSTEM 100 is a modular mixer system which may be configured with single channel microphone and line level input modules or stereo line level inputs in groups of four. SYSTEM 100 is supplied in five frame sizes. The smallest frame holds two electronics assemblies which becomes a four input (mono or stereo)/stereo output mixer. The largest frame will accomodate sixteen input/stereo output with an optional eight track switching and monitor module.

see us at the Los Angeles AES
Booth 104-105, Demo Room 474

AUDICON MARKETING GROUP

1200 Beechwood Avenue • Nashville, Tn. 37212
615·256·6900 • Telex 554494

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ELECTRONIC NEWS GATHERING

• The new Electronics News Gathering System features a 20 db gain microphone pre-amp for low level transmissions. Also included in the system are two nine volt batteries which give the user approximately 15 hours of continuous operation. Microphone electronics provide for hi or low impedance microphones with phantom bias. Incorporated into this system is a headset monitoring position for monitoring a shotgun mic input. High band frequencies are from 150-470 mHz.
Mfr: Swintek Enterprises Inc.
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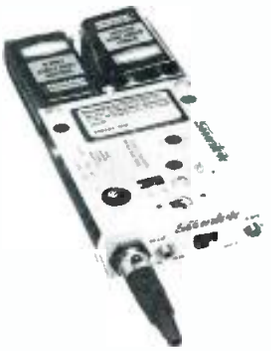

STANLEY SCREAMERS

• A new line of entertainment products, known as Stanley Screamers, was recently introduced. Included are the Model 1020-R Dual Subwoofer System that includes two low frequency sound reinforcement loudspeakers with output of 20Hz to 80Hz. The Model 3210-R, a three-way, tri-amp Ready System includes two 15" duplex loudspeakers, one high frequency compression driver with radial phase plug and low mass magnet; and one directivity horn (dispersion 90 x 40 degrees), extended range system with tri-amp ready inputs. Stanley Screamers are available in two versions road finished and utility finished.
Mfr: Altec-Lansing
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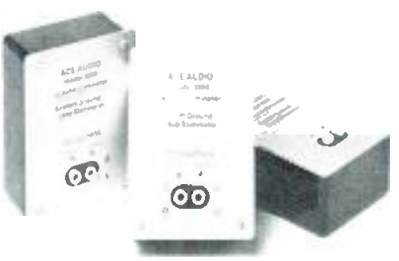
GROUND LLIMINATOR



• Featuring a unique audio component which is designed to break up ground loop faults in connecting cables and to improve the hum performance of a stereo system, the Model 3900 Ground Lliminator offers many necessary functions. While hum may come from faults in the individual components, it often comes from ground loop errors in the connecting cables which can give either subtle or gross defects.
Mfr: Ace Audio Company
Price: $16. ($14.95 kit)
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Talk is Cheap.

While others talk about performance and reliability, BGW is at work proving it, day after day after day. That's why so many pros Depend on BGW.

You already know BGW is pre-eminent in discos... recording studios... and on the road. Tough, demanding applications. But, BGW is chosen for even tougher assignments.

Consider the 1980 Winter Olympics. Future Sound, Inc. of Weston, CT was faced with providing PA, background music and network feeds for the Alpine events on Whiteface Mountain. The four amplifier sites were inaccessible by road. The only access was by snowmobile or on foot. Temperatures are, at their mildest, bitter. Naturally, Future Sound selected 20 BGW 750's because of their proven reliability.

And, when the Pope celebrated Mass on Washington's mile-long Mall, BGW 750's were there again (along with BGW 250's and 600's)... selected by Audio Technical Services, Ltd. of Vienna, VA for their reliability and because they can be operated right up to the clip point for hours with no problems.

In fact, the BGW 750 outperforms Crown's latest amplifier, the PSA-2. The 750 delivers more power at 4 and 8 ohms, has more output devices, and uses audibly superior full complementary circuitry.* One thing the Crown does have... a higher price, it's 37% higher.* And you know the BGW 750 is dependable. If you don't know from personal experience... ask the Pope.

*Based on Manufacturers' specifications.

Depend On Us.

BGW Systems, Inc., 13130 S. Yukon Ave., Hawthorne, CA 90250 (213) 973-8090 In Canada: Omnimedia Corp., 9653 Cote de Liesse, Dorval, Quebec H9P 1A3

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STAGE SPEAKER MONITORS

• A new trio of stage monitors including the SM-15, a two-way system with a 15-inch woofer and horn tweeter; the SMP, a two-way system with dual 12-inch woofers and horn tweeter; and the SM-12, a two-way system with a 12-inch woofer and horn tweeter. All the new monitors have high power handling capacity, extended frequency response, wide dispersion, as well as auto protect circuitry, and phone plug connectors and rugged sealed enclosures.
Mfr: Cerwin-Vega
Circle 74 on Reader Service Card

CONSOLE

• Series 400 is a fully modular 4-buss mixing console for up to 8-track recording and for sophisticated sound reinforcement. It is available in two mainframe sizes, one for up to 18 input channels and the other for 26. All controls are laid out logically and are easy to use. Metering is by 16-segment led bargraph whose displays can be switched individually to vu or peak reading characteristics.
Mfr: Soundcraft Electronics Limited
Circle 75 on Reader Service Card

TAPE RACK

• The RL 200 Tape Transport Console features an overall height of 31¾" with a front opening that measures 19" wide and mobile versatility that make it quite desirable for studio use. The unit is solidly constructed, comes wholly assembled and is available with easy rolling casters for flexibility. It comes in wood grain finishes or a variety of solid colors. It's built with standard EIA tapped steel rails that facilitate attachment of electronic equipment.
Mfr: Ruslang Corporation
Circle 76 on Reader Service Card

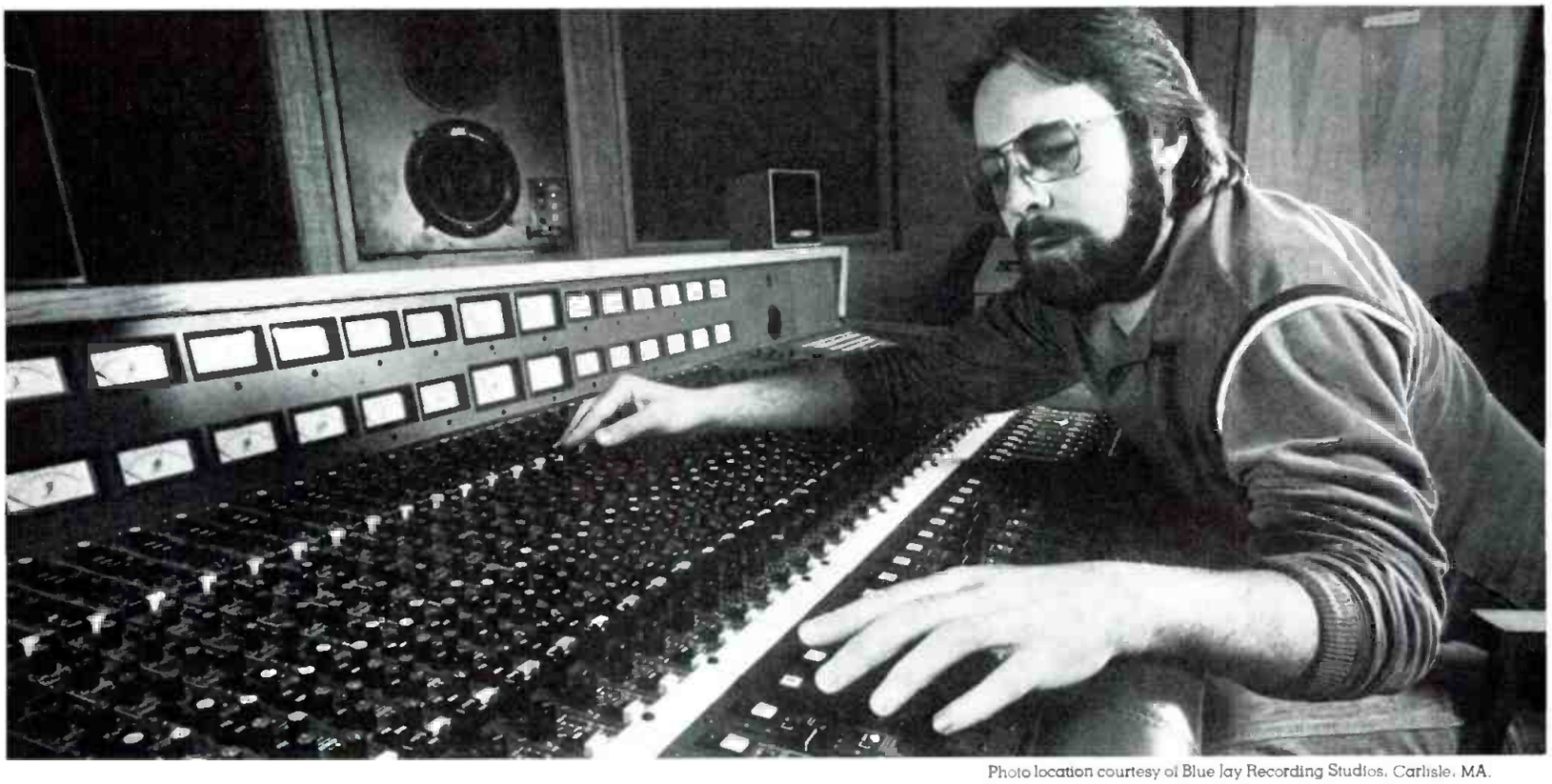

Photo location courtesy of Blue Jay Recording Studios, Carlisle, MA.

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That's why the new dbx Model 2001 not only delivers a distortion and noise combination as low as any you can find on the market today. It also goes a lot further.

The 2001 maintains its specified performance and musical clarity regardless of input and output levels. Its 50MHz bandwidth, widest in the industry, means you can add more than 30dB of gain without worrying about high frequency distortion or attenuation. And unlike other VCAs, the Model 2001 won't "thump" when you mute or duck a channel.

INTRODUCING THE STATE-OF-THE-ART DBX MODEL 2001.

Ever since we developed the very first VCA for professional audio recording in 1972, we've paid attention to the little things that make a VCA more reliable and easier to use.

Which is probably why most consoles manufactured today use dbx.

Write for details on our complete line of high-performance VCAs. And be prepared to raise your expectations.

dbx, Incorporated, 71 Chapel Street, Newton, MA 02195. 617/964-3210.

The unique dbx 2001 package requires a minimum of external circuitry and trim for greater reliability and easier installation while providing thermal stability.

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INTEGRATED AMPLIFIER

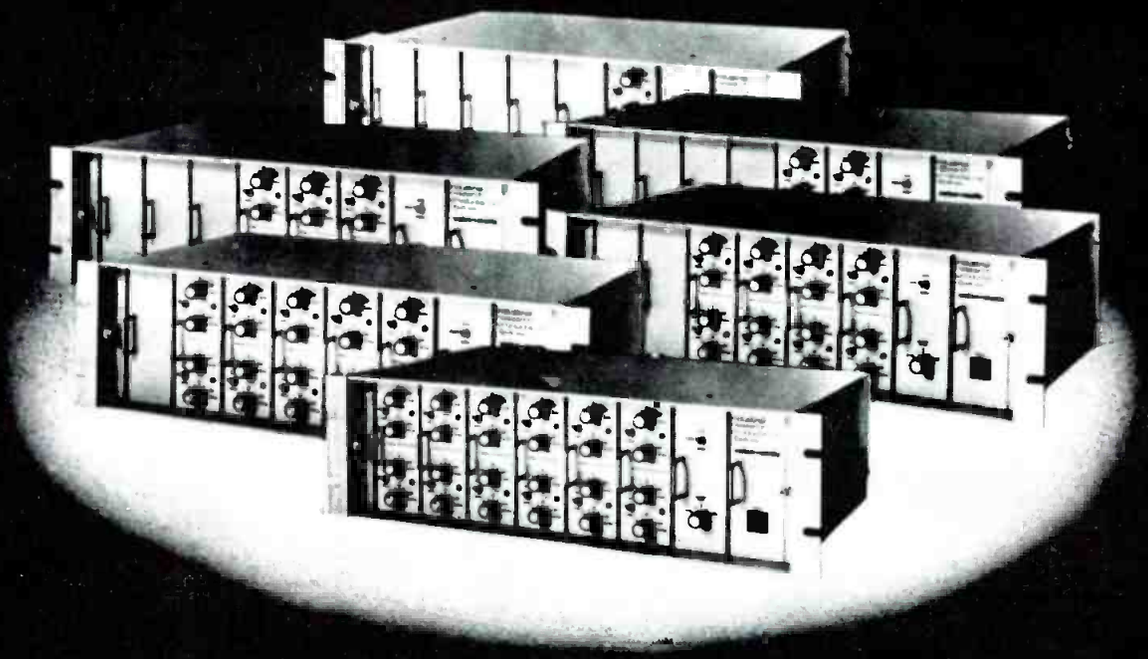
• Featuring a built-in parametric equalizer, the A14 Integrated Amplifier is rated a 140 watts per channel driven into 8 ohms with a frequency response of 20 Hz to 20 kHz. This is accomplished with no more than 0.05 per cent total harmonic distortion. Each of the two bands of the A14's parametric equalizer consists of a level control which provides up to 16 dB of boost or cut, a frequency control which is adjustable anywhere from 20 Hz to 1.2 kHz for the low band and 1.2 kHz to 20 kHz for the high band, a bandwidth control which is adjustable from 1/3 octave to 3½ octaves. The equalizer can be used to modify the musical program for increased listening pleasure or for the tape recording. In addition, the A14 also features a second phone circuit which will accept input from either a moving magnet or a moving coil cartridge. A fluorescent bar graph display provides accurate monitoring of power or level output. A special external processor connection accepts input from an accessory signal processor, leaving the tape monitor loop free for a tape deck. A front panel switch allows the processor to be activated before or after the tape monitor loop; or between two tape monitor loops for dubbing purposes.
Mfr: Scientific Audio Electronics, Inc.
Price: $650.00
Circle 77 on Reader Service Card

MIXER

• The DM-2 features a beat synchronizer that can be used on program or cue (headphones) to help a DJ sync a record to a given dance beat, thus facilitating smooth transition segues. The mixer is constructed with easy to read and access layout and comes standard in a black finish. Input and output jacks are located on top of the unit for fast hookup and tear-down.
Mfr: Cerwin-Vega
Circle 78 on Reader Service Card

PERFORMANCE

FROM VOICE-MATIC™ MODEL DE–4013 THE AUTOMATIC MIXER



automatically the better choice

The Voice-matic mixer will introduce you to a new way of mixing for multiple microphone sound systems. Our unique principle of Dynamic Threshold Sensing differentiates between active and inactive microphones and automatically attenuates inactive channels thereby reducing background noises and allowing increased gain. When more than one microphone becomes active gain is automatically reduced to eliminate the howl of feedback. Improved sound clarity and overall system quality are achieved.

Our modular design makes the Voice-matic ideal for rooms that need as few as two microphones or many, many more. Using two channel input modules you choose as many channels as you need. Council Chambers, Churches, Conference Rooms, and Court Rooms are ideal for the Voice-matic.

- Sophisticated circuitry suppresses feedback "howl".
- Dynamic Threshold Sensing (DTS) eliminates gating common to VOX systems.
- Adjustable attenuation for active or inactive channels.
- Low noise. Wide dynamic range.
- Transformer balanced inputs.
- Modular design—2 to 12 microphone inputs—allows economical selection of inputs.
- Multiple chassis may be tandem connected if additional inputs are needed.
- Second fully mixed output for tape recording, off-premises transmission, etc.
- Front panel input channel status LED's.
- Flexibility is provided by many options giving a custom-made system for each installation.

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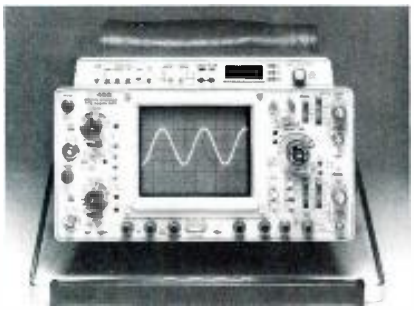
DISC CLEANING MACHINE

• The new disc cleaning machine is unique in that it can clean both sides of the record at the same time. The unit accomplishes this by applying a cleaning solution, brushing the wet record surface and then vacuuming the top layer of fluid off. All dirt is removed with the fluid that is vacuumed off. The machine then blows clean air deep into the grooves to totally dry the record. This process is claimed to be more effective for removing static than merely vacuuming the record dry. The total cleaning process takes about 3½ minutes.

Mfr: TMA Enterprises
Price: $695.00
Circle 79 on Reader Service Card

OSCILLOSCOPE



• Using state-of-the-art technology advances, the Model 468 Digital Storage Oscilloscope increases digital storage bandwidth-limits, detects aliased signals, and corrects envelope error and display jitter. The Model 468 in the non-storage mode has all the capabilities of the 465B 100-mHz Portable Oscilloscope. Storage mode is selected by simply pushing a button; waveforms are acquired and stored as easily as they are viewed. Features include a 25-MS/s, 8-bit digitizer, a new display interpolation technique, increased speed, and large storage capacity.

Mfr: Tektronix, Inc.
Circle 80 on Reader Service Card

ELECTRET-CONDENSER LAVALIER

• The new C-567 is among the smallest lavaliers obtainable with comparable professional acoustical quality and mechanical durability. The microphone head and output module are all-metal zinc construction and also chrome plated to offer a non-reflective and universal appearance. No battery compartment is provided for the C-567. Instead, the microphone may be phantom powered from the mixer or recorder to which it is connected. It may also be powered by any of the external ac or battery operated phantom power supplies. Accessories include tie-bars for one or two C-567's, a belt clip, and a wire-mesh windscreen. The unit is omnidirectional with a frequency response of 20-20,000 Hz.

Mfr: AKG Acoustics
Price: $195.
Circle 81 on Reader Service Card

MICROPHONE ADAPTER

• The Model A27M Stereo Microphone Adapter allows two microphones to be mounted on a single stand, thereby providing a convenient method of miking for stereo broadcasting, recording, and sound reinforcement applications. Use of the A27M permits horizontal coincident (mounted on same axis) or closely spaced mounting of microphones in a wide range of directional angles. The user can select the X-Y, ORTF, or other stereo pickup configurations. The A27M permits miking for improved pickup of stereo ambiance in comparison to other methods, such as two or more microphones widely spaced, or individual miking of instruments or instrumental sections.

Mfr: Shure Brothers Incorporated

Circle 82 on Reader Service Card

PROGRAMMABLE METER

• The Model 3440-A Programmable RF Millivoltmeter, calibrated for operation from 10 kHz to 1.2 GHz but actually usable beyond 3.0 GHz, is a state-of-the-art instrument that features a temperature regulated detector probe that eliminates drift and calibration errors caused by changes in ambient temperature. A patented continuous curve-matching circuit ensures smooth tracking over the full input-voltage range—a feature that speeds and simplifies recalibration and maintenance procedures since this approach reduces the number of internal adjustments. Another feature is its monolithic chopper-stabilized amplifier which makes no audible noise and has significantly high MTBF.

Mfr: Ballantine Laboratories, Inc.

Price: $1,215

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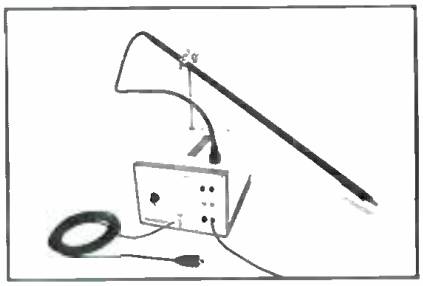
IMPULSE GENERATOR



• The GTS-51 Acoustical Impulse Generator produces an electrical spark adjustable from 0 to 12 joules, with acoustical peak levels up to 140 dB at 1.5 meters, and a 4 to 200 kHz frequency band. To assure safety, the grounded, doubled-insulated generator produces high voltage just prior to discharge only; high voltage dissipates if spark discharge is prevented. The GTS-51 can be fired up to once per second (faster rates optional) with 0.3 dB standard deviation. Application includes acoustical scale modeling, super-imposing acoustical waves, and "N" wave generation.

Mfr: Grozier Technical Systems, Inc.

Price: $3850.00 ($4000 with computer control)

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MICROPHONE MIXER

• Any multiple microphone sound system suffers from reduced gain to avoid the howl of feedback. The more open microphones there are in your sound system, the more the volume or gain must be reduced. Rapid loss of amplification results with addition of microphones. The Model DE-4013 Voice-matic Microphone Mixer restores the lost gain by automatically attenuating inactive microphones. Therefore, as much gain is generated as in a single microphone system without feedback. Background noise and other room ambient noises are eliminated from the system. The modular method of construction allows the buyer to choose 2-4-6-8-10 or 12 channel units.

Mfr: Industrial Research Products, Inc.
Circle 85 on Reader Service Card

LOUDSPEAKER

• The Model 802 loudspeaker system features a multiple array of matched full-range drivers. The close acoustical coupling of the drivers results in a smoothening and broadening of individual driver resonances producing transparent and detailed sound. The full-range driver also eliminates the need for a crossover. Each Model 802 enclosure, the eight drivers are mounted on four separate facets for smooth dispersion. Dual reactive air columns increase the bass output, while lowering distortion by reducing cone excursion at low frequencies. A unique impedance control circuit, internal to the cabinet, lowers the high-frequency power requirements by reducing the slope of the impedance-versus-frequency curve. Other features include: light cones (for transient response) powered by massive magnets, an edge wound aluminum voice coil for each driver, and built-in equalization for wide response.

Mfr: Bose Corporation
Circle 86 on Reader Service Card

MULTITRACK CONSOLE

• The console model UPS 5000 series include several variations designed for precise requirements from the same technology which is characterized by its compactness and durability. There are multiple versions available featuring 10 to 24 input channels.

Mfr: Enertec
Circle 87 on Reader Service Card

CLOSED CIRCUIT INTERCOM SYSTEM

• Minicom is a new, closed-circuit intercom system designed for fixed or portable communication. High performance is provided by contoured, wide-range frequency response and high-volume capability. The unit's noise attenuating headset and noise cancelling microphone further assure that intelligibility will be maintained, even under high ambient noise conditions. Each Minicom system utilizes a dynamic microphone which is boom mounted to a single-muff or double-muff headset. Every headset has its own in-line control box with an adjustable mounting clip. The control box conyains microphone and headphone amplifiers, and includes a volume control and microphone on/off switch. The power pack/main station has a 3-headset XLR type connector, and will handle up to twelve headsets via the use of standard microphone wire splitter cords.

Mfr: Minicom Inc.
Circle 88 on Reader Service Card

ULTRA-MONITOR LOUDSPEAKER

• The UM-1 Ultra-monitor is the latest addition to the Ultra-monitor line. The system includes a control electronics package which features speaker protection via SpeakerSense. SpeakerSense is a portion of the controller circuitry which continuously monitors the voltage at the speakers and acts to reduce the drive to the amplifiers when the safe limits for power or excursion are exceeded.

Mfr: Meyer Sound Laboratories, Inc.
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Ron started as a singer in Philadelphia. He worked the board at several major festivals during the late '60s before entering the studio in England during the early '70s. Along the way, he began producing. As a producer and/or engineer, Ron has worked with The Who, Led Zeppelin, Bad Company, Dave Mason, The Babys, UFO and many others. His most recent project was with The Jefferson Starship.

ON MULTI-TRACKING

"I go for the whole thing. I would rather not do anything for two days than have to take the band down to three pieces and have to build it back up again. I'd rather piece the tracks together than piece the band together. I mean, there'll still be overdubs and things like that, but rock'n roll is so much a feel situation, you know?"

ON DIPLOMACY

"A lot of times, people will stand around and everybody will think the other guy likes it. Nobody will say 'Well, I don't like it.' It won't be till after a while that they find out that nobody ever liked it. They just never wanted to say anything. Now, I'm the guy who goes in there and gets it all out of them—what they like and what they don't like—so there's none of that. I can be the bad guy, sometimes. I'm just real frank and rough. If somebody's not doing something, I like to say it right then and there, so one of the band members doesn't have to say it. It might be a shock, but none of it is taken out of the studio."

ON MUSICAL STYLES

"You know, hard rock stuff is the hardest thing to record. People whacking the hell out of the drums. Guitars turned up to ten. Everything is distortion. People screaming down microphones. The harder the rock, the harder it is to record."

ON TAPE

"Consistency. That's the most important thing. You know, you can work all day for that one thing and you put that tape on and it drops out or it does something. You stay with it until it cracks up. Then you use somebody else's. And I did that a lot. I've used everybody's tape. I've been using 3M tape for five or six years, exclusively. They happen to use the same tape I do, here at The Record Plant. But if they didn't, I would have my own tape in in a second."

SCOTCH 250
WHEN YOU LISTEN FOR A LIVING.

db Editorial

A Tour of Sound Reinforcement

HOW WOULD YOU REACT to an assignment that imposed the following conditions?

Set up a temporary outdoor p.a. system that will adequately cover thousands of people. Get it right the first time, since no pre-event sound checks will be permitted, and there will only be one performance. Make sure the neighbors don't complain about the SPL. Make sure the audience can't see the speaker systems.

Fortunately, none of our May authors received *all* of these instructions, or we'd have nothing much to publish this month. However, one or more of these conditions are pretty-much typical of almost any sound reinforcement job, such as the ones we look at on the following pages.

Last February, Pope John-Paul II visited the United States, and in Boston, he celebrated high mass on the Boston Common, a large park with no provisions whatsoever for anything of the sort. To complicate matters, a large choir was to assist his holiness in the celebration of the mass. A rather complex sound reinforcement system was obviously required, and system reliability would play an important part, since security precautions prevented the audio team from getting to their equipment immediately before, and during the mass. Brad Meyer describes the hardware system that was selected and installed for the job.

A different set of problems confronts the designer of a sound system for an open-air amphitheatre. Here, a reasonable amount of "cut-and-try" may be possible. However, since the installation is to be permanent, the neighbors' feelings must be taken into account. While his holiness may pass this way but once, a long-running gun battle (continuous performances daily) will soon have the neighbors forming their own posse if the racket reaches the front porch. Michael Rettinger describes various ways to handle the problem, short of building four walls and a ceiling.

Hotel ballrooms usually don't have to worry about annoying the neighbors, but they do have the annoying habit of continually being sub-divided at a moment's notice, to suit the requirements of groups large and small. In the afternoon, the entire garden club meets (all 25 of them), while at the same time, there's a wedding reception on the other side of the partition. Then in the evening, there's to be an intimate little dinner for 500. And—except for audio conventions—most ballroom guests don't want to see speaker systems.

The sound system must be able to handle up to four separate p.a. chores simultaneously, and then—also at a moment's notice—become a single system covering the entire ballroom. Many hotels handle the logistics of this sort of task the easy way—by ignoring them. Christine Kofoed describes the sound reinforcement system that recently went into the New York Hilton Hotel, where the problems were confronted in a more realistic manner.

Last month, we looked in on sound *for* the cinema, so this month we'll have a look at sound *in* the cinema. To be specific, Neil Weinstock interviews Jim Forrest, who finds himself very busy these days, as more and more movie theaters are becoming aware of the audience-drawing potential of high-quality audio.

For a change of pace, Bob Metzler reviews the various methods of packaging audio test equipment. Believe it or not, packaging is not one of those parameters to be ignored by the studio engineer.

Next, it's off to London for the Audio Engineering Society's 65th convention, where once again, the Society's British section put on a first-rate show. And then, back home again for *still* more on audio pads, in which we correct some of Edsel Murphy's work, and then offer an expanded pad-designing program. Leave this one alone, Edsel! ■

Look What's Missing From Altec Lansing's Incremental Power System.

NOTHING!

Well, actually there are a few things missing. Like having a rack full of conventional components. Or having to wire and solder. Even the need for back-up amplifiers is missing.

What you're not missing is one of the best power systems made! The Altec Lansing Incremental Power System picks up where traditional components leave off.

With Incremental Power you have more than just an amplifier. Each main frame actually contains a flexible array of input devices, electronic crossovers, line amps and power amps. These plug-in modules can be combined to meet almost any conceivable audio application. Incremental Power is a complete amplification system, prewired and ready to use!

And if you think its versatility is impressive, now check out the specs. Below you'll find the published specifications for an Incremental Power System set up for stereo, triamplified operation. The performance speaks for itself!

And you can bid farewell to back-up amplifiers. If a module goes down in the parallel mode (and they rarely do), it's automatically bypassed and operation is continued with no apparent loss of power or quality.

There's more to tell about the Incremental Power System, so contact our Commercial Sound Sales Department for all the details. Or check the Yellow Pages under Sound Systems for the name of your local Altec Lansing Sound Contractor.

Honestly, with Incremental Power you're not missing a thing. In fact, you get features the competition can only dream about. Altec Lansing's Incremental Power System . . . it stands alone!

	Power Available for L.F. @ Mfg. Rec. Load	Power Available for M.F. @ Mfg. Rec. Load	Power Available for H.F. @ Mfg. Rec. Load	Electronic X-over	Cooling	Weight	Height	Reliability
Incremental Power System	300 Watt Total 150 Watt/Ch. @ 8 ohm	150 Watt Total 75 Watt/Ch @ 16 ohm	150 Watt Total 75 Watt/Ch. @ 16 ohm	2 or 3-way Selectable Freq.	Built-in fan blows side-to-side	70 lbs	7"	Excellent each unit factory tested

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ALTEC LANSING

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MICHAEL RETTINGER

Sound Reinforcement Systems in Amphitheatres

With today's high music level rock-and-roll, reinforcing an amphitheatre for sound (while keeping the neighbors and the law happy) can prove to be quite an interesting proposition.

SOUND REINFORCEMENT SYSTEMS in open-air amphitheatres are often the cause of noise complaints from residential areas adjoining the entertainment facility. Unfortunately, there may be even more complaints on those pleasant summer evenings, when temperature inversion (temperature rising with elevation) is apt to return part of the sound power to distant locations, by refraction. Nowadays, reproduced rock-and-roll, with its high music levels, is of particular concern to noise-sensitive listeners in the neighborhood.

In calculations for sound level reductions with distance, it becomes important to consider not only the type of space over which the sound "rays" have to travel, but also, the extent of the sound source.

HIGH PRESSURE SOUND REINFORCEMENT

FIGURE 1 shows a so-called high-pressure sound-reinforcement system, with but one or two loudspeaker systems installed above the stage! When the sound level at 15 feet from the source is 120 dB-A, then at 150 feet (near the central part of the audience) the level will be:

$$L = 120\text{-}20\log(150/15)$$
$$L = 100 \text{ dB-A}$$

The above equation takes the ratio of the two distances and expresses that ratio as a dB difference. Since what is being measured is sound-pressure, which varies in proportion to change in distance, the level diminishes 6 dB for each doubling of the distance, or 20 dB if distance changes by a factor of ten.

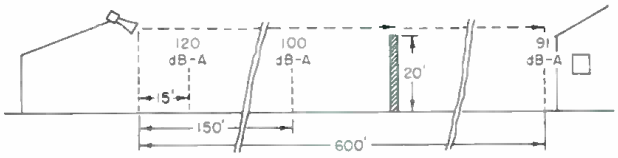

Figure 1. High pressure reinforcement system.

The diagram shows a 20-foot high wall or barrier at the rear section of the amphitheatre. A sound ray from the speaker system just barely contacts the top of the wall on its travel to the nearest resident, 600 feet distant. The sound level reduction of such a barrier amounts to no more than 6 dB at 500 Hz. Also, reflections from sound rays that have struck the ground in the

Michael Rettinger is an acoustics consultant and author of "Acoustic Design and Noise Control."

The world's most advanced hand-held wireless microphone

After three years of extensive research, Vega proudly announces two all-new hand-held wireless microphones designed for use by discriminating professional performers, or anyone who must have superior sound quality without a mic cable. These microphones are a substantial improvement over all previous hand-held wireless mics, offering not only top audio performance, but also a revolutionary case/antenna system. Because the antenna is incorporated into the microphone housing, unsightly dangling wires and "rubber duckies" have been eliminated. This new design assures that the RF output is equal to, or better than, that which could be achieved with an external antenna—no matter how the microphone is held. Light weight and a gracefully contoured shape contribute to the mic's comfortable, well-balanced feel.

The Model 80 is equipped with an Electro-Voice EV-671 mic capsule, and the Model 81 utilizes a Shure SM-58 capsule. Due to very low distortion and a flat transmitter-to-receiver frequency response of ±2 dB from 40 Hz to 15 kHz (±1 dB 100 Hz to 12 kHz), the sound is as clear as you would expect from the best of conventional hard-wired microphones. Used with a Vega "Dynex" receiver, overall system dynamic range is better than 90 dB, eliminating the mixer gain control riding and distortion caused by compresion and clipping. (The mics are available without Dynex for compatibility with older Vega receivers or those of different manufacture.)

Both models use a standard 9V alkaline battery, offering from 7 to 9 hours continuous use, and a range of up to 1000 feet. Since operation is in the 150 to 216 MHz VHF range, there is no interference from CB radios or FM broadcast stations in normal use. An audio gain control on the bottom of the case lets the user adjust the mic's sensitivity. Optimum setup can be verified with an adjacent LED indicator that doubles as a battery monitor. The mics also include a Power On/Off switch, plus a separate Audio On/Off switch so you can keep the receiver quiet when you want to temporarily silence the mic.

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A view looking out from the stage level.

seating area tend to reinforce the direct sound from the stage and the stage loudspeakers. As a result, the sound level reduction may be only 4.5 dB for double the distance instead of the 6 dB attenuation mentioned above. To account for this 1.5 dB change, the next equation uses the coefficient of 14.5 instead of 20. It also includes the 6 dB barrier loss. Hence, at the nearest neighbor the sound level will be:

$$L = 120\text{-}6\text{-}14.5\log(600/15)$$
$$L = 91 \text{ dB-A}$$

This level is 41 dB above the daytime noise level limit of 50 dB-A specified in most anti-noise ordinances. After 10 PM, it is 51 dB above the nightime limit of 40 dB-A.

A 40-foot high rear wall would represent a barrier with an effective height of only 20 feet, since as was shown, a 20-foot high barrier barely touches the sound ray from the loudspeaker to the nearest resident. Such a barrier is able to reduce the sound level at 600 feet by only another 11 dB. At 80 dB-A this is still considerably above day and night noise level limits. Such a construction is also likely to be considered a case of "visual pollution," with additional public complaints.

It is seen, therefore, that for amphitheatres on level ground and near residential areas such a sound-reinforcement system is out of the question as far as the acoustic comfort of the environment is concerned.

CONTROLLING SOUND PROPAGATION

In the case of the amphitheatre at Universal Studios, Universal City, California, problems in sound propagation were encountered, even though the theatre is in a canyon near a mountain top, and the nearest neighbor is 2800 feet in distance. It became necessary to erect a 24-foot concrete block barrier that completely surrounds the theatre, and to install special loudspeaker baffles above the units to minimize the transmission of reproduced rock-and-roll music into the neighborhood.

LOW PRESSURE REINFORCEMENT SYSTEMS

FIGURE 2 shows a so-called low-pressure sound reinforcement system for the same hypothetical amphitheatre described earlier. It consists of many small loudspeakers, installed on 10-foot high posts within the spectator area. Such a system is able to reduce the transmission of reproduced music because of the following three conditions:

1. The sound radiated by the loudspeakers strikes the ground at a relatively small angle of incidence (the angle between sound ray and vertical to ground), so that much of the signal is reflected skyward.

2. Because of the lower elevation of the speakers, the 20-foot high barrier can intercept a larger amount of the signal and hence is able to achieve an additional 10 dB of sound level reduction; that is, 16 dB at 500 Hz.

3. The sound level at the center of the seating section is still 100 dB-A as far as the total sound from all loudspeakers is concerned. The sound level from each unit is much less at 5 feet from the diaphragm, and is estimated as 81 dB-A, but this is strengthened some 19 dB (10log 81 = 19 dB) by the 80 other loudspeakers. However there is the disadvantage that the sound source is now broadened emitting essentially-cylindrical waves, whose level decreases only 3 dB for double the distance.

The following equations provides for only a 3 dB decrease in

New realms of expression from MXR.

The Pitch Transposer is MXR's newest addition to our professional line. It is one of our most innovative products, and possibly the most revolutionary signal processor in the music industry today. It is a unique, high-quality unit which provides a cost effective and flexible package for today's creative artists.

The Pitch Transposer extends your musical boundaries by creating live instrumental and vocal harmonies. It has 4 presets which allow the artist to predetermine the intervals to be processed. Transposed intervals can be preset anywhere from an octave below to an octave above the original pitch. The chosen interval is activated by means of touch controls or a rugged footswitch. LED indicators display which of the four presets has been selected.

A mix control is provided, enabling the unit to be used in one input of a mixing console, or with musical instrument amplifiers. A regeneration control provides for the recirculation of processed signals, creating more and more notes, depending upon the selected interval. This results in multitudes of voices or instrumental chords. An entire new range of sound effects and musical textures, unattainable with any other type of signal processor, is suddenly at your fingertips.

With many other pitch transposition devices a splicing noise, or glitch, is present. The MXR Pitch Transposer renders these often offensive noises into a subtle vibrato which blends with the music, and is, in some cases, virtually inaudible. The result is a processed signal which is musical and usable.

We have been able to maintain a high level of sonic integrity in this most versatile signal processor. The frequency response of the processed signal is beyond 10 kHz, with a dynamic range exceeding 80 dB.

A micro computer based display option allows the user to read the created harmonic interval in terms of a pitch ratio, or as a musical interval (in half steps). This unique feature allows the pitch to be expressed in a language meaningful to both musicians and engineers.

We designed our Pitch Transposer as a practical musical tool for those actively involved in creative audio. It reflects our commitment to provide the highest quality signal processors with the features and performance that will satisfy the creative demands of today's musical artist. See your MXR dealer.

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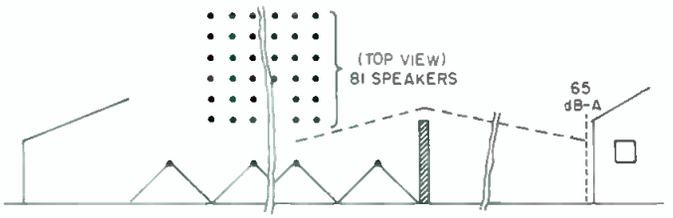


Figure 2. Top-view of the 81 Speakers.

level for each doubling of distance by using the coefficient 10 instead of 20. By using the calculated equation, sound level at 600 feet from the amphitheatre stage now comes to:

$$L = 100\text{-}16\text{-}10\log(450/5)$$

$$L = 65 \text{ dB-A}$$

This level is still 15 dB above the daytime noise level limit and 25 dB above the nighttime limit specified in most residential areas.

KEEPING THE NEIGHBORS HAPPY

A 30-feet high barrier would lower the level at the nearest resident by only another 4 dB, which would still not be enough for the complete insurance against public noise complaints, unless the signal levels from the loudspeakers are attenuated or the loudspeakers themselves are lowered to, say, a height of 8 feet.

To assure adequate reception of the signals in such a low-pressure system, it is also necessary to introduce time delay to the various reproducers, so that the signal from the stage doesn't arrive later than the instantaneously-reproduced signal from the overhead speakers. (For a practical application of time delay, see *Reinforcing the Pope* in this issue of **db**—Ed.) Of course, a sure-fire solution to such noise level problems consists of enclosing the amphitheatre completely, thereby transforming it, essentially, into a concert hall.

A less than sure-fire solution consists in erecting only a roof, with a highly sound-absorbent underside, as was done at the amphitheatre at Magic Mountain in Valencia, California.

In passing, it may be noted that similar quiet-disrupting conditions exist in football and baseball stadiums, unless they have a very-high-rising seating section, as in the case of the Coliseum and the Dodger Baseball Stadium in Los Angeles, California.

MAGIC MOUNTAIN AMPHITHEATRE

The spectator section of the amphitheatre under consideration consists of a sloping canopy or roof, a rear wall, and open or partially-open sidewalls. The front part of the structure facing the stage is also open. Both the underside of the overhead cover and the rear wall carry a weatherproof and non-defaceable sound-absorbent treatment to reduce radiation towards the stage by the time-delayed signal reproductions from the loudspeakers installed below the roof. A view towards the stage is seen in FIGURE 3.

Such a structure is able to reduce the outdoor transmission of the reproduced music by being contained to some extent within this "shed." This is made possible by employing a few low-positioned loudspeakers to cover the listeners adequately as compared to blanketing them with reproduced sound from a stage-located "high pressure" emitter. Furthermore, the sound radiated out of the enclosure suffers reflection by the acoustic mismatch between the interior seating area and the wide-open exterior surrounding the facility, while at the same time considerable sound energy is absorbed by inter-reflections within.

ARRANGING THE DESIRED SOUND

FIGURE 4 shows the plan and elevation of such a canopied amphitheatre, with a seating capacity of 1500 persons. Allowing 5 square feet per spectator, exclusive of aisle space, the floor area comes to 7500 square feet, and with a 500 square foot aisle space, totals 8000 square feet, as shown in the figure.

Assume 40 rows of seats, 2.5 feet distant from each other. With each row rising 5 inches above the preceding one, the total floor rise is 16.7 feet.

The figure shows only six loudspeakers to cover a floor area of 8000 feet. This is a very tentative estimate and was based on the following calculations. Assume that the radiation angle of the loudspeakers over most of the audio frequency range is 90 degrees. The circular coverage area on the floor is H^2, where H is the slanting distance of the loudspeaker. The slanting distance is that distance along a line drawn between loudspeaker source and the listener position. If H = 20 feet, the number of loudspeakers is $8000/3.14 \times 20^2 = 6.37$. For best sound coverage, "fill-in" units are sometimes used, a fill-in unit being like the center dot of a dice showing 5 points.

For the loudspeaker arrangement shown in the figure, three sound-delay units are necessary. For instance, when the distance from seating area to stage is 113 feet, and sound requires .1 seconds to travel this distance, the delay should be set for .1 seconds.

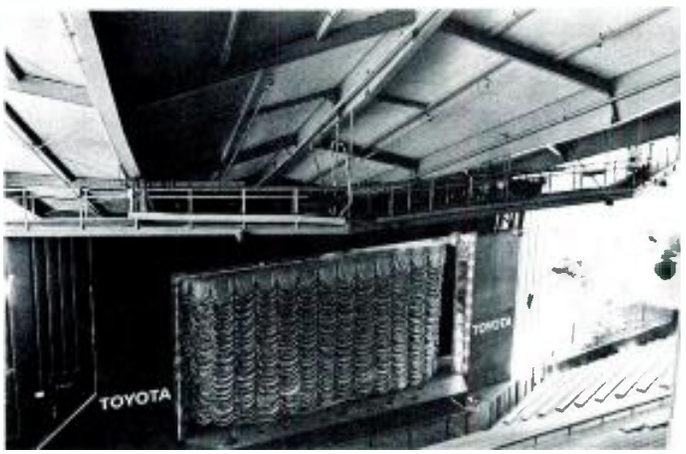
REVERBERATION TIME FOR AMPHITHEATRES

It is difficult to calculate the reverberation time in the covered seating area, since all reverberation time formulas assume uniform sound distribution in a room, which is difficult to achieve in an enclosure with three open sides. From this investigator's experience, however, considerable sound absorptive treatment was necessary in the covered theatre at Magic Mountain, California, to achieve satisfactory hearing conditions in the spectator area.

KNOWING YOUR LIMITS

Let us assume that, on stage the performers are facing north. Behind the stage, towards the south, there is a noise-sensitive residential area. By installing a parapet on the stage roof and mounting plywood or plastered "wings" or reflective panels on the sides of the stage, much of the sound radiating out of the seating section towards the stage will be reflected to the north by the parapet and the wings, thus lowering still more the sound transmission towards the south. These reflecting baffles should be treated sound-absorbently so as not to direct too much sound to the north, even though the area there is assumed to be less noise-sensitive (being zoned "commercial") than the south.

View towards stage of canopied amphitheatre at Magic Mountain, Valencia, Ca.



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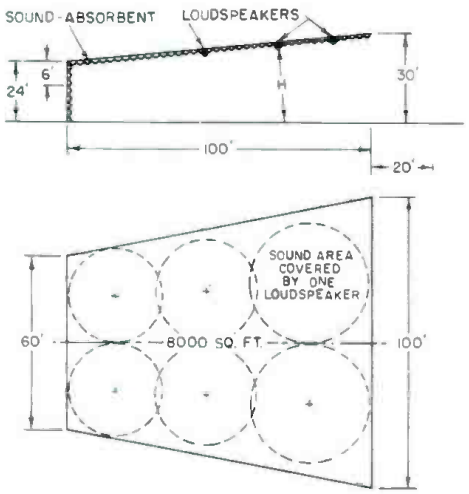


Figure 4. Elevation and plan of canopied amphitheatre.

It is also desirable, if possible, to erect other structures, like buildings or even a concrete block wall, to the open sides of the canopied seating section, so as to minimize the transmission of sound in the easterly and westerly directions.

The seats for the spectators should rise adequately towards the rear or north of the structure to allow a good unobstructed view of the stage. To further reduce sound reflections in the seating section it is recommended that at least the aisles be covered with an indoor-outdoor carpet.

Both the rear wall and the roof should be substantially sound insulative, to reduce sound transmission into the open. The roof may consist of metal decking. The rear wall may be either concrete blocks or stucco.

It should be noted that this type of construction allows the complete closing in of the canopied structure, should the transmitted signal in the residential area be found objectionable later, either because of a noise level limit change or other reason.

Besides being able to reduce the sound transmission into adjoining residential areas, such a canopied amphitheatre also has other advantages:

1. The seating area is shielded from overhead noises, such as aircraft flyovers.
2. It allows the all-weather performance of concerts and other entertainment events.
3. By locating the control room below the roof, the mixer has a full view of the stage, and can readily control the sound level within the seating area because he is in it too. The booth may also be used as a control room for stage lighting effects.

THE TANGLEWOOD MUSIC SHED

There is nothing new about canopied amphitheatres. One of the finest concert facilities in the world is the Tanglewood Music Shed in Lennox, Massachusetts. This incredibly beautiful outdoor music theatre has an internal seating capacity of 6000. An additional 6000 people may sit about on the lawns outside the "shed." The acoustics of the structure are highly prized by many famous conductors and performers. Isaac Stern, the famous violinist, considered it to have a brilliant, ringing sound with wonderful definition.

In this well-known and highly-publicized entertainment facility, the lower portions of the sidewalls are open, while the

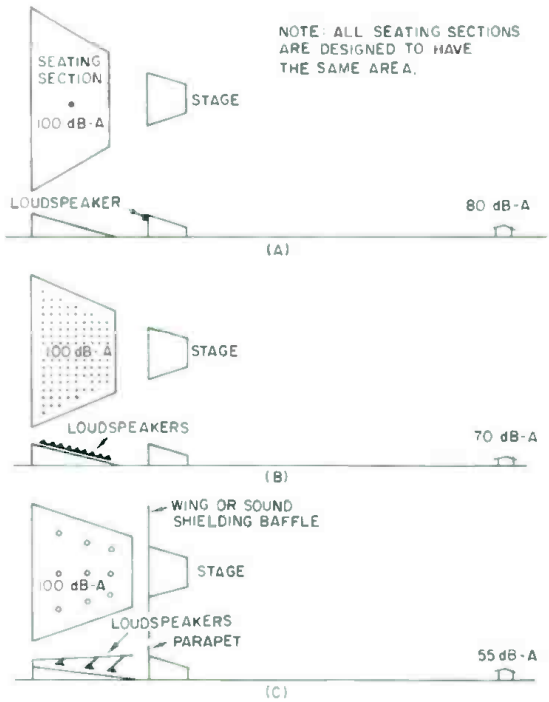


Figure 5. Calculated A-Weighted sound levels at 600 ft. from the seating area of amphitheatres employing different sound-reinforcement systems in the open (A,B) and canopied (C) unit together with various types of sound baffles.

upper ones carry ¾" painted fiberboard. Since the shed is located in the Berkshire Hills, sound transmission to the far residences is no problem.

"OPEN" VS. "CANOPIED"

From on-site calculations, as well as from measurements obtained from a scaled-down acoustic model of a canopied amphitheatre, it has been learned that the mid-range, or 500-hertz sound attenuation, of such a facility is in the order of 25 dB, compared to an open-air, unbaffled facility with a high-pressure sound-reinforcement system in which one or two high-power loudspeakers are placed above the proscenium arch of the stage.

FIGURE 5 is a pictorial representation of the A-weighted sound levels which may be expected at 600 feet from the seating area of amphitheatres employing different sound-reinforcement systems in the open and in a canopied unit.

Diagram A on top of the figure shows the "conventional" amphitheatre with a raised seating area and a high-pressure sound-reinforcement system. The stage affords very little shielding because the rear elevation of the spectator section is practically the same as that of the stage, and the rear width of the seating area is too great for applying baffles to the sides of the stage. The noise level at the nearest neighbor, 600 feet distant, is 80 dB-A.

Diagram B illustrates a low-pressure sound reinforcement system, employing many loudspeakers installed on 10-foot high posts. The estimated sound level at the nearest resident comes down to 70 dB-A.

Diagram C represents a canopied amphitheatre with wings to the sides of the stage and a parapet on top of the stage. The sound-reinforcement system within the enclosure is "hybrid" between the high- and the low-pressure systems. The noise level at the nearest resident is estimated to be 55 dB-A. ■

BRAD MEYER

Reinforcing the Pope in Boston

Sophisticated sound system including digital delay and reverberation equipment lets the Pontifical message go forth.

ON OCTOBER 1, 1979, His Holiness, Pope John Paul II celebrated a pontifical mass on Boston Common. The entire downtown area was closed to vehicular traffic at midnight on the day of the event, and over a half a million people came, by mass transit or on foot, to attend.

The Boston Common, together with the adjacent Boston Public Garden, is the only large open space in the central part of the city. Partly wooded, and with gently rolling contours, the Common itself covers forty-eight acres. For those readers who are used to dealing with indoor spaces, this comes to over two million square feet. Some estimates indicated that virtually the entire area might be filled with people. The majority of these people would have no line of sight to the pavilion where the Pope would be standing, and the farthest point on the Common from the pavilion was over 1,700 feet away. The event clearly required an unusually large and carefully designed sound system.

The job of designing this system was given to the well-known Cambridge, Massachusetts, acoustics firm of Bolt Beranek and Newman, Inc. The equipment used was provided and installed by Capron Lighting and Sound of Needham, Massachusetts. The time-delay equipment necessary for the proper operation of the system was provided by Lexicon, Inc. of Waltham, Massachusetts. The completed system was operated jointly by BBN and Capron. Capron also supplied loudspeakers by JBL and Altec, crossovers and mixing board by Yamaha, power amplifiers by BGW, equalizers by White, and AKG condenser microphones.

LOUDSPEAKER SITING STRATEGY

The Papal pavilion was located on the west side of the Common, just north of the entrance to an underground garage (see FIGURE 1). This spot offers a good view of the pavilion to a large number of spectators because of the natural amphitheater formed by the hill to the east, on top of which stands the Soldiers-Sailors Monument. The BBN staff members in charge of the design, senior consultants Thomas R. Horrall and Lawrence Philbrick, decided to cover the entire area west of this hill with sound by using two arrays of loudspeakers, each on its own 50-foot tower. The main arrays each consisted of: four horn-loaded low-frequency cabinets, each cabinet containing two 15-inch woofers; three stacks of four long-throw high-frequency horns, whose radiation pattern covered a span of 20 degrees vertically and 40 degrees horizontally; and four 40-degree by 60-degree high-frequency horns.

The author is an independent audio consultant whose company, POINT ONE AUDIO, is located in the Boston area.

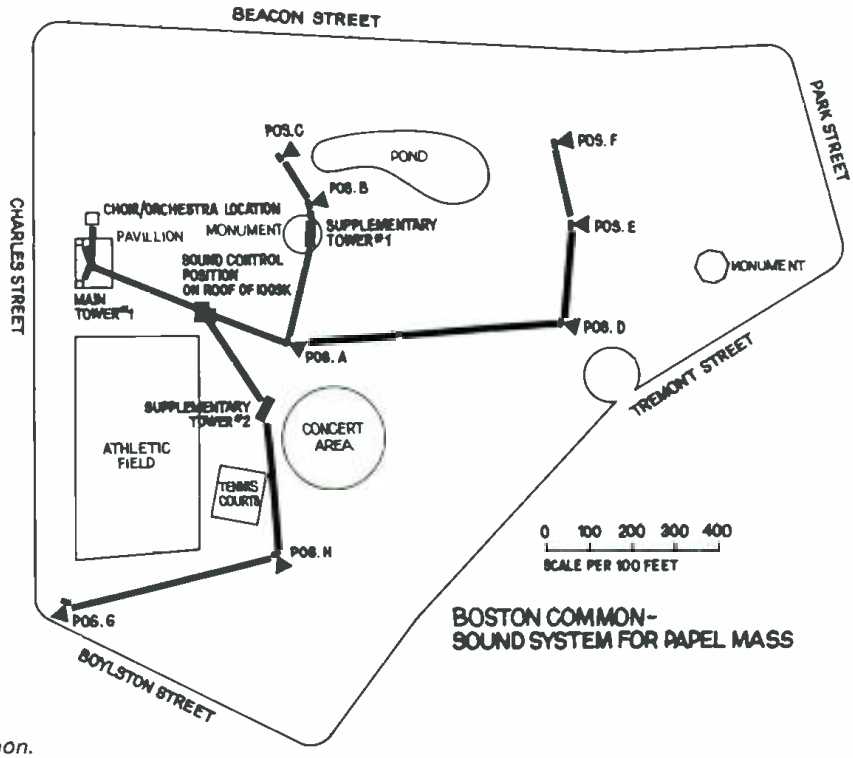


Figure 1. Boston Common.

The 40 x 60 horns were aimed downward about 20 degrees from the horizontal; their function was to cover the areas near the towers. The areas farther out were covered by the stacks of long-throw horns. Stacking the drivers in this manner reduces the vertical dispersion substantially. The on-axis sound pressure level is increased by 12 dB, and the possibility of feedback is reduced. The prevention of feedback was quite important because the main towers were firing as much as 800 feet, and yet they were located just 50 feet from the platform where the celebrant stood. Because there was music both before and during the mass, the sound system had to deliver high power levels over a wide bandwidth. The main arrays had a theoretical maximum output of 95 dB SPL at 600 feet, using conservative assumptions of both directivity and driver power handling.

The two main towers could cover the western part of the Common, but they left 70 percent of the total area uncovered. Of immediate concern was the area behind the hill directly to the east of the pavilion. To cover this area a 30-foot supplementary tower was erected, and on it were placed two bass cabinets, each with two drivers, two stacks of four 20 x 40 long-throw horns, and a single 40 x 60-degree horn to cover the area near the base of the tower. This was supplementary Tower #1.

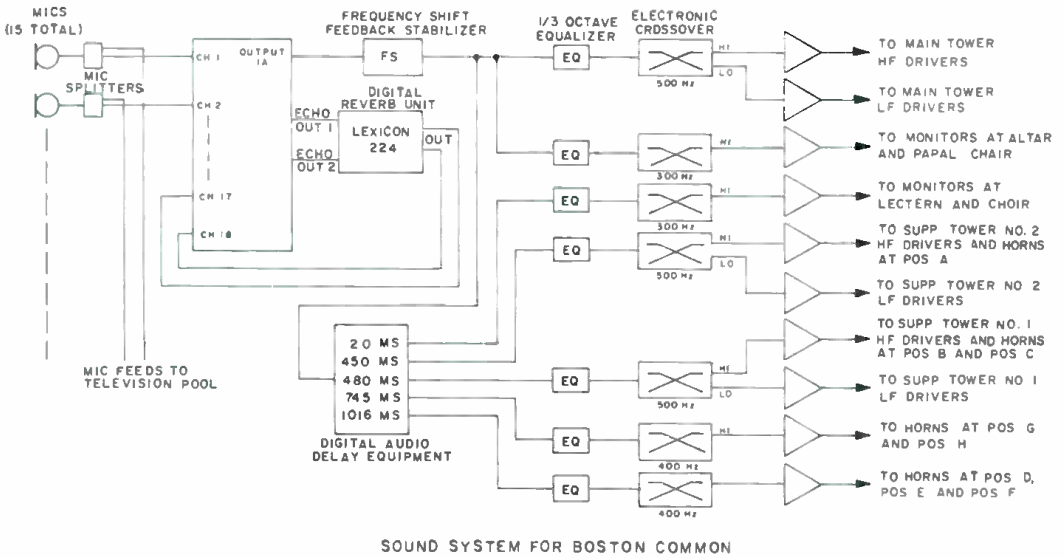
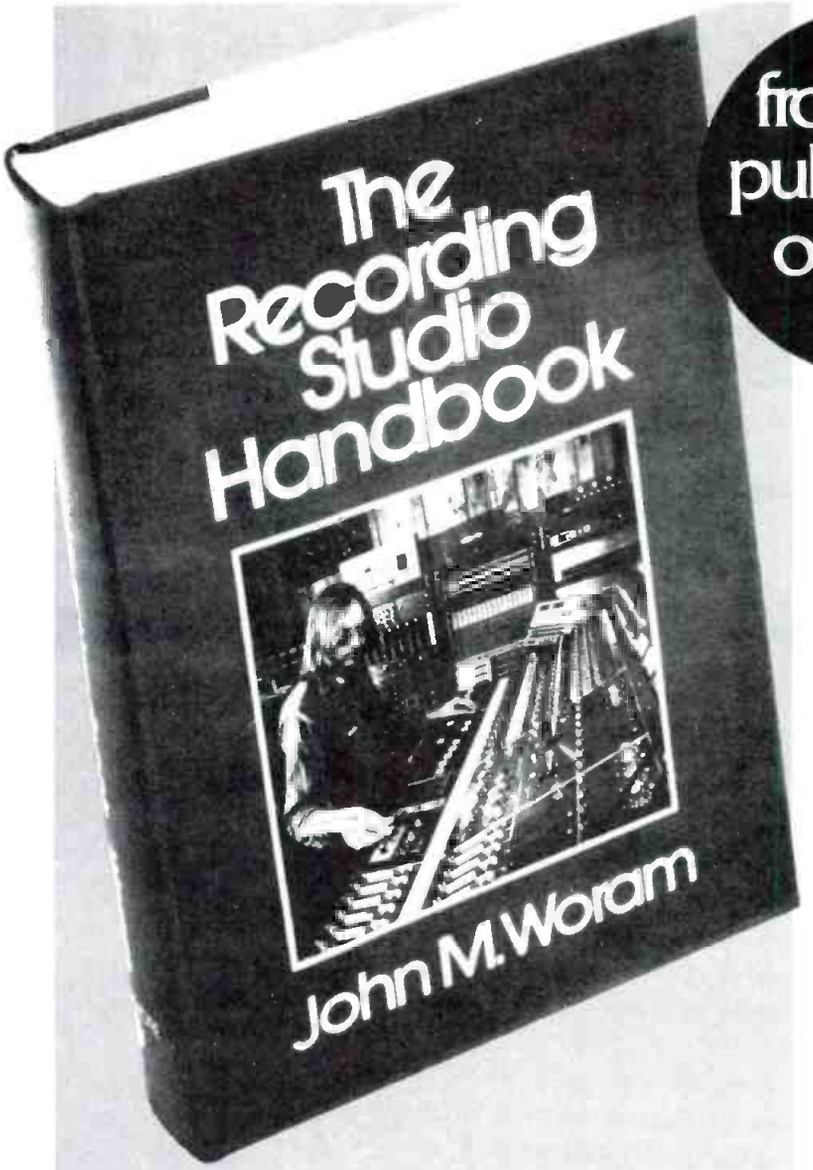


Figure 2. Sound systems schematic.

An identical tower, supplementary Tower 2, was placed 500 feet to the southeast of the pavilion. Situated on the shoulder of a low hill, this tower covered the area between this hill and Tremont Street. Remaining dead spots on the central part of the Common were taken care of with 40 x 60 horns mounted in trees, one each at Positions B, C, and H, and a stack of two at Position A. The eastern end of the Common was covered by single 40 x 60 horns, also mounted in trees, at Positions D, E, and F. Finally, sound was sent southward from the corner of Boylston and Charles Streets by means of a single 40 x 90-degree high-frequency horn.

The control center for the system was set up under a tent on the roof of a kiosk 300 feet from the pavilion. This kiosk covers one of the exits from the underground garage. Microphone lines to the control center and cables to all loudspeakers in the area of the pavilion were run underground through the garage; wires to the supplementary towers and to the various single speakers were run through the trees, so that there was no danger of damage from the crowd.

The Lexicon Time-Delay Distribution System.



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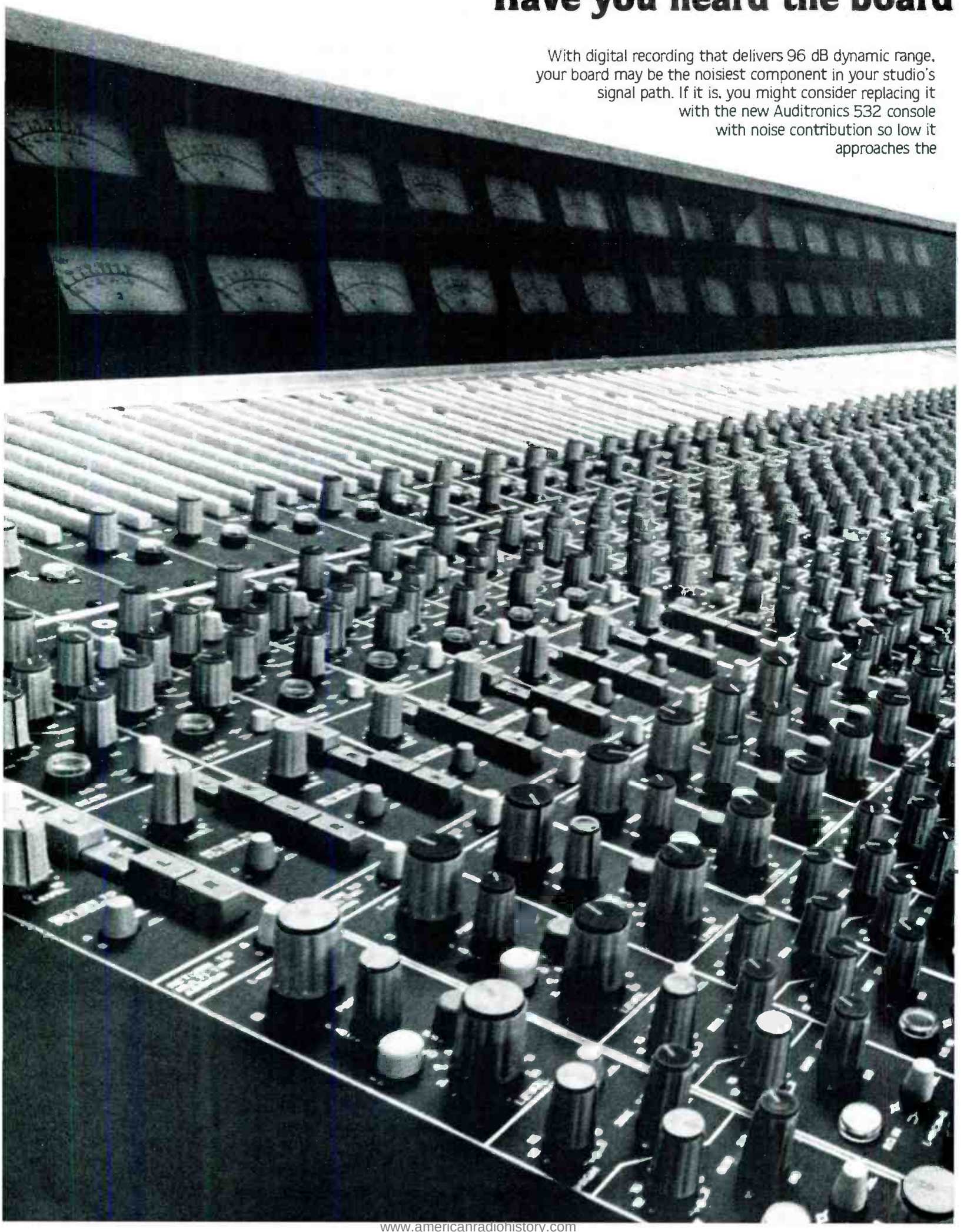

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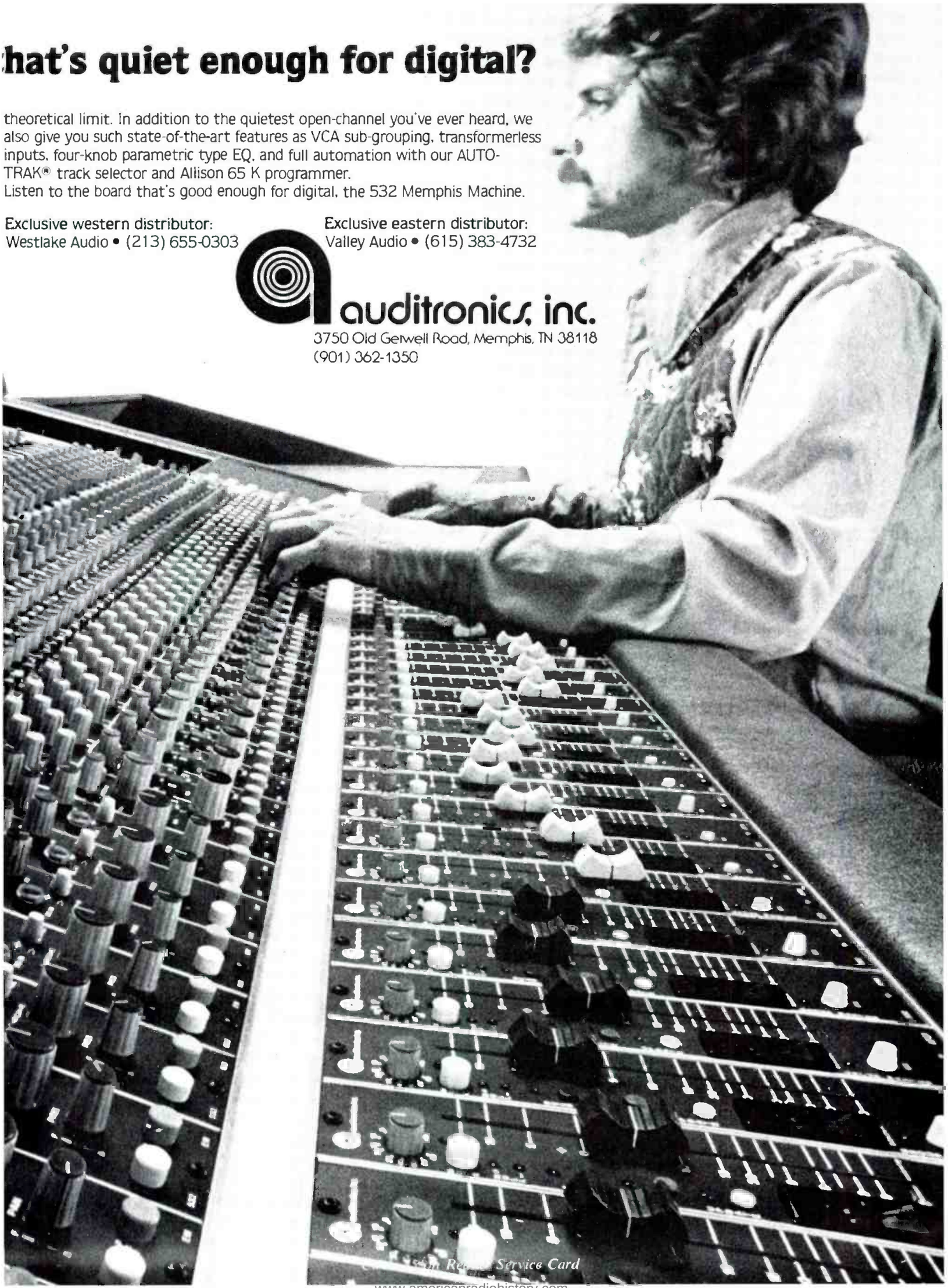

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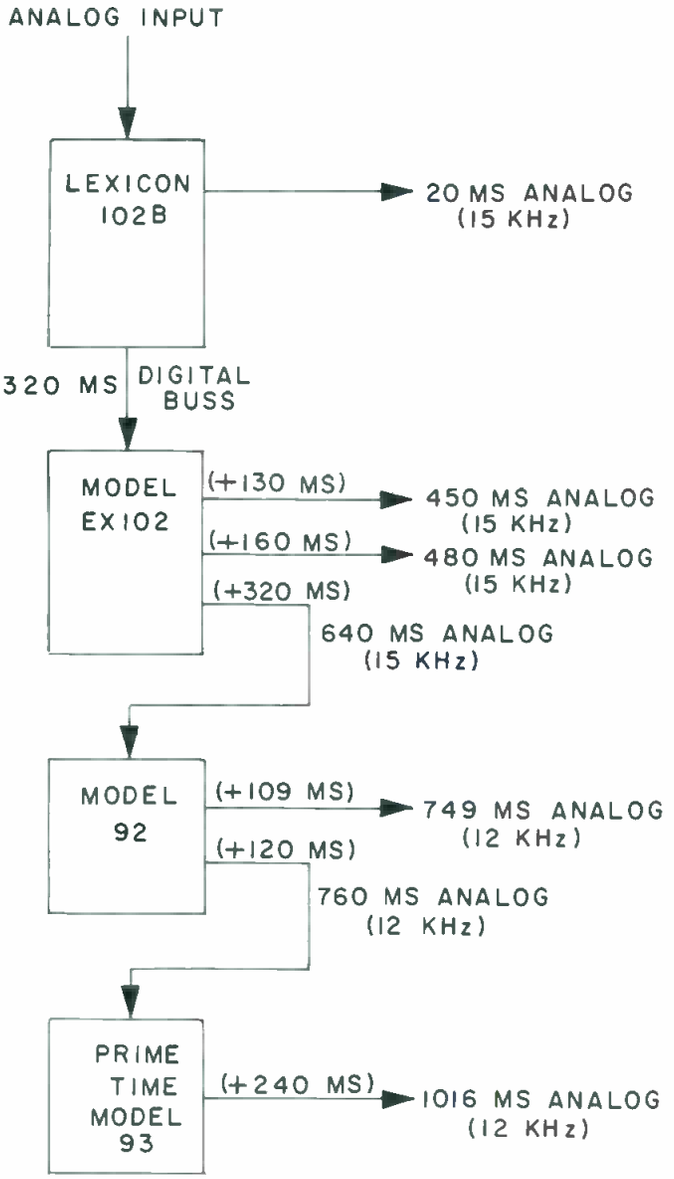

Figure 3. Delay Distribution System.

SOLVING THE DISTRIBUTED SOUND PROBLEM

There is, of course, more to covering an area this size than having enough speakers and amplifiers. A listener standing next to Position A hears the sound from the speaker at A delayed by perhaps 10 milliseconds. But he is 538 feet from the nearest main tower. This means that the sound reaching him from the tower will be delayed by 476 milliseconds (538 feet / 1,130 feet per second). This amount of delay would hopelessly garble speech, and its effect on music would be even worse. A system of this size requires extensive use of time delays to cure these problems.

Any sound system, whether or not it uses time delay, must meet two criteria. The first of these is *intelligibility*. The brain will integrate two highly correlated sounds and treat them as one if they arrive at the ears within about 40 milliseconds of each other. It is therefore necessary to adjust the time delays so that there are no two speakers which deliver the same sound to a listener more than 40 milliseconds apart. In the case of the listener standing near Position A, the difference between the path lengths from the main tower and the speaker at A produces a difference in arrival time between the two of 476 milliseconds. To correct for this, the signal going to the speaker at A must be delayed between 436 and 516 milliseconds.

The second criterion for a good sound system is *naturalness*. In an auditorium, where the sound system is used to reinforce sounds from the stage that are audible but too soft, a clever designer will adjust the time delays so that the sound arrives at any listener, first from the stage, and then from the speakers. The brain will then locate the sound on the stage on the basis of this first arrival, and assume that the sound from the speakers is part of that first arrival. This is called the precedence, or Haas effect. However, in an outdoor installation of the size we are dealing with here, there is no possibility of a significant amount of sound from the original source reaching the listeners. What takes the place of the live sound in the designer's considerations is the signal from the two main towers flanking the pavilion. Delays were therefore calculated so that the first arrival would always be from these towers.

In order for this to be true for all listeners, it was necessary to direct all the sound outward from the pavilion. If this were not done, the supplementary drivers would be feeding simultaneously to listeners whose path lengths from the main towers differed by more than 90 feet, or 80 milliseconds. There would then be no single value for the delay of the supplementary speaker that would provide natural sound for all within its range. As the system was actually installed, with all the speakers pointing away from the pavilion, a spectator in the sound field of one of the supplementary speakers has that speaker between him or her and the main towers, so that the difference in arrival times from the two sources remains sufficiently close to the value provided by the time delay.

Overview of the Sound Control Center.

DIGITAL DELAY ARRANGEMENT

The equipment used for the time delays is shown in FIGURE 3. Ideally a single Model 102 system with two or three extension chassis normally would be used in a system of this size. Since 102 extension chassis are connected via a digital bus, no signal degradation would occur as additional chassis with more delay and outputs are added. However, due to the equipment available under the time constraints on this job, Lexicon Models 92 and 93 Prime Time units were cascaded with an analog connection to provide the last two delayed outputs in the chain.

A Lexicon Model 102B with a single output module was used to provide a 20 millisecond delay for monitor speakers at the choir, orchestra and at the lectern, which stood at the front of the pavilion. This delay was necessary to fill in the time it took for sound to arrive from the tops of the main towers, which was about 60 ms. The monitor speakers covering the altar and the Papal chair were far enough from those locations to provide sufficient delay acoustically.

From the 102B the sound, delayed 320 ms, and still digitally encoded, was sent to a Model EX102 extension unit. The EX102 was equipped with three output modules—one providing 450 ms for supplementary Tower 2 and Position A, one providing 480 ms for supplementary Tower 1 and Positions B and C, and the third sending an analog signal with a total delay of 640 ms to the next link in the chain, a Lexicon Model 92. The 92 sent an analog output, delayed by an additional 105 ms for a total of 745 ms, to Positions G and H, and a 120 ms signal, total delay 760 ms, to a Lexicon Prime Time Model 93. The Model 93 added 256 ms more of delay and sent a signal with a total delay of 1,016 ms out to Positions D, E, and F. The rack containing the delay equipment is shown in FIGURE 4; the signal progresses through it from bottom to top. Performance of the entire delay chain was measured after assembly. After having gone through more than a full second of delay, and having been converted from analog to digital and back three times, the signal still had a bandwidth of 12 kHz, a signal-to-noise ratio of 84 dB, and total harmonic distortion of less than 0.12% at any frequency.

DIGITAL REVERB ADDS AMBIENCE FOR CHOIR

There was choral music during the mass, and a concert involving chorus, orchestra, and soloists beforehand. In order to provide a somewhat more church-like sound for the music than would ordinarily be obtainable in a virtually anechoic outdoor environment, Lexicon provided a Model 224 digital reverberation unit, which was inserted in the echo loop of the main console. The 224 is an extremely sophisticated microprocessor-controlled, programmable reverb system which can provide up to eight different programs which can simulate the sound of plates or acoustic chambers. It also has programs designed to simulate the reverberation of concert halls, both large and small. Times for 60 dB of decay are settable separately for the lower and upper parts of the frequency range, as is the crossover frequency between the two. There is also a control which sets the frequency at which treble roll-off of the reverberated sound begins, another which places the listener forward or backward in the acoustic space, and a pre-delay control which determines the time delay between the direct sound and its first reflection in the onset of reverberation.

For the choral and orchestral pieces, the large concert hall program was called up, and the following settings dialed in:

Bass decay time: 2.8 sec.
Midrange decay time: 2.2 sec
Crossover frequency: 780 Hz
Treble decay: 3.7 kHz
Depth: 2 (on a scale of 0 to 7)
Predelay: 24 milliseconds

The output of the Model 224 was used sparingly in the final mix by Philbrick and Horrall, who were reluctant to let the sound become too reverberant for fear that it would sound unnatural outdoors. Nevertheless, the chorus sounded noticeably fuller and better blended, with a slight accompanying sense of room acoustic, when heard from in front of the pavilion. Both the frequency response and the level of the music were satisfactory as well. With 5,400 watts of amplifier power available and drivers being used conservatively, the system was never driven into audible clipping.

Main Tower #1 (40 x 60 horns in 2nd tier not in final position.)

Supplementary Tower #1.

SOUND SYSTEM RATED BEST ON POPE'S VISIT

For a job of this size and complexity to have come off as smoothly as it did on such short notice is a testament to the skill and experience of all involved. The project was assigned only five weeks before the event, which took place on a Monday. Sound checks were supposed to be run on the Saturday previous, but were held up by rain until the next day. Heavy security precautions dictated the closing of the entire pavilion area for most of the three days preceding, and the area that included the control center on the kiosk was closed to all sound contractor personnel until 2:00 p.m. on Sunday, and then again after 10:00. Due to a failure in communication with the Secret Service, BBN, Capron and Lexicon personnel were denied access to their equipment for much of Monday as well. There was, therefore, no time to balance the various sets of drivers on the towers, to equalize the orchestral or choral microphones, or to do more than a quick adjustment of EQ on the sound from the pavilion. Rain fell steadily throughout the mass, and there was enough wind to blow a steady fine drizzle back under the canopy as well as into the equipment/control center. Fortunately, the latest AKG condenser capsules are made with a diaphragm material that is designed to handle high humidity; although there was a good deal of anxiety amongst all concerned about the likelihood of failures, and no one had access to the pavilion to change microphones, there was only one failure, and that was of a capsule which stood directly under a steady stream of water coming off the roof of the pavilion. Those who followed the Pope's visit after his Boston stopover agrees that the sound system in Boston was the best sounding and most reliable one of the tour. ■

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CHRISTINE KOFOED

The New York Hilton Makes a Sound Investment

In keeping with their policy of quality customer service, the New York Hilton sets to the task of a major overhaul in their Grand Ballroom sound system. Enter Andrews Audio Consultants.

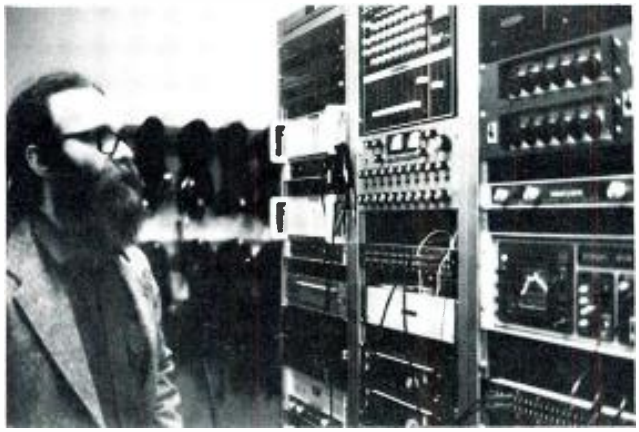
RARELY DOES A MAJOR New York hotel recognize the need for upgrading its meeting room sound systems. Usually, it is the customer who notices, neglects to inform the hotel, and then looks elsewhere when it's time to schedule the next event. It is not often either that a major New York hotel, an important link in one of the largest hotel chains in the world, tries unsuccessfully for five months to find a contractor willing to investigate their problems, or even to return their telephone calls. So perhaps it is not so surprising that the job of designing and installing the sound system in the Grand Ballroom of the New York Hilton went to a consulting firm less than two years old who had never approached a job of this magnitude—Andrews Audio Consultants of New York City.

FILLING A TALL ORDER

David Andrews, principal of Andrews Audio, is enormously enthusiastic about his work at the Hilton, no small feat considering that the Ballroom has consumed much of his time and attention for over a year.

"The Hilton had no idea of what could be done for them," he relates. "What they asked for was a sound system that would cover whatever a customer might want to do in that room. The Grand Ballroom regularly schedules such events as the Heismann Trophy, two or three Friars Roasts, a number of big industrial shows for General Motors and IBM, stage shows with full orchestra, political events, trade conventions.... The Grand Ballroom can also be broken down into two or four

Dave Andrews, principal of Andrews Audio, examines the equipment rack featuring a Crown real-time analyzer.



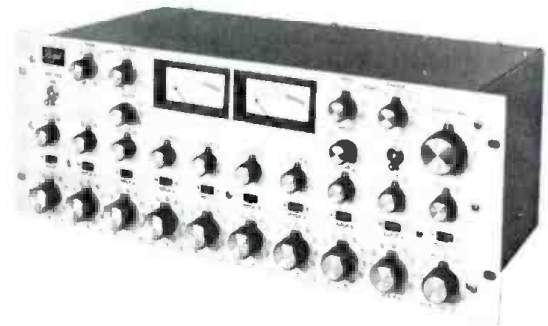
Christine Kofoed is the Executive Vice-President of Community Light and Sound, Inc. of Philadelphia.

separate rooms for smaller meetings or events. So the system had to cover everything from a single microphone and a small audience to a discotheque."

CUSTOMER SERVICE

It was customer demand that brought about the Hilton's attention to their problems. Just prior to one of their largest events of the year, an annual conclave of national sales managers for many of the Fortune 500 companies, the Hilton chain's interior decorator had taken offense to the appearance of some column speakers hung upon the supporting pillars in the Foyer area of the Ballroom. She ordered them removed. They were.

"The intelligibility in the room dropped, ah, noticeably," David recalled. "In fact, it became just about non-existent. People attending the subsequent sales event complained loudly to each other and to the hotel. And good hotels are very responsive to their customers' wishes. So, Mr. Leigh Cameron, the building superintendent, was instructed to look into getting the sound system into a usable state."



A Bozak CMA 10-2 Stereo Mixer Amplifier provides uncomplicated control of Grand Ballroom mixing chores. Mic feeds from the East and West Ballrooms may be combined, or mixed separately.

THE NEW YORK HILTON GRAND BALLROOM

The New York Hilton Grand Ballroom consists of the full Ballroom and the full Foyer, each capable of being divided into two rooms, East and West. Each one of the rooms had to operate as an independent system, and, as part of one large system serving the entire Grand Ballroom. The East and West Ballrooms total 183 feet in width and 87 feet in depth, with a 22-foot ceiling. Centered on one side of the ballroom is a stage, which had its own reinforcement system. A U-shaped balcony runs above the sides and back of the Ballrooms. The base of the U protrudes over the entrance to the Foyers. The foyers are 137 feet wide and 45 feet deep, with a ten-foot ceiling. Total distance from the stage to the rear of the Foyers is 132 feet. David's solution to the task eventually led to the creation of six separate systems for the Grand Ballroom: the four independent East and West overhead-distributed systems, the stage and side-stage reinforcement system, and the stage orienting line array tucked over the entrance to the Foyers. David described the old system he replaced:

"Flush-mounted in the wall on either side of the stage, where we are now installing the large stage stacks, was one Altec A7, running off a 70 volt amplifier. When I looked the A7s over, I discovered that one high frequency driver had been turned all the way down, and the other had a ruptured voice coil. The low frequency on one had a severe rub. Also operating off the same amp was a single overhead distributed system of twenty-three flush-mounted Jensen 12-inch speakers on 2-4 watt taps, which were spaced throughout the Ballroom. Around the back of the Ballroom, over the balcony, were fourteen 12-inch speakers also mounted in the ceiling. We've since added fourteen more speakers there, and changed all of the 12" speakers to Altec 617-8As. Under the balcony, there were sixteen 8-inch speakers for overhead fill. Due to the cost of adding speakers and running new cable through the plaster we decided not to add any more, even though the area could use a few. In the Foyers the column speakers of course, had been taken down. All that was left there were fifteen 8-inch Jensen speakers on one-watt taps. All of the 8-inch speakers in the room were changed to Altec 409s, all tapped at 8 watts. High-frequency coverage in the Foyer is not as good as I would like simply because there are not enough speakers, but usage there is mostly limited to business meetings, so I'm not too concerned."

DIVIDING THE BALLROOM

David chose the Bozak CMA10-2 mixer to divide the distributed system in the Ballrooms into East and West, because the Hilton wanted at least ten microphone lines, and the Bozak was the smallest, simplest 10-by-2 mixer available. By flicking a pan switch he can separately mix the East and West Ballrooms, or combine East and West together.

For Foyer mixing, David chose Shure M67 for each Foyer. There is a single microphone jack in each foyer that feeds directly into both mixers, so that both foyers can be operated from either mixer. The output from the Bozak mixer in the Ballroom also feeds both Foyer mixers.

SETTING THE STAGE FOR SOUND

David described the installation of the stage system: "I really wanted to put a central cluster over the stage, but we were told that it would not be allowed under any circumstances. They didn't want to see any speakers. So we decided to do the best we could and went with a split proscenium system. We have a four-way system mounted on the wall on either side of the stage. The Hilton enlarged the space for us. We have a Community GGM bass cabinet handling the bottom, with two Pioneer TAD TL-1601 300-watt, 15-inch drivers in each cabinet. Low mids are provided by the Community MB60 sixty-degree radial horns with an Electro-Voice EVM-12L speaker in each of them. Mid-range is a Community BRH90 radial horn, loaded with a TAD 4001; the high end is another Community ninety-degree radial, the RH90 with the TAD 2001 driver. Both of the TAD compression drivers have beryllium diaphragms, which are feather-light and handle complex transients very well. I chose Community horns because they're very predictable, and sound good.

In addition to the main speaker stacks, we have—again flush-mounted in the wall, about sixty to sixty-five feet to the left and to the right of the stage—some Community PBL full range cabinets, two per side. One is located about five feet above the height of the balcony floor, for balcony side-fill. The other PBL is mounted lower down in the wall for additional side stage coverage, because of the width of the room. I had originally specified that the PBLs be put on a delay line, but it turned out that they sounded much better without the delay. It was supposed to keep the image in the center, which it did do, but it also added a tremendous hollow echo because of room acoustics. So we took the cabinets off the delay and they sounded fine."

"The line arrays in the Foyer came into being because we wanted to achieve stage orientation there when the rooms were opened up. Stage intelligibility in the Foyer was non-existant, because the stage system begins about eight feet off the Ballroom floor, and the Foyer has a ceiling height of ten feet.

Chart of equipment in use in the ballroom and its placement.

LOCATION	MIXER	EQUALIZER	AMPLIFIER	CABINET	SPEAKER
Ballroom EAST WEST	Bozak CMA 10-2	Urei 539 (1) Urei 539 (1)	Crown PSA 2 (1) Crown PSA 2 (1)	Ceiling Mounted Ceiling Mounted	Altec 617-8A (14) 409-8D (16) Altec 617-8A (14) 409-8D (16)
Foyer EAST WEST	Shure M67 Shure M67	Crown EQ 2 (1)	PSA 2 (½) DC 300 (½) PSA 2 (½) DC 300 (½)	Custom Column (8) Ceiling Mounted Custom Columns (8) Ceiling Mounted	4-inch Speakers (6/Col.) Altec 409-8D (9) 4-inch Speakers (6/Col.) Altec 409-8D (6)
STAGE SYSTEM IN BALLROOM	Shure SR 101 (1) Shure SR 101 (3)	Crown EQ 2 (1½) Urei 539 (1)	DC 300 (2) PSA 2 (1) DC 300A (1)* D 150A (1) D 75 (1)* D 150A (2) *(Each amp driven by (1) Crown VFX 2A Crossover)	NC 12 (4) GGM (2) MB 60 (2) BRH 90-201D (2) RH 90-201D (2) PBL 60 (2) PBL 90 (2) (All Community Light & Sound)	Emilar EA 175 (4) Electro-Voice EVM 12 (4) Pioneer TAD TL 1601 (2) Electro-Voice EVM 12L Pioneer TAD TD 4001 (2) Pioneer TAD TD 2001 (2) Emilar EA 175 (2) Electro-Voice EVM 15L (2) Pioneer TD 2001 (2) Pioneer TL 1601 (2)
SOUND ROOM	Shure M 677 (2)		D 75 (1)		Auratone 5C (2)

The Hilton people didn't want to see any speakers in the Foyer, which makes things difficult in an area that's ten feet high and almost 140 feet long. So, we ended up doing something a little different. We created a large line array consisting of sixteen custom-built columns, each 3'6" long, containing six 30 watt 4-inch speakers. We installed the columns horizontally over the Foyer entrance to the Ballroom. The columns are used for voice reinforcement only, on a delay line, and operated at a level which is necessary to give intelligibility to the main speaker stacks. It gets a little beamy at high frequencies if you're moving, but at lower levels it sounds really good."

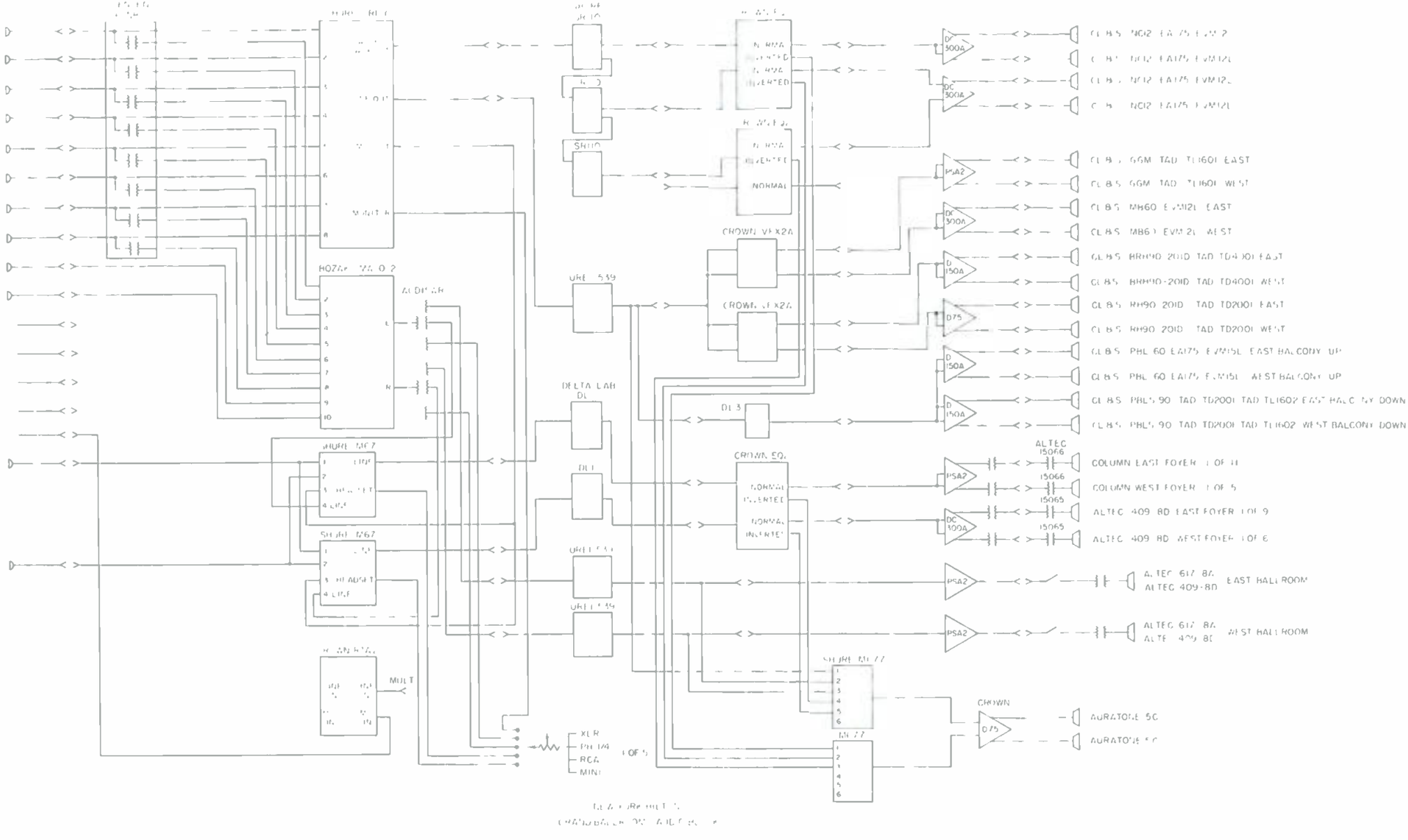
The line array of speakers in the foyer of the Grand Ballroom.

STAGE MONITORING

Previously, if anybody wanted a stage monitor, the staff would drag a bookshelf speaker out onto the floor and run it off the same 70V amplifier. So we gave them three circuits of monitor mixing capability, using three Shure SR110 monitor mixers. "The stage system is fed by a Shure SR101 Series 2, an 8-by-1 mixer, primarily chosen for easy interfacing with the SR110. The SR110 takes a post-fader, pre-master feed from the SR101. Each SR110 feeds a Crown EQ2 equalizer, which goes to a Crown DC300A power amp. The amps feed Emilar EA175 high-frequency compression drivers and Electro-Voice EVM 12L low ends, mounted in Community NC 12 cabinets. The NC 12 was designed as a vocal spot monitor. Equalization of the system is aided by a real time analyzer—the Crown RTA-2 which is permanently installed in the sound room. They can use either a pink noise method of EQ or a regenerative feedback method. Everything in the system appears at a patch point except for the monitors in the sound room itself.

AMPLIFICATION

"There are four Crown PSA2s, four DC300As, three D150IOCs, and two D75-IOCs driving the system." David elaborated, "There's a PSA2 for the East Ballroom overhead, a PSA2 for the West Ballroom overhead, and one channel of a DC300A for each of the Foyer overhead systems, run at 70V. There's a PSA2 for the Foyer line array run 70V, tapped at 32 watts each. The floor monitors each operated off a channel of a DC300A. On the speaker stacks in the wall, the GGMs share a PSA2, the MB60s have a DC300A, there's a D150 on the BRH90s and a D75 on each RH90. The four PBLs each have a channel of a D150. The equalizers for the two overhead systems in the Ballroom are UREI 539s. The equalization on the stage system is also a UREI 539. There is a spare channel on one



Blueprint of the equipment layout installed by Andrews Audio.

Crown EQ2 that can be patched anywhere it is needed. The line arrays in the Foyer have a channel of an EQ2 and the two overhead distributed systems in the Foyer each have a channel of an EQ2."

INSTALLATION: NO EASY TASK

Installing the system was no easy task. Andrews' contract with the Hilton stipulated that there was to be no down time in use of the Ballrooms and Foyers while the system was being installed. Also, David and his crew, headed by technician Jesse Koapholz, were to make sound reinforcement available for whatever event was to take place in the rooms, no matter at what stage their installation was in.

Originally, the ballroom was to be shut down for two weeks while three crews worked on various aspects of the system, but because of an extremely long-term back order on some equipment racks ordered for the sound room, the scheduled two weeks passed, and other methods had to be employed. Every available minute that the ballroom was not in use was seized by David and his crew as installation time. Often this meant arriving for work in the early hours of the morning, running cable through the ceiling while events took place on the ballroom floor, and wiring while running sound for everyone from Chita Rivera to Cyrus Vance.

UPGRADING AND MODIFICATIONS

"The Hilton was tremendously cooperative," David recalls. "They provided everything available to them to help us out. They were total professionals. The people here are very pleased with the system. I told them when I was awarded the contract that I didn't care if I made money on this job. My only concern was that they be as satisfied with the final job as they were with the specification. I try to keep on the verge of whatever the current state of the art is. As this installation proceeded I put in whatever I thought would improve its performance. For instance, the stage system went from two-way to four-way as soon as I discovered that there was such a thing as an MB60 available. I have about $15,000 of additional equipment in the Hilton which they didn't order originally. Some of these changes were user-requested. The system was used bit by bit as we put it in, because of the agreement that there be no down time during installation. So we ran redundant systems for a while. As we put things in, the sound men from the Hotel got to see in real life what we'd been describing to them, and they came up with suggestions—we'd like to be able to do this or that—in terms of patching, etc. So, they're getting their money's worth. They're paying a professional price for a professional system."

"I would love to do all kinds of acoustical treatment to that room—they won't hear of it. One of the first things I told them was that I wanted to take all the mirrors away, and have the front of the balcony softened. There are a lot of bad "pings" in that room caused by the speaker stacks hitting parallel walls with mirrors. The balcony and the under-balcony act as a trap for bass. It kind of hangs around under there and muddies the sound. Well, they didn't listen. But eventually I expect to have my way. They'll realize that the simplest, cheapest, best method of accomplishing any pro audio task is to do it properly the first time. I don't give up easily."

HILTON SHOWS ITS APPRECIATION

One determined audio engineer pitted against the staggering mediocrity of the hotel systems of the world may not be as weighted as it sounds.

As this article was being written, Andrews Audio Consultants was awarded the job of installing a new sound system at another Hilton Hotel, the prestigious Waldorf-Astoria. ■

NEAL I. WEINSTOCK

Sound Rehabilitation for Theatres

Breakthroughs in high fidelity sound for the movies has forced many old theatres to reconsider their sound system, for their customer's sake, in favor of more contemporary approaches.

JIM FORREST is an audio engineer with a peculiar specialty. Located in New Jersey, his business is the movie business, but on a not-so-well-known end of it: dozens of movie theaters in the Northeast now owe their sound installations to him. As sound on film has come to be more of a high fidelity experience in the last few years, many old palaces have found their sound systems so outmoded as to chase away customers. Jim has very definite ideas as to how the old theaters should be renovated, but no definite idea about how he ever came to be doing this.

COST OF NEW CONSTRUCTION A FACTOR

"I used to work on nightclubs, discos and what have you. From what I read about the disco craze winding down I suppose I should be glad I'm not in that anymore," Jim said. "I just got a call from a theater in Manhattan, and one thing led to another.

Neil Weinstock is a free-lance author.

But now, I think I can plan on this sort of thing continuing for some time. Cost of new construction is so high.... And there are still a lot of great old places out there to work on. So I called some of the chains around here, and showed them what we can do. Now we have more work than we can handle."

He deplores the type of modernization that involves breaking a huge hall down to two or more very small ones. "Within limits, a larger room is much better acoustically, of course," he says. "And it's much more interesting when a large hall is also going to be used for live shows, concerts.... But many of these places have very asymmetrical dimensions, and ornamentation that bounces sound around in crazy ways. But that's the challenge. I've never taken any of that stuff down. We've always been able to work around it, so far...."

OLD THEATRES BEAUTIFUL, BUT...

Then he admits, "Well, there was one time in Providence. As usual, there's a lot of ornamentation over the emergency exits on either side of the screen, behind which there used to be a couple of speakers – the only speakers. Well, the decoration was an art-nouveau metal thing, and the tin just bounced the sound back at the speakers! It was the worst possible place to put a speaker! Eventually, we cut away some of the metal, backed all that we left with plywood, mounted the drivers right against the cut-away part, damped everything with glass fiber, and used the few feet of space in back as a real big enclosure."

We talked with Jim in his office in suburban New Jersey. He employs ten people full time now, he and another audio engineer doing all initial design. "The halls that do all kinds of shows are most interesting," he said. "Come on, I'll show you one." We drove out to a nearby town and a huge, fifty-year-old palace. Once inside, Jim said, "The hardest part of the work is ripping out all the old stuff. Here, we had to pull out at least ten miles of lead-encased wiring. I'm pretty proud of this one, if only for that. Usually it's a little easier, but they used to put on a lot of vaudeville here. The owners now want to put on live shows, too. The place was a pit, it was filthy, it showed porno. Now it's coming full circle."

SPEAKER PLACEMENT AND AIMING

He pointed out the speakers—large enclosures at either side of the screen, and on both side walls toward the beginning of the balcony. There were small speakers pointed down from the low ceiling over the rear of the mezzanine. "Aiming them is a big problem. This theater was built to fit a city lot, not for the best

acoustics. So we've got a slant outward in that wall, and a slant inward in the opposite...." The hall is shaped like a trapezoid, and we were at the rear. "A slightly different angle to any of these speakers and there would be an intolerable effect. It took a lot of trial and error. We'd rather not have located them in so many places, but otherwise you'd blast people out in one section trying to let the rear mezzanine get a decent level. When we thought we'd finished it turned out that under the balcony, just got terrible, terribly-muddy sound. So we had to augment the high frequencies with these." He pointed out the small speakers on the ceiling.

DESIGNING FOR MULTIPLE PURPOSES

Each speaker is driven by a mono four hundred watt amp (there are eight, all told) located up in the control booth. Jim's men have cut a large window in the booth, which is left open. "We can just drop a thermopane glass over it if necessary for live recording. But for staging shows with an audience, it's much better to be part of the room." From the chair behind the console, the whole hall can be seen, except that part under the balcony. There are twenty mic input channels. "Although I don't really like a lot of mics personally. For an orchestra I'd rather hang two mics from the ceiling and record the whole ambience. You can see we're set up for that—" He pointed out a mic hanging down from the ceiling, toward the front of the hall. "But for electronic instruments and tiny-voiced singers, you've got to have all of that." There are inputs for four channels from film, and Jim pointed out the circuitry that would cut off low frequencies and channel them to the towering woofers at the sides of the room.

THE CONTROL BOOTH

There were only two quarter-inch tape decks in the control booth, a half track and a four track. Jim apologized. "I know this must look rinky-dink to you, but they simply haven't been recording very much here yet. These are being used for playing effects, mostly. They didn't want to install the bigger units till there's more call for them. But we have them designed in. This booth won't be obsolete for a long time."

No, it didn't seem like it. As opposed to many such booths we've sweated our way through, it was spacious, well equipped, and seemed well ventilated. Jim said that his men were able to open up the back and side walls of the original booth, and extended along one side as well. The result is an open workspace. We asked if he worked with an architect.

"No. When you've worked in enough of these you know what

you want. We've worked with a contractor on other jobs. Then you do have to get an architect's okay, sometimes, to get plans approved by the city. It's amazing how much red tape there is sometimes because it's a movie theater. Other times it's easy. But you usually can't do any modification of the projection booth, because of the old fire laws, when film was flammable. The only time that was a real hindrance was when we put in a big video projector complex in Chicago. Actually, it was better for the image to mount it on the ceiling, much closer to the screen, but that ceiling was fifty feet high!"

Back to the booth. It is completely isolated except for the open window. A high-quality monitor is suspended over the window ("You can't mix good sound with a bad monitor," Jim said). The board is not huge, but looks substantial because of the additional mic channels and because beside it sit more controls for lighting effects. "They do a lot of lighting from back stage," Jim points out the window. "We figured, in this instance, lighting would not usually be integral with sound, like at a disco, so we'd keep the lighting out of the audio people's hair. When there is an effect that needs perfect sync, we can come out and easily wire it into here."

There are communication lines between the sound booth, the projector booth next door, backstage, dressing rooms and office. The com lines suddenly gave us a feel for what a very large place this was.

SHOWTIME AND BEYOND

The work was finished last October. "They opened up with a big Halloween party. So far they've had movies every week, including Apocalypse Now for a long time and a lot of rock shows. None of those apocalypeses has hurt anything yet," said Jim Forrest.

"I wouldn't move into any other part of the audio field right now," he said. "This is too exciting, for other reasons. It's all part of the revitalization thing. A few years ago, this area was foresaken at night. Now, people want to have something to do with the centers of old towns again. It's important to save what's good about what's old. Hell, with all the new halls designed by computer to be acoustically perfect, and then somebody forgets to enter in some variable, and the hall is far from perfect: here, we know we're working with something that's not perfect. But it's valued. And to make the sound as clean as the most modern hall—that's exciting." ■

BOB METZLER

Packaging: A New Dimension in Audio Test Equipment

"Packaging doesn't always *mean the cardboard box the instrument is shipped in, but rather, the kind of physical package or case in which the manufacturer builds the instrument."*

TEST EQUIPMENT IS traditionally thought of in terms of electrical specs: Can it make the required measurement? What's the accuracy and resolution? How much output does it have? Until a few years ago, such parameters were the major factors in the selection of different test instruments (in addition to such things as the manufacturer's reputation, reliability, and quality of manuals).

In recent years, however, a quiet revolution has been taking place which gives the user another dimension of choice—packaging. In this sense, packaging doesn't mean the cardboard box the instrument is shipped in, but rather, the kind of physical package or case in which the manufacturer builds the instrument.

Three fundamentally different kinds of packaging of audio and general-purpose test equipment are available today. In the test equipment industry, they are known as monolithic single-function, monolithic multi-function, and modular multi-function. These terms are defined below and some examples are given of each.

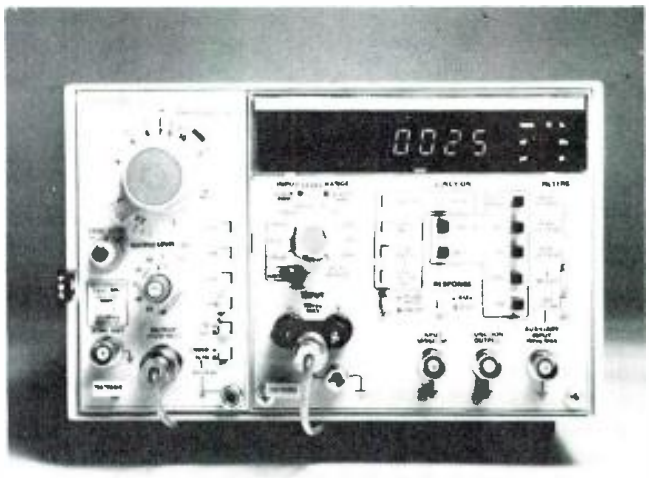
KINDS OF PACKAGING

A monolithic instrument is one that can't be modified easily after it leaves the factory, except perhaps to add a specific field-installable option. A monolithic instrument comes self-contained with its own cabinet, an internal power supply, and a spec sheet that defines what it is—forever. Most test equipment built today is monolithic.

Single-function and multi-function are probably pretty clear terms. A single-function instrument does only one thing; obvious examples are audio oscillators, ac voltmeters, and frequency counters. A multi-function instrument may include anything from two functions up to a complete test set. An instrument that combines an oscillator, a voltmeter, a counter, and an oscilloscope would be multi-function. There are some gray areas here; for example, a multimeter which measures direct and alternating current dc and ac voltage, and resistance might be considered multi-function. However, these functions have been combined in a single instrument for so long, and represent such minor variations on the basic dc voltmeter theme, that most experts call the multimeter a single-function instrument.

In the audio field, most measurements require multiple functions. Gain/loss, signal-to-noise, and frequency-response measurements all need both an oscillator and a voltmeter.

Bob Metzler is Marketing Manager for Tektronix's TM 500 Division.



Newest additions to Tektronix's modular series: the SG 505 ultra-low-distortion oscillator and the AA 501 automatic distortion analyzer.

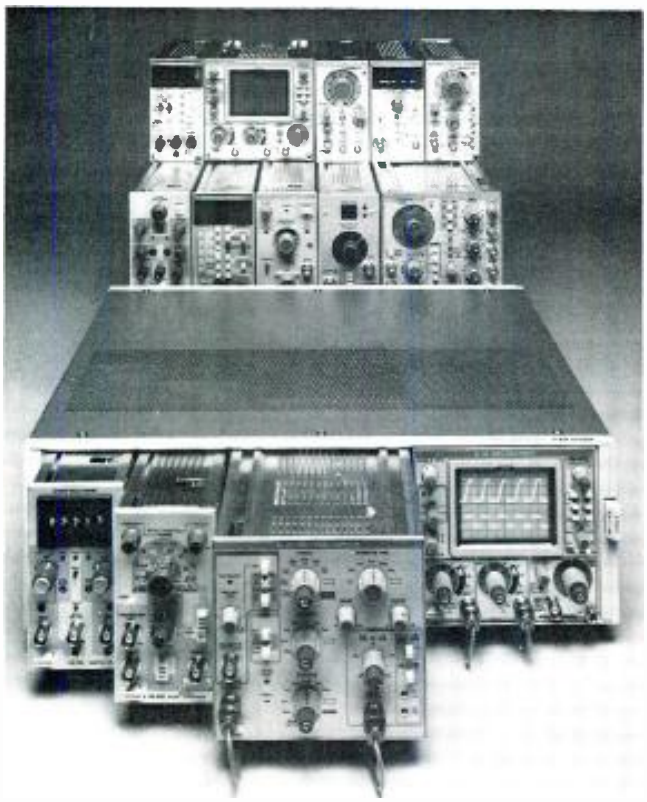
Harmonic or intermodulation distortion measurements also require an analyzer, and sometimes a second oscillator. An oscilloscope is usually needed to look at the output of the distortion analyzer. Frequency counters are convenient, and become absolutely necessary when measuring response of sharp filters. Burst testing of speakers or frequency sweeps of systems call for a function generator. So, whether the functions are in one box or a lot of separate boxes, multiple functions are the rule.

A modular package is one designed to be easily changed, on a plug-in basis, after it leaves the factory. Single-function examples that have been around for a long time includes 'scopes with plug-in vertical amplifiers and time bases, and frequency counters with plug-in front ends to cover different frequency bands. The multi-function modular concept is represented by the Tektronix TM 500 line, where (for example) an oscillator is one plug-in, a distortion analyzer is another, and oscilloscopes or counters are others. These plug-ins can be mixed and matched in any desired combination by the user.

Just to be sure the definitions are clear, some readily available examples of each type of packaging are listed below.

Monolithic Single-Function
- Hewlett-Packard 200CD Audio Oscillator
- Hewlett-Packard 334A Distortion Analyzer
- Tektronix 465B Oscilloscope
- Fluke 8000A Digital Voltmeter

Monolithic Multi-Function
- Leader LAS5500 (Oscilloscope, Oscillator, AC Voltmeter, Wow and Flutter Meter, etc.)
- Amber 4400A (Function Generator, AC Voltmeter, Counter, Filter, etc.)
- Sound Technology 1700 Series or Hewlett-Packard 339A Distortion Measuring Sets (Distortion Analyzers with built-in Oscillators)



The modular approach to test equipment. In the foreground, a group of modules easily plug-in to a portable main frame. In the background, other plug-in modules, ready for use, as required.

Modular Multi-Function
Tektronix TM 500 Series, including
AA 501 Distortion Analyzer
SG 505 Audio Oscillator
SC 503 Storage Oscilloscope
DM 502A Autoranging Digital Multimeter
DC 504 Counter
FG 504 Function Generator, and so forth

Many commonly-needed items of audio and general-purpose test equipment are available in all three packaging concepts. A comparison of the fundamental advantages and disadvantages of each concept can help you judge which is most suitable for your application. The most logical choice will depend on how and where you use test equipment and how well defined your testing job is.

MONOLITHIC SINGLE FUNCTION

• **Advantages.** Widest breadth of choice. Some instruments, especially highly-specialized types, may be made by only one company and only as monolithics. Assembling your complete test equipment facility as a collection of monolithics lets you pick and choose from many manufacturers.

Single instrument need. If only one item of equipment is needed (like a VOM to check resistors), then a single-function monolithic makes sense.

Limited budget at one time. If your test equipment purchases must be made in small-dollar amounts—for example, when replacing an inventory of older test equipment on a limited annual budget—you may be more able to afford one single-function instrument at a time.

• **Disadvantages.** Poor portability. When multiple functions are required, as they are for most real-life testing situations, portability becomes more important. It isn't easy to carry three or four separate monolithic instruments out to your car, or even down the hall.

Larger size. The collection-of-monolithics approach almost always takes up more bench space than a multi-function approach, making some instruments harder to reach or connect and requiring longer leads.

Possible higher cost. Five monolithic instruments include five cabinets, five power supplies, etc., with no opportunities to reduce costs via sharing. However, no generalization about costs of a collection of monolithic instruments versus either multi-function approach can be completely accurate without a careful analysis of the performance levels, features, and functions of the specific alternatives.

Non-standardization. Each instrument has a different scheme for control locations and displays. Cabinet size and shape variations inhibit stackability or rackability.

Poor rack-to-bench or rack-to-portable conversion. Removing rack slides or simply dismounting a racked instrument for use elsewhere requires tools, time, and sometimes a helper to support the weight during dismantle.

Lots of power cords. The several single-function instruments needed to make a complete test may overflow the available ac outlets and even lead to ground-loop problems.

No special provisions for interconnects. Separate cables and connectors for paralleling several instruments are required, and if the instruments are moved to another location; the cabling must all be torn down and then set up again.

No provision to integrate user-built items. That special breadboard you've built for a particular test is, in effect, one more monolthic instrument to move, find power for, and interconnect with the factory-built items.

MONOLITHIC MULTI-FUNCTION

• **Advantages.** Smaller size and better portability. One unit is easier to carry than the collection of single-function monolithics needed to perform the same tests.

Possible lower cost. Sharing of a common power supply, common cabinet, and common display may reduce cost—but be sure specs and features are equivalent.

Better human engineering. Standardization of control types can reduce confusion. Internal interconnects and switching can, for example, let a meter be connected across an oscillator to check level without needing to move test leads around.

One power cord. Only one outlet is required, and all functions are automatically grounded together.

• **Disadvantages.** Designer's choice. An engineer at the factory decided which functions to include, and at what level of specifications. If you need another function not included, or a level of performance beyond what's included, you have to buy a supplementary instrument. When you add that separate instrument, you sacrifice most of the compactness and portability that were your reasons for buying the unit in the first place. A single change of your measurement needs in the future can obsolete your entire multi-function instrument.

Difficult rack-to-bench or rack-to-portable conversion. Removal is easier than with multiple monolithics only because one unit is involved instead of several.

Shared displays are typical. Two measurements can't be made simultaneously, such as amplitude and frequency, if the same digital readout is used for both.

No provisions to integrate user-built items. You still have to stack your breadboard or aluminum box on top, just as in the case of single-function monolithics.

MODULAR MULTI-FUNCTION

• **Advantages.** User's choice. The user chooses the functions, not a designer at the instrument factory. The user picks the instrument types needed, plugs them into the most suitable mainframe, and has a "custom test set" for a particular application.

Small size and weight. Modular units provide superior portability for any multi-function testing needs in the field, downstairs, or just across the room.

Possible lower cost. As compared to monolithic single-function units, sharing of the common mainframe power supply and cabinet by several plug-in modular instruments reduces the cost.

Easy rack-to-portable or rack-to-bench conversion. The rack-mounted mainframe stays bolted in the rack. Individual instruments unplug in seconds and plug into a bench or portable mainframe, in a different configuration if desired.

Instruments are electrically separate. There are no shared displays, and the plug-ins can make several measurements simultaneously even though they share power from a common mainframe.

Internal interconnects. Cable clutter is reduced and measurement speed is increased by allowing (for example) a meter or counter to monitor an oscillator at the touch of a switch, without moving cables.

One power cord. A single line powers up the entire system, and the instruments are automatically grounded.

More standardized displays and controls. As a result, modular plug-ins are easier to use than a variety of separate, single-function monolithics.

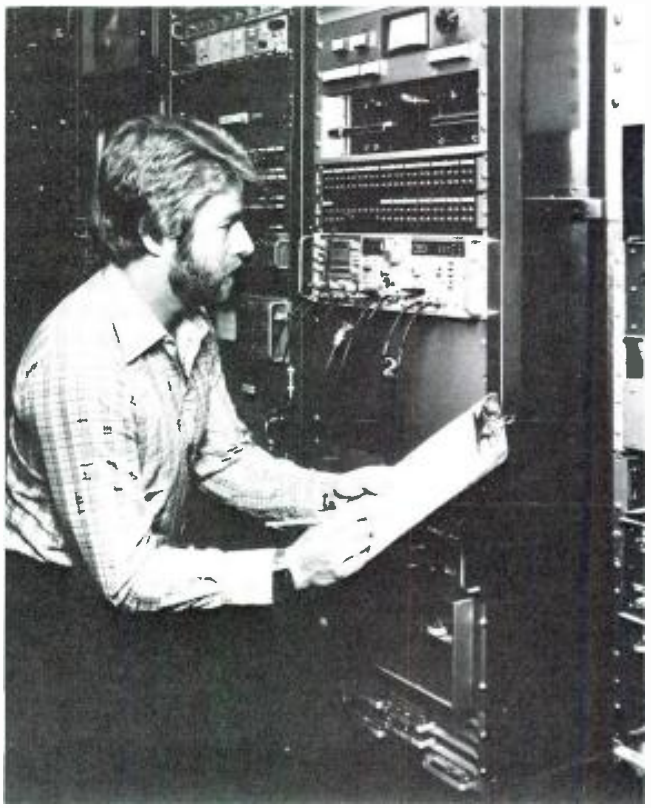
Open-ended, expandable, reconfigurable systems. Test setups can easily be changed at any time. Upgrading can be accomplished in the same package by replacing a function with a higher-performance unit. Additions are especially economical if extra mainframe "holes" are purchased at the time of the original investment.

• **Disadvantages.** Unsuitable for single measurements. Modular units typically are not cost-effective for a single-function measurement need, particularly if the function itself is low cost, because of the inability to share the mainframe costs across multiple instruments.

Necessarily finite choice. If the modular instrument manufacturer does not make the type or performance level needed, the modular multi-function package must be supplemented with separate instruments. The size and portability benefits are then reduced. The custom plug-in kit can offset the disadvantage of finite choice if the needed function is not too complex for the user to build, such as a pink noise generator, or special signal gating and routing or timing circuits.

Not practical for very-high-power products. The heat-dissipation limitations within a plug-in package can accommodate most common audio test equipment types, but a very-high-power pulse generator or high-power variable dc supply might not be practical.

Techtronix's equipment in action.



A technician checks readout on some of the modular equipment in use.

CHOOSING THE RIGHT PACKAGE

Each of the three test equipment packaging approaches has its own strengths and weaknesses. Measurements in the audio field almost always require several different instrument functions. The principal factors that will make one or another of the instrument packaging concepts most logical are; how well-defined your measurements are and where you make them.

If you know pretty firmly what functions you need to measure, and to what level of specs, then a monolithic multi-function instrument may give you the most performance for your dollar. On the other hand, if your measurement needs are likely to change or become more difficult in the future, the flexibility inherent in monolithic single-function and modular multi-function test equipment is important. With either of these approaches, you can upgrade any part of your test equipment complement without obsoleting the rest.

If all your measurements are made at one fixed location, like a bench or an equipment rack, then any one of the three approaches will be perfectly suitable. If, even occasionally, you need to go into the field, to an auditorium, to a remote transmitter, or down the hall to another studio or lab, the superior portability of either monolithic multi-function or modular multi-function will be valuable.

So, think about these key factors and the way you use test equipment before you make your next purchase. Today's market is so competitive that you can probably find the types you need, with the electrical specs you need, from a number of different sources. The additional dimension of packaging may well be the critical element in helping you get maximum value for your investment. ■

JOHN WORAM

AES Convention Report—London

The London Hilton and Park Lane Hotels were the hosts for the 65th Audio Engineering Society Convention. Many major European audio companies, and a few Americans, were there to boast of their wares.

After an absence of five years, the Audio Engineering Society returned to London last February, for its 65th convention. The convention reached London-town a full year ahead of schedule, as plans for a different location on the continent were scuttled – almost at the last minute. The Society's London section generously volunteered to accelerate their own 1981 convention planning, to help pull things together. The result was a remarkably smooth-running four-day collection of papers and exhibits, with no trace whatever of the intense pressure which the Londoners must have worked under.

A convention highlight was the AES "Golden Ear Room," in which "objective-subjective" listening tests were carried out. The object was to learn a bit more about what may be required from digital recording systems, in which low-pass anti-aliasing filters are inserted in the audio signal path. In the first experiment, the audibility of several low-pass filters was evaluated. Listeners were asked if they could hear a difference in sound quality when the filter was inserted. Three filters were used, with cut-off frequencies of 10 kHz, 16 kHz and 20 kHz.

The tests were conducted under the supervision of Mr. Laurie Fincham of KEF Electronics, Ltd., who certainly has his work cut out for him in evaluating the mass of collected data. We'll have more information about the test results in a later issue.

THE EXHIBITS

The 150-plus exhibitors were divided between the London Hilton and Park Lane Hotels, located a pleasant stroll apart. Despite some early mis-givings about splitting the convention, the two-hotel arrangement seemed to work out quite well. The dedicated convention-watcher wasn't trapped indoors for four days, and, since there was room to spread out, the booths didn't seem to be always over-crowded. Notable exceptions were the mobs that continuously surrounded anything digital, and some of the "super-boards."

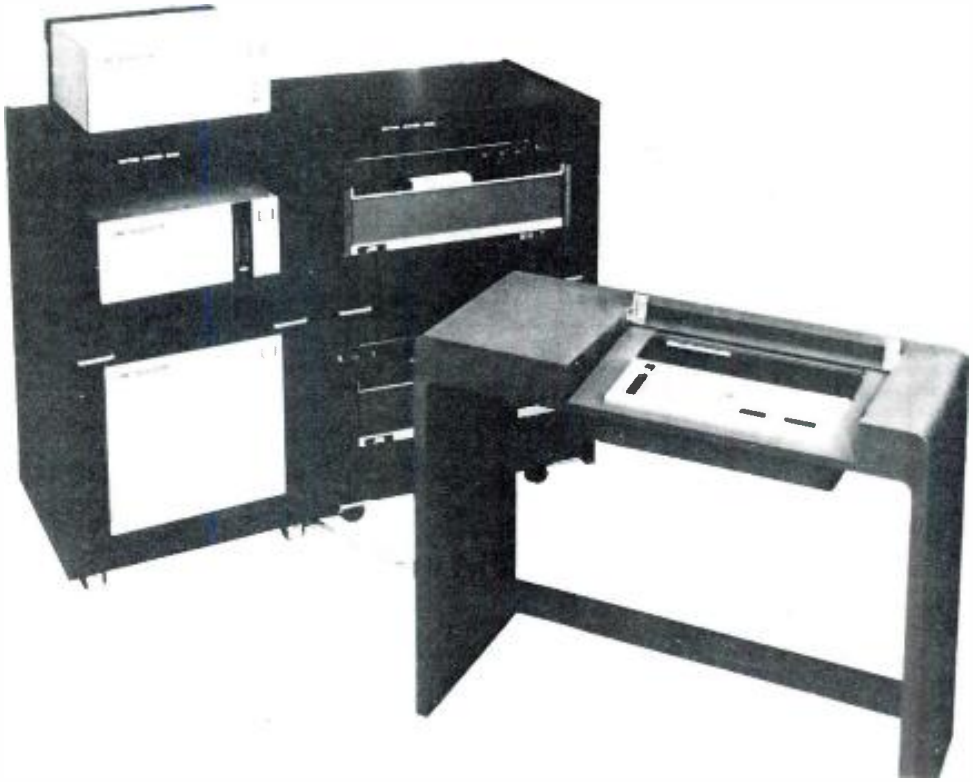
John Woram is editor of **db Magazine,** *principal of Woram Audio Associates, and author of the "Recording Studio Handbook."*

In the background, Sound Workshop's Michael Tapes tries to keep from falling onto one of his consoles, during a "hands-on" demonstration.

DIGITAL TAPE RECORDERS

The latest entry into the digital tape recorder arena is the Victor Company of Japan—better-known as JVC here in the colonies. The company introduced its series 90 Digital Audio Mastering System, which—like the Sony PCM-1600, uses the U-matic video cassette format to record two channels of audio program. The prototype system demonstrated at the convention stores about six seconds of program in memory for editing purposes, and this is played back via a horizontal slide fader on the editor's front panel. Production systems with about 12 seconds capacity should be available late in 1980.

At their Hilton Hotel demo booth, 3M's Digital Mastering System was introduced to Europe. The complete system, comprising a 32-track recorder, a 4-track recorder, and a digital editor, was bound for Britain's Roundhouse Recording Studios.



JVC's Series 90 Digital Audio Mastering System.

Later on this year, London's Town House Studio will take delivery of a 3M 4-track recorder and preview unit. Town House thus becomes the first European disc-mastering facility to be able to cut discs from Roundhouse's digital masters.

ANALOG TAPE RECORDER

Within a relatively short period of time, Otari's MTR-90 24-track, two-inch analog tape recorder has become a serious contender in the professional studio market. Both the CB-104 Remote Session Controller and the CB-107 Memory Locater appear to be quite well-designed, with layouts that are clean and clear.

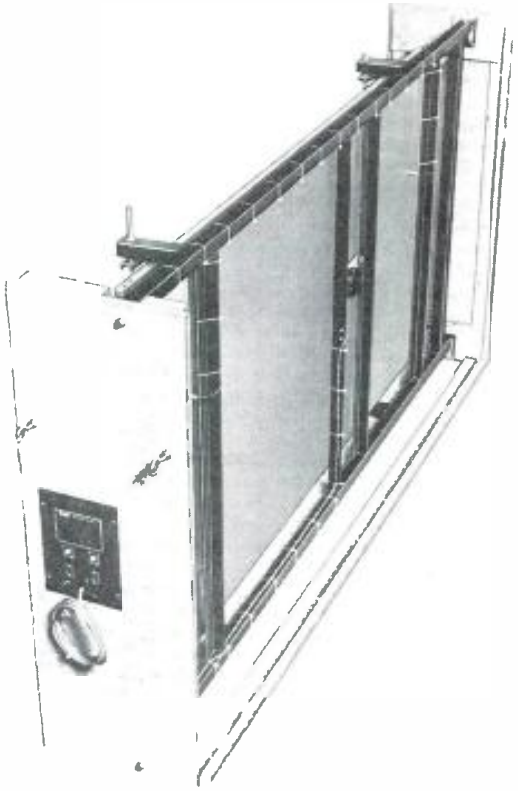
Otari prefers mechanical switches for channel status selection, pointing out the advantages of the tactile "feel" that such switches offer. The point is well-taken, especially on those long sessions in dimly-lit smoke-filled control rooms. However, others may prefer the newly-popular membrane type switch, which probably lends itself more readily to external automation systems. (For an interesting post-script on Otari, see this month's **People, Places, Happenings**—Ed.)

Still committed to analog (or analogue, in the Queen's English), Ampex introduced the ATR-124 to Europe. (For more on the ATR-124, see our January, 1980 issue—Ed.) As we noted in our January 1980 editorial, the ATR-124 incorporates some features usually associated with the console. Still earlier (August, 1979) we discovered that some tape recorder functions were being incorporated into the latest generation of "super boards." And at the London convention, we learned of one new studio that has ordered ATR-124 recorders and Solid State Logic consoles. The interfacing requirements should be intriguing, to say the least. But more on this later.

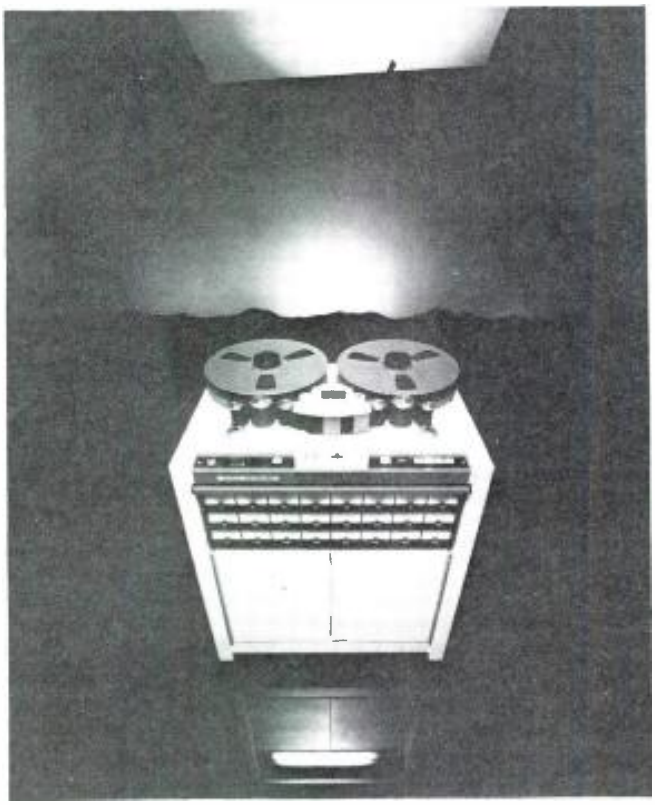
Speaking of Solid State Logic, their latest board features an elegant color-graphics CRT display that looks—from across the room—like a new video game. On closer examination, it turns out to be a colorful representation of the status of any module on the console. Contrasting colors indicate the previous and present positions of each control. To get back to an earlier setting, just push, pull, twist or slide until the "present" color merges with the "previous" one. An interesting feature of this Total Recall system is the SCAN function. On command, SCAN looks around for controls that may have been moved, accidentally or otherwise. When it finds one, it sounds an audible warning, and the color graphics display reveals the culprit. (At the moment, it does not reveal *who* has been mucking about with the controls—that's still up to you to figure out.)

With Total Recall, golden-eared engineers can preserve their standard pre-session start-up settings in living color. Next time around, the "gopher" can set the board before the session (and memorize old golden ears' routines as well). And so on. The possibilities are endless, even if Total Recall is not yet ready to play "Star Wars."

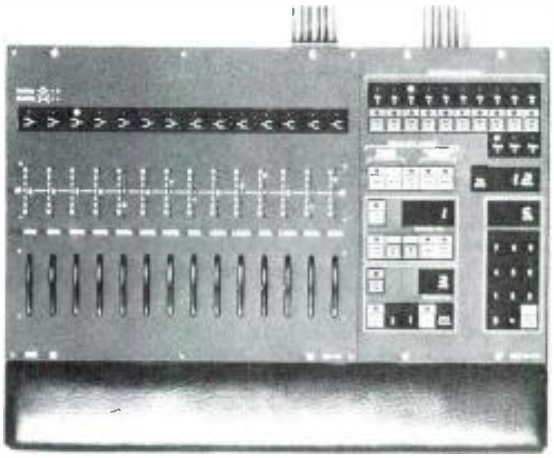
After a period of financial uncertainty, Britain's Cadac Audio is back on its feet again, after an extensive internal re-organization. Marketing manager Geoff Sore was on hand, to explain Cadac's Digicat fader system. Digicat uses a resistive ladder network in the audio chain, which is controlled by a digital fader. Individual and group faders each output an 8-bit



Designed by Jim Cunningham, the Ecoplate is available in horizontal—or vertical-mount units.



Otari's MTR-90 24-track, two inch analog tape recorder.



The NTP type 582-100 programmable equalizer.

The 20-channel electronic effects vocoder, Syntovox 221, from Synton.

word, and 12 bits of attenuator control data are used to vary the ladder network.

UNE NOUVELLE GENERATION

For creating those des effets tres speciaux—otherwise known as special effects—Publison's Messieur Peter Dean demonstrated the DHM 89B2 Stereo Digital Audio Computer. The system provides delays up to 1.2 seconds, pitch shifting over several octaves, and a variety of wacky effects which Messieur Dean took delight in demonstrating. The DHM 89B2 is capable of storing a sound in memory, and—via an external keyboard—varying the rhythm and pitch of the stored information.

The Synton 222 Vocoder.

The Publison DHM B2 Audio Computer, with accessory KB 2000 Keyboard.

REVERBERATION PLATES

For more traditional effects, two new reverberation plates were demonstrated. Jim Cunningham's Ecoplate reverberation system was set up in the Audio Engineering Associates demo room. Ecoplate reverb time is variable from one-to-seven seconds.

And from Sweden, the Stocktronics RX 4000 reverberation plate was heard at the dB Cassette Company booth. On first hearing (briefly, over headphones), the RX 4000 produced one of the most natural reverberation sounds these tired ears have ever heard. Perhaps its the famous Swedish steel?

Audicon's new "The Plate" is another new reverb system, but was not seen at the London show.

EQUALIZER

In May, 1978, we reported on NTP's type 582-100 programmable equalizer, which the Danish firm introduced to the AES at its 59th convention in Hamburg, Germany. Since then, the system has been revised, and the 582-100 now incorporates a floppy-disc control system interface, which allows hard-copy disc storage of equalization data.

A central control panel allows equalization to be programmed for up to 64 channels. Equalization settings may be copied to other channels, changed and updated from the control panel. If you can make do with 32-input consoles, one 582-100 could handle two of them nicely, and also allow the entire contents of either console to be transferred to the other one. This could be handy when moving from one studio to another down the hall. The equalizers themselves are in a rack somewhere out of sight. So all it takes is two controllers (or one portable), and you're in business.

VOCODERS

Finally, from Holland, Felix Visser brought three Synton vocoders—the Syntovox 202, 221 and 222. Unfortunately for us, the vocoder pretty-much defies explanation on paper. However, if you're planning to be at the May AES convention in Los Angeles, you can hear the vocoder for yourself. Then, *you* describe it. If you like what you hear, you'll be pleased to know that Syntovox list prices start at about $700. Of course, it's uphill all the way from there, but at least you can now begin vocoding without a second mortgage on your studio. ■

Still More On Audio Pads

IN THE MARCH ISSUE of **db**, our application note on audio pads contained a program submitted by Ronald Ajemian for computing the resistor values in T and H pads. True to form, Edsel Murphy made some "corrections" to the program, thereby thoroughly confusing anyone who tries to run it.

Here's the offending section, with the errors in lines 220 and 240 corrected (we hope!)

```
210 S = SQR (Z1/Z2)  [or, S = (Z1/Z2)^.5]
220 R1 = Z1*(K^2 + 1 - (2*K/S))/(K^2 - 1)
230 R2 = Z2*(K^2 + 1 - (2*K*S))/K^2 - 1)
240 R3 = Z2*2*K*S/(K^2 - 1)
```

Note that K/S in line 220 becomes K*S in line 230. No, this is not one more of Murphy's "corrections," although the change may puzzle some engineers who are more familiar with another version of these formulas, in which K*S appears in all formulas.

Therefore, although the lines above are now correct (we hope!), we include a slightly different version below, which conforms to the formulas found in the Audio Cyclopedia, and elsewhere. Needless to say, both versions of the four lines should produce the same final answers!

```
210 S = (Z1*Z2)^.5
220 R1 = (Z1*(K^2 + 1) - 2*K*S)/(K^2 - 1)
230 R2 = (Z2*(K^2 +1) - 2*K*S)/(K^2 - 1)
240 R3 = 2*K*S/(K^2 - 1)
```

If resistance values for several desired attenuations are required, the following expanded program may help. It lets the user enter several values of attenuation, and then computes the resistances required for each one.

```
  5 V = 1
 10 INPUT "ENTER Z1";Z1
 20 INPUT "ENTER Z2";Z2
 30 S = (Z1/Z2)^.5
 40 PRINT "ENTER DESIRED ATTENUATION, IN DB."
 50 PRINT "TO CONCLUDE, ENTER A ZERO (0)."
 60 INPUT A(N)
 70 IF A(N) = 0 THEN 200
 80 N = N + 1
 90 B = N - 1
100 GOTO 60
200 HOME
210 PRINT "T PADS";
220 PRINT TAB(10)"R1 = ";
230 PRINT TAB(20)"R2 = ";
240 PRINT TAB(30)"R3 = "
250 VTAB 12
260 PRINT "H PADS";
270 PRINT TAB(10)"R4 = ";
280 PRINT TAB(20)"R5 = ";
290 PRINT TAB(30)"R3 = "
300 FOR N = 0 TO B
310 K = 10^(A(N)/20)
320 R1 = Z1*(K^2 + 1 - (2*K/S))/(K^2 - 1)
330 R2 = Z2*(K^2 + 1 - (2*K*S))/(K^2 - 1)
340 R3 = Z2*2*K*S/(K^2 - 1)
350 V = V + 1
360 VTAB V
400 PRINT A(N); "DB";
410 PRINT TAB(10)INT(R1*100 + .5)/100;
420 PRINT TAB (20)INT(R2*100 + .5)/100;
430 PRINT TAB(30)INT(R3*100 + .5)/100
440 VTAB (N + 13)
450 PRINT A(N); "DB";
460 PRINT TAB(10)INT(R1*50 + .5)/100;
470 PRINT TAB(20)INT(R2*50 + .5)/100;
480 PRINT TAB(30)INT(R3*100 + .5)/100
500 NEXT N
600 PRINT
610 PRINT "Z1 = "; Z1; "OHMS", "Z2 = "; Z2; "OHMS"
700 END
```

This program was created on an Apple II computer, and may require some minor modifications for some other computers. By the way, the slash through the zero (0) is just to clarify that these are zeros, and not the letter 'O' (lines 50, 70 and 3000. Lines 60-100 allow the entry of one or more values of attenuation, which are stored as A1, A2 . . . A(N). When a value of zero is entered, line 70 jumps the program to line 200. The screen is cleared, and then two headings are printed; one for the T pads, and the other—midway down the screen—for the H pads.

At line 300, the calculations for the first entered value of attenuation begin. At line 400-430, the values for the T pad are printed. Line 440 jumps the display to below the H pad heading, and then lines 450-480 print out these values.

Line 500 returns the program to Line 300, and the values for the second entered value are computed, and then printed. The process continues until resistance values have been computed for all entered values of attenuation. Then, line 610 reprints the values that were entered for Z1 and Z2.

Assuming that we entered Z1 = 600 (ohms), and Z2 = 500 (ohms), the display should look like this when the program is run;

T PADS	R1 =	R2 =	R3 =
10 DB	348.43	226.21	384.9
20 DB	501.47	399.45	110.65
30 DB	566.53	466.33	34.68

H PADS	R4 =	R5 =	R3 =
10 DB	174.22	113.11	384.9
20 DB	250.74	199.72	110.65
30 DB	283.26	233.16	34.68

Z1 = 600 OHMS Z2 = 500 OHMS

What if one or more resistance values turn out to be negative? The first few readers to figure out the significance of a "negative resistance" in this context win a free subscription to **db**. (We told you we'd do it again sometime!) ■

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PRO-SOUND equipment. Mail order discount catalog free. Write or call **Sonix Co., Dept. D, P.O. Box 58, Indian Head, MD 20640 (301) 753-6432.**

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DO YOU KNOW A MACHINE THAT talks? For "Vox Inhumane" (radio documentaries on talking machines)—Wanted: leads to phone answering machine messages, how-to records; talking toys, games, computers; phone #'s of "Dial-A's—. . . ;" PA announcements. Prefer unusual, ingenious, strange, funny. We are non-profit radio production company. Send information to: **Radio Fdn., Box 884, Ansonia Station, New York, NY 10023.**

WANTED

WANTED: RECORDING EQUIPMENT—mikes, recorders, consoles, outboard gear. **Greg Field, Box 243, San Mateo, CA 94401. (415) 343-1353.**

USED 16 TRACK AUDIO TAPE MACHINE, must be late model, state of the art, in good condition, such as; MCI JH-16, Ampex MM-1200, Studer A80/VUMK II or Otari MTR-90. Att. **Lee Short, General Television Network, 13225 Capital Avenue, Oak Park, Mich. 48237 (313) 548-2500.**

SUBSCRIPTION RATE CHANGE

Effective with the June 1980 issue of **db—The Sound Engineering Magazine** there will be a change in the subscription price. The new rates will be:

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2 years—$22.00
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db People/Places/Happenings

• Late last fall a speeding car careened across Hyperion Blvd. in the eastern part of Hollywood and through the front wall of **Music Lab Recording Studios.** Unfortunately, behind that wall sat an **Otari 5050** tape recorder in a wooden roll-about cabinet.

According to **Chaba Mehes** (owner of Music Lab) the place looked like a war zone. When the clean-up crew started to dig out the hundreds of pounds of stucco, plaster and other debris, they found the 5050 across the room... 10 feet from its original location. Naturally, the wood cabinet was in splinters, but the only visible damage to the 5050 was a bent frame and dented screen.

Mehes had his shop dump as much debris out of the 5050 as possible, they then used compressed air to clean out the rest of the plaster dust. To everyone's amazement, the 5050 operated perfectly when it was plugged in. After straightening the frame and screen, the 5050 was put back to work in Music Lab's studio and dub-down room. No other work was done on the machine!

As a postscript, a week after the first accident, another car careened across Hyperion demolishing a parked car . . . which fortunately kept Music Lab from losing another front wall and...

• **Teledyne Acoustic Research** has announced the appointment of **Peter D. Gaskarth** to the position of Vice-President. Gaskarth, based in **Acoustic Research's** Houghton Regis offices, is in charge of AR's entire overseas operations. He was most recently Sales and Marketing Director for **Rola Celestion Limited,** a British loudspeaker company. Gaskarth plans to concentrate on management development, cost control, and improved market penetration for AR internationally.

• **Falcon Records** of McAllen, Texas recently completed the updating of their studio from 16-track to twenty-four track according to owner **Mark Ramirez.** The studio features an Otari MTR-90 20-channel recorder, a Sound Workshop console, dbx noise reduction, and assorted peripherals. The installation was done by **Westbrook Audio, Inc.** of Dallas, Texas.

• **Rupert Neve Incorporated** recently announced the appointment of **Peter V. Horsman** to the position of Regional Sales Manager in Hollywood. Mr. Horsman joins Neve with 17 years of sales, engineering and management experience. From 1972 until recently, he was manager, Professional Division of James B. Lansing Inc. He is a graduate of Lincoln College, Lincoln, Illinois. Mr. Horsman is a member of the Audio Engineering Society and served as chairman of the Los Angeles section in 1978. Horsman will manage Neve's newly-renovated facility on Sunset Boulevard in Hollywood.

• **Thomas E. Mintner** has been appointed Manager of Broadcast Products Division, of **Studer Revox of America.** His responsibilities will include developing the broadcast equipment market for the company. He will be based in their New York office. Mintner was most recently affiliated with the **Rupert Neve Inc.,** Lyrec and Necana Computer sections. He is a member of the Audio Engineering Society and comes to Studer with a wealth of marketing expertise and broadcast products knowledge.

• **Kendun Recorders Service Corp.,** of Burbank, have recently expanded and renovated their facilities. The eight studios, designed and constructed by **Sierra Audio,** features the latest in acoustic design with special emphasis on digital recording for the 80's. New consoles are being installed in Studio 1 at Kendun and in Studio B and C at Artisan. **Artisan Sound Recorders,** a long established mastering house, now contains two fully equipped mixdown rooms. Studio C features an automated MCI 556 console for 48-track work. Studio B, with its 32-channel console makes Artisan capable of taking any project from mixdown to completion.

• **Westbrook Audio, Inc.** of Dallas, Texas, announces the appointment of **Keith Kavanaugh** as director of sales for the company. Kavanaugh has been with Westbrook Audio as a salesman since 1979. He was formerly a staff engineer and arranger for **Rainbow Sound** of Dallas.

• **Leader Instruments Corporation** recently announced the appointment of **Charles I. Ogden** as Director of National Sales. In this newly created position, Ogden, will be responsible for managing Leader's continuing growth in existing markets and for the development of new markets for the company's electronic goods. He brings to this position over 20 years of sales and management experience in the electronics and computer industries. Most recently he was the Branch Marketing Manager for **Honeywell Information Systems.** Ogden is a graduate of Pace College and now resides in Wayne, New Jersey with his wife.

• **David E. Nally** has been appointed Vice-President of Operations for the **Recordex Corporation** of Atlanta, Georgia. The company manufactures audio tape duplicating equipment and accessories. In his new position he will be responsible for all phases of plant operations for the full Recordex product line sold throughout the US and Europe. Nally is a graduate of Georgia State University, and a native of Cartersville, GA. He has been with the corporation for the past four years.

• **Thomas H. White** has been elected President of **White Instruments** in Austin, Texas. Mr. White joined the firm in 1964 after studying at the University of Texas. He became Executive Vice-President in 1972 and served that capacity until becoming president. White Instruments has most recently developed a one-sixth octave sound system analyzer and equalizer.

• **TDK Electronics Corp.,** manufacturer and marketer of quality audio and video recording tape products, announced the roll-out of major deck manufacturers that have selected the TDK metal tape as their reference tape for the metal bias position. A total of sixteen major deck manufacturers, representing eighteen different brands, have selected TDK because of sound reproductions qualities that deliver four times the magnetic energy of the best high bias tapes. These companies represent over 98% of metal deck sales in the United States at this time.

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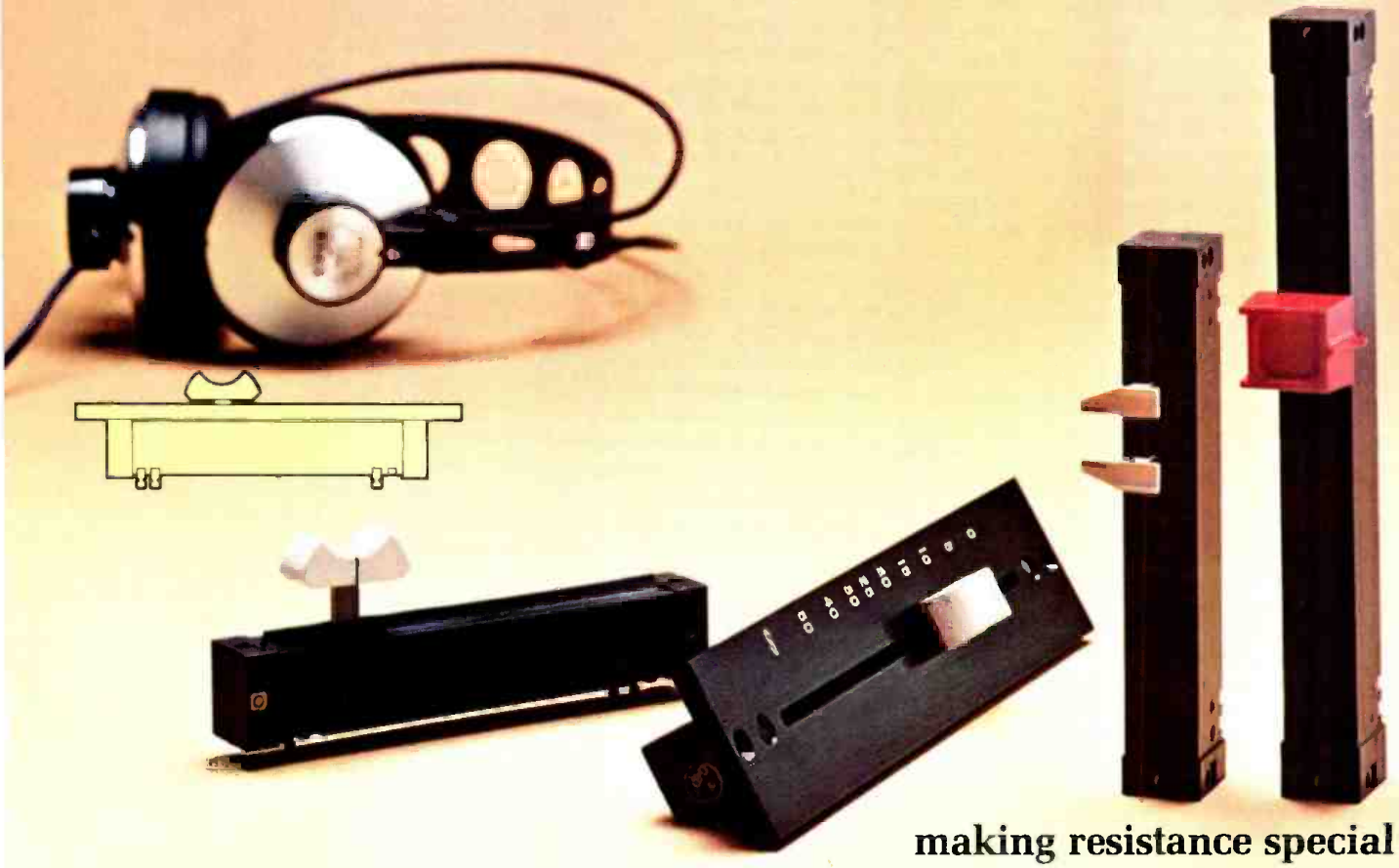

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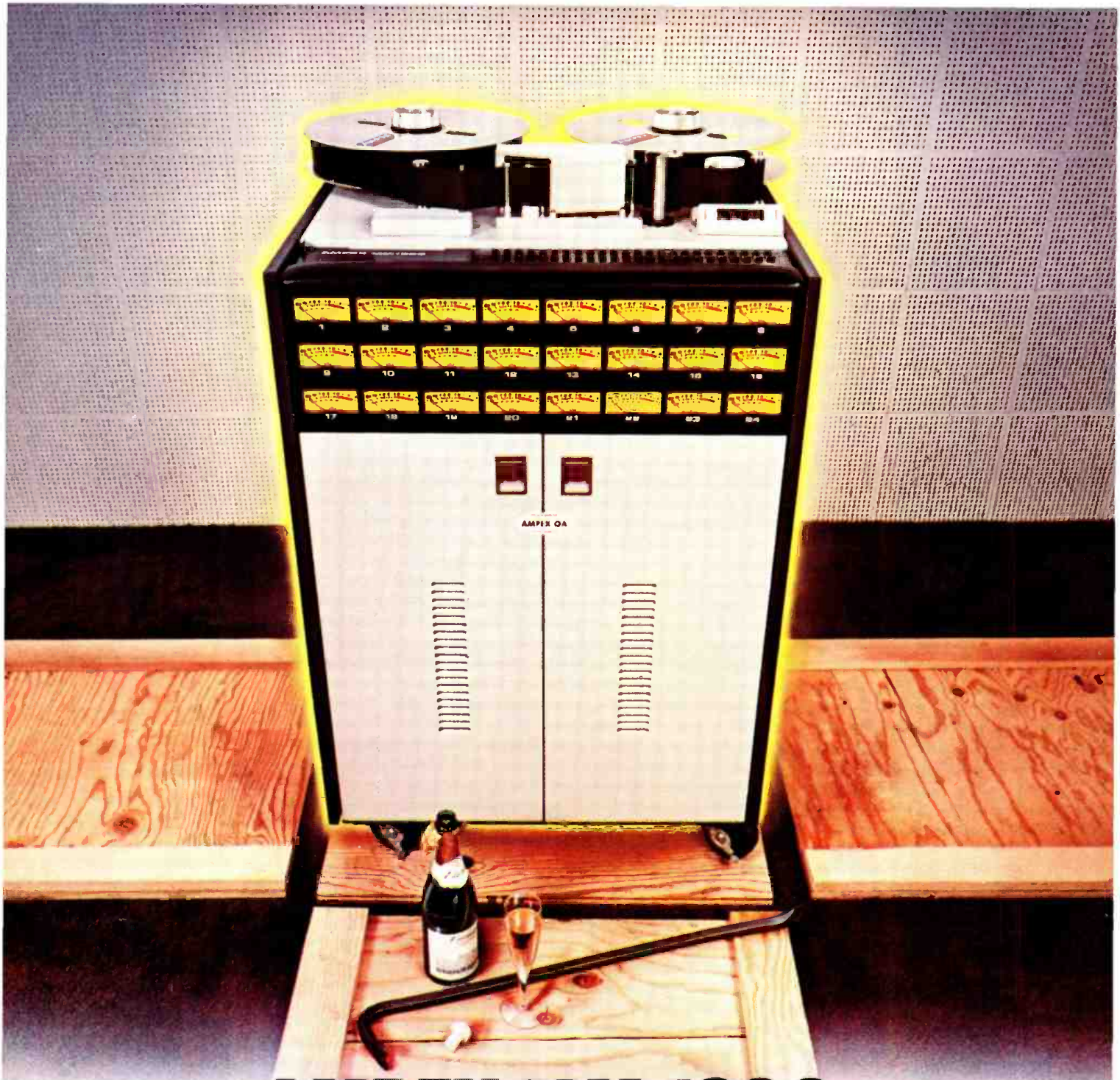

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