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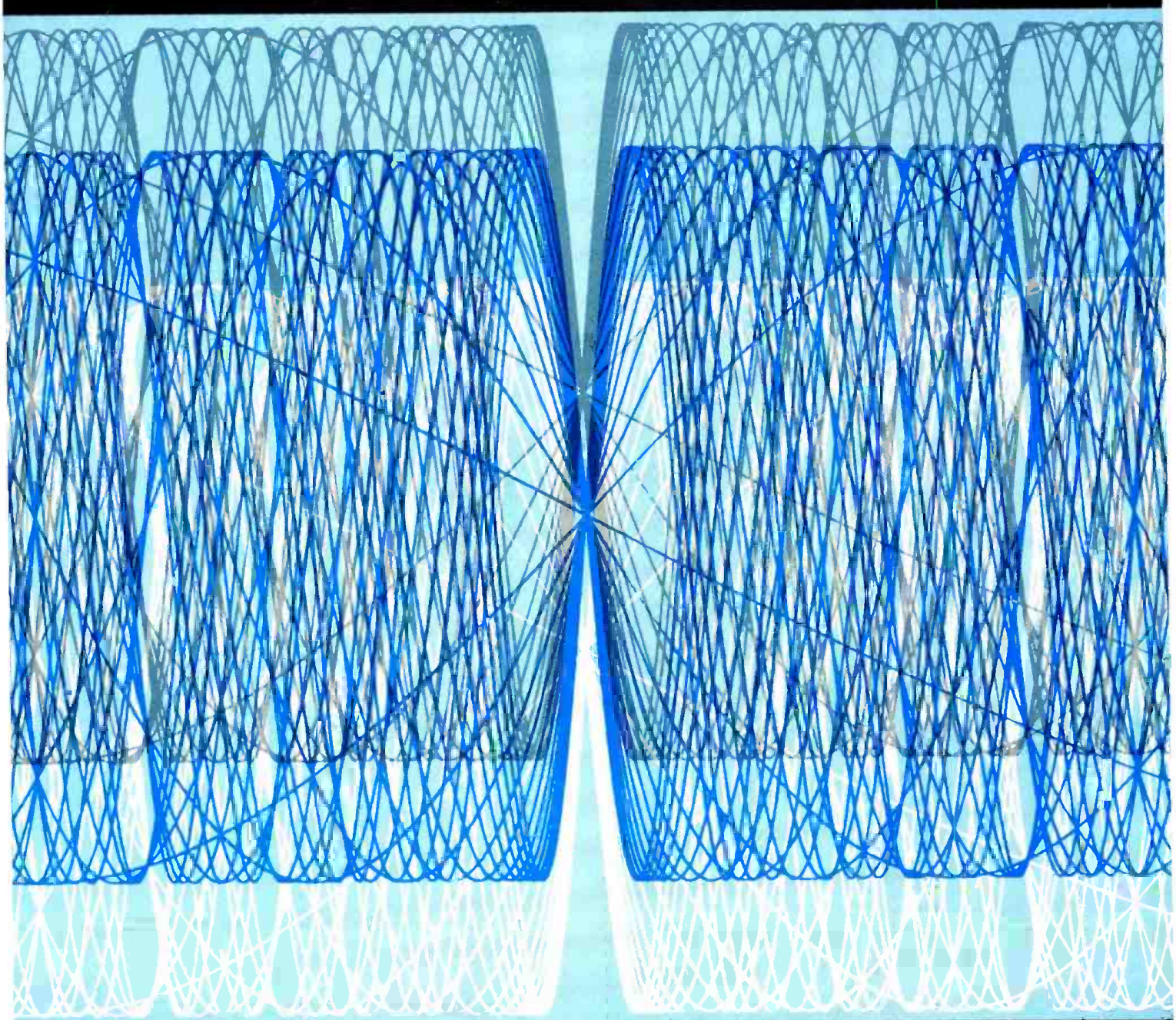
THE SOUND ENGINEERING MAGAZINE

DECEMBER 1974 $1.00



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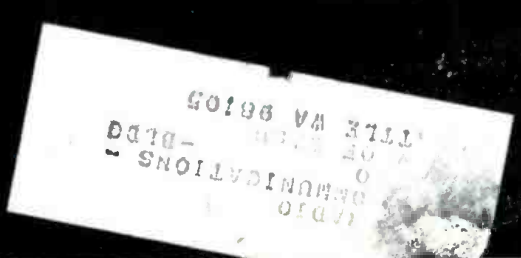
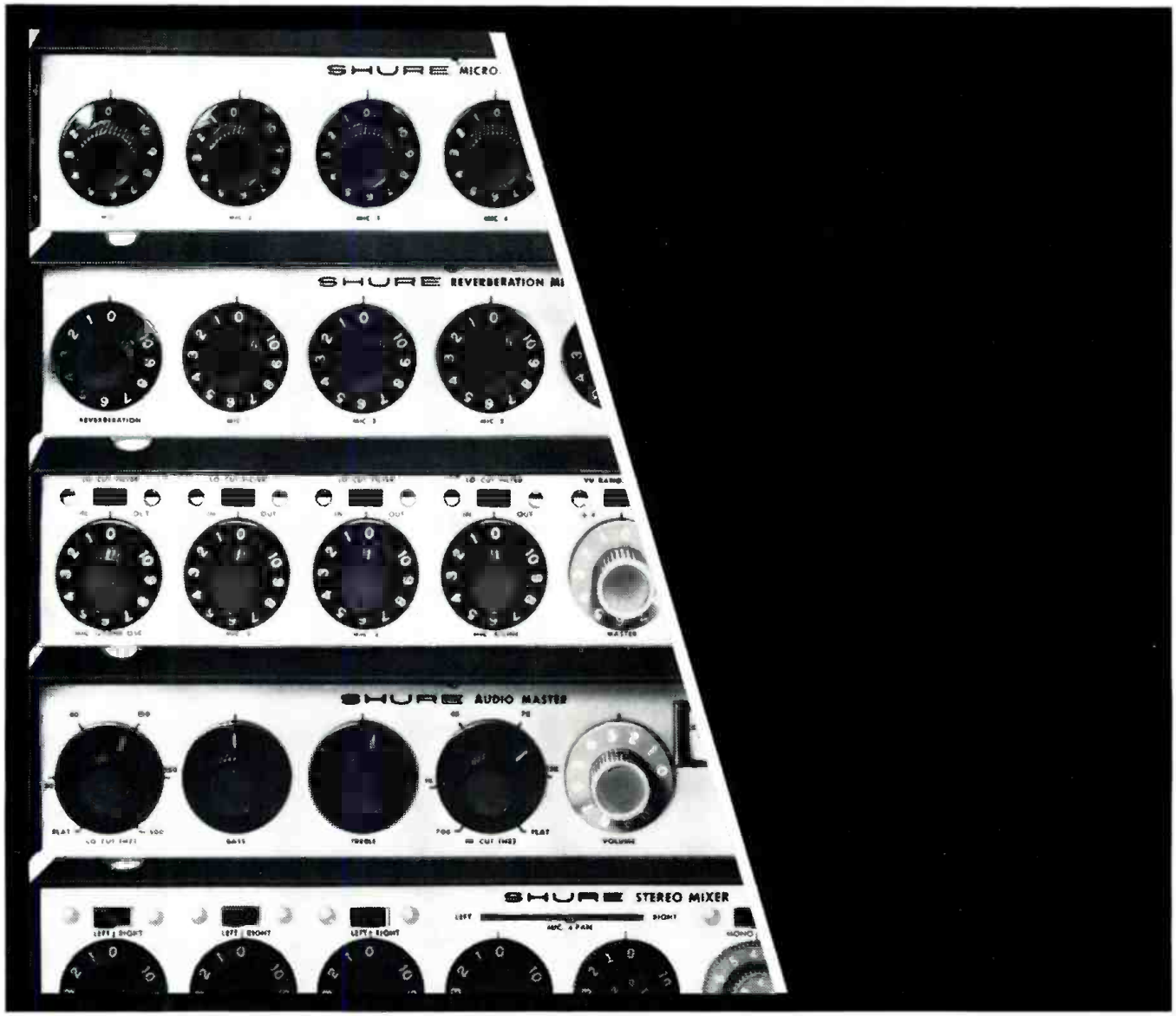
- Professional Sound Recording A British View, Part 2
- Recording Studio Acoustics, Part 3





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COMING NEXT MONTH

Accent on Education

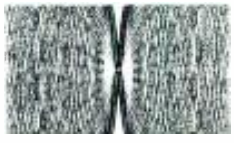
● SOUND EDUCATION BY THE BAY, by Ron Ziskin, reveals how San Francisco State University, with its well-equipped facilities, is providing valuable experience in sound recording for film, broadcasting, commercial recording, and live performances.

In addition to offering audio courses, Syracuse University boasts a modern communication center which houses nine studios, as well as an f.m. station—all described in AUDIO GETS BIG BOOST AT SYRACUSE, by Mark Gander.

Can you square milliamps? Calves? Millicalves? Before you try to square milliamps, read Marshall King's HOW TO HANDLE A SQUARE, wherein he discusses squaring of things like calves, millicalves, boxes, candy, and—oh, yes—milliamps.

Also, there'll be our regular columnists, Norman Crowhurst, John Woram, and Martin Dickstein in **db. The Sound Engineering Magazine.**

ABOUT THE COVER



● The plot on the cover is by John Whitney, drawn on a CalComp 748 flatbed plotter. Whitney, whose computer generated films have won international recognition, created the plot as a schematic rendering of some theoretical work he is doing on the sponsorship of the National Endowment for the Arts. The full plot is a superimposition of every whole sine wave plot from one to twenty-four and is part of Whitney's study of what he calls "visible harmonics" and of the foundations of periodic graphics.

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Larry Zide EDITOR
Alex Porianda MANAGING EDITOR
John Woram ASSOCIATE EDITOR
Bob Laurie ART DIRECTOR
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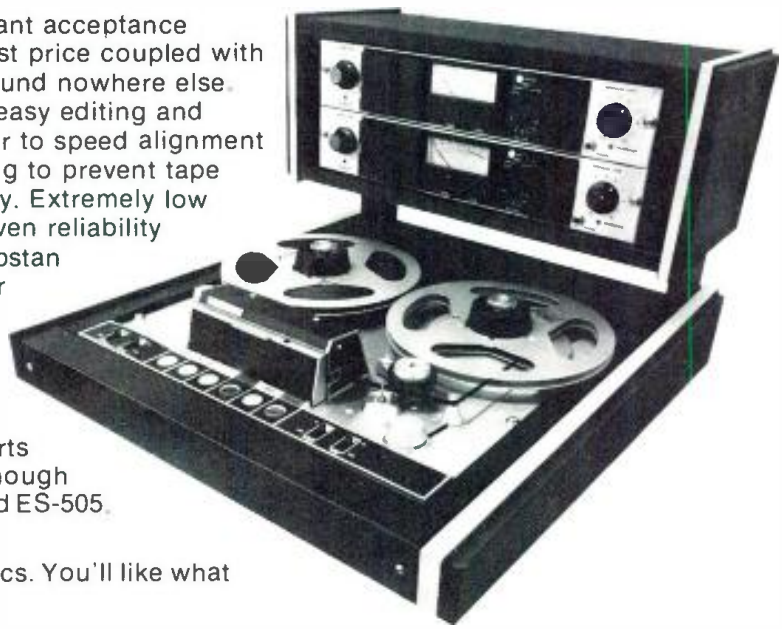

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Circle 13 on Reader Service Card

db letters

THE EDITOR:

Even though it has been some time since the article by Ting Barrow, *A Mic Preamp/Mixer*, appeared in the June issue there are some additional considerations which your readers might find of value.

Photocells are inherently slow devices even when driven by light emitting diodes. For the example given, of an Opamp Labs preamp, to drop the gain from 50 dB to 47 dB gain (—3dB) requires that the photocell reach a resistance of about 15k. If the led is receiving 40 ma, this will take substantially less than a millisecond. If the led is not receiving 40 ma (about +27 dBm) it will take proportionately longer. This does not take into account any capacitance across the diode which will tend to slow the risetime of the photocell. This means that unwanted peaks will tend to slip through.

It has always been my experience that bridge rectifiers placed across audio lines tended to increase the distortion of the line. If the bridge circuit suggested by Mr. Barrow is used, it would be good practice to use a spare output to drive the led circuit.

Also of interest to readers wishing to use this circuit is that a non-hermetically sealed version of the VTL 2C2 is available from its manufacturer, Vactec. The nonsealed version is the VTL 5C2 and costs about half the price of the other. There are also several different types of photocells available for other applications. The address is:

Vactec, Inc.
2423 Northline Industrial Blvd.
Maryland Heights, Missouri 63043

They have a good brochure which describes the VTL 5 series of *Vactrols*.

Philip C. Todd
Long Beach, California

CORRECTION

In the circuit diagram of the article, "An Almost Something for Nothing Power Supply," **db**, September, 1974, p.30, the polarity of CR1 and C4 should be reversed. We are sorry about this error.

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Circle 14 on Reader Service Card

db the sync track

JOHN M. WORAM

". . . the problems of a small company"

● Here's a follow-up letter on the microphone controversy that brings up some interesting thoughts on:

". . . the problems of a small company or individual located out of the mainstreams of the communications industry.

"On a limited budget, say $100 to $300, let's say you need a microphone. If you look at the variety available from Shure, AKG, Beyer, and the others, it's easy to be confused by the bewildering array of choices. RCA or Columbia may get a sample to try, but how about the XYZ studio in Oshkosh? How do they know which is the best value, which make is reliable, and which is more responsive or more rugged? Notice I am not talking about placement technique, etc., but about quality and value.

"To use another example, suppose I need a 2-track tape recorder for portable use. The choices are Crown, Revox, Teac, Otari, Electrosound, ITC, Superscope. How do you know which one is a dog, and will always be in the repair shop? Once you buy the machine it's yours, and if it is a dog you are stuck with it. How does XYZ Studio know a distributor's stock of parts, or the ability of a manufacturer's service technicians?

"If you rely on a salesman, generally he will recommend what he has in stock, not what is the best. In a big city like New York, you can discuss with your colleagues these aspects and specific items, but how about the beginner? How can he tell that Brand X is great and Brand Y a lemon, (I own both). The specs are the same, and they are both 'professional,' yet there is a world of difference. I have never seen a bad test report on pro equipment. From what I am told, if the reviewed equipment is not up to par, the review is not published.

"To get back to mics, when a person wants to buy a microphone he may use it for recording voice or instruments. A spec sheet will be of no help. Placement and attenuation are important and they can only be learned by practice (as you stated) but reliability and suitability cost money to learn about. Taste you have, or can acquire, but that comes from practice."

Well, there's no doubt at all that the out-of-the-mainstream company, or individual, does have problems not faced by the big-city boys. Of course that's true no matter what business you're in. If your nearest source of supply—whether for product or just information—is miles away, you don't have it as easy as the midtown business. Perhaps you have other advantages, like lower taxes, air you can breathe, safe streets and such, but when you need to buy a mic or get a tape recorder fixed, you may have a problem.

Your out-of-the-way position forces you to be better prepared for emergencies; if you get an unexpected big session, you can't borrow extra mics from the studio down the block, and if your console falls apart, no one's going to drop in to give you a hand putting it back together again. And even if you're just wondering what's the best buy in a whatchamacallit, there's no one in town to talk to. So, what do you do?

You can't hope to find a textbook of answers to your problems. The wisdom to make a wise choice from among a seemingly endless variety of makes and models doesn't come out of a book. But doesn't that apply to autos as well as audio? Or to just about anything for sale?

On the subject of tape recorders, for example, I've had several of the Brand X's that this reader likes. They were excellent machines—until they needed servicing. After a few round trips to the service department, I learned the lesson: if you have trouble with a Brand X, the last place to look for help is from their service department. Eventually I dumped the damned things and bought a Brand Z. Now I'm happier, and wiser for my experiences.

But there's nothing here for the textbook. Although my Brand Z was made on the other side of the world, their service company is just across the bridge from where I work, and their technicians are competent, although fortunately I've never needed to call on them (yet). So, what shall I say in this space?

If I say that Brand X (the writer's favorite) is no good, he'll realize I'm a know-nothing. If I tell him that Brand Y or Z is the best, then what about the guy in the midwest who is near a Brand Y service center, but 1,000 miles away from help with my personal favorite? Or the other fellow, whose uncle's father-in-law knows someone at Brand Q, and can get a real bargain, but is it worth it, since

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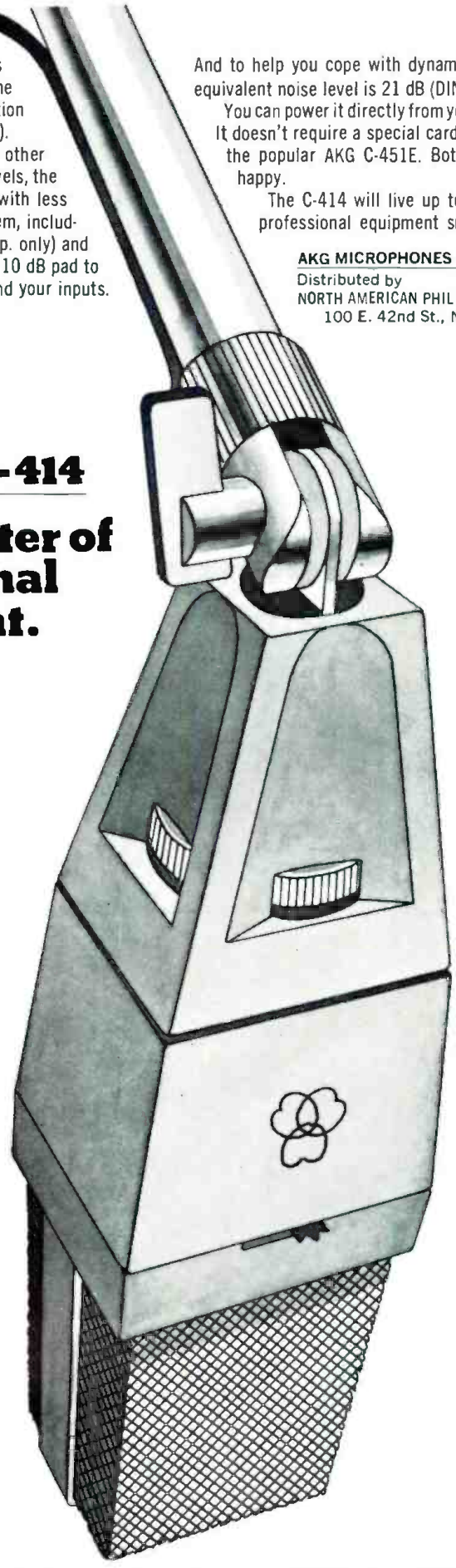

Circle 15 on Reader Service Card

the sync track (cont.)

their nearest service station is in Okinawa?

Once again, there's no textbook answer. Each person's situation, location, budget, personal preference, education, ability, needs, (and on and on) must be considered carefully, and what makes sense for one will not for another, and vice versa.

A hell of a lot of help that is to the guy out in the woods wondering what to do next. Maybe this brings us back to the discussion about dealers.

WHAT ABOUT DEALERS?

Dealers do not make much money recommending equipment they do not sell, just because it happens to be best for you. Years ago, in the movie, "Miracle on 34th Street," Edmund Gwenn played a Macy's Santa Claus who told a parent she could find what her child wanted in—horrors!!—*Gimbels!* Truly a miracle for any street. Well, ole Santa almost got himself nailed to a Christmas tree, until Mama told the store manager she was so impressed with this honesty stuff, she'd do all her future shopping at Macy's.

There's a very elemental lesson here, but I guess most of the dealers didn't catch the movie, or else don't believe in Santa Claus anyway. It would seem to me that if a dealer made a point of recommending one or two items he didn't happen to sell, the customer would be so shaken up that he would be a sucker for anything the dealer was trying to unload. But so far, the world doesn't spin that way, so don't go around looking for miracles on 34th street. And, if you've finally found the biggest discount shop north of the equator, don't go around looking for service and good advice either. Expect what you're paying for, 'cause that's just what you're going to get.

YOU GET WHAT YOU PAY FOR

So, where does that leave the small guy? That *is* the question isn't it? We all know what a tremendous variety of equipment is now available. With a few exceptions, reliability, value, durability, are all functions of cost, or, the more you pays, the more you gets. It's often that simple. If you're out of the mainstream, don't forget it. You get what you pay for . . . And what if you don't know what to pay for?

This is turning into a great big ad isn't it? Well, I did my plug for the consultant a few columns back, and although a few folks have made some pointed cracks about creeping commercialism, no one has come up with an alternative solution, good *or* bad. One of the things that led me into the consulting racket was a suspicion that there was a viable maret for helping the small guy get his studio together. Now that I've been doing it for a while, I note a frequent resistance on the part of the small guy to go along with my lofty dreams of making a killing laying advice on the millions. I guess I'll cope, but why is it that the person who will at one time or another hire a lawyer, an accountant, a tax attorney, and other assorted hangers-on, would rather go out of business than call for assistance, even though he writes that he needs it?

If this were my own little problem, I'd keep quiet about it, and maybe go see a shrink, but I hear the same thing from others, including reputable dealers. A customer will come in who is just starting out and bargain away until he gets a rock bottom price. Then he'll spend a week or a month trying to get the supplier to teach him the business. Later, he'll go back to the woods and blame everybody but himself for his troubles.

Which forces me into an awkward position. What *is* the answer to the questions raised in this guy's letter? I think we'd all like to know. ■

you write it

Many readers do not realize that they can also be writers for db. We are always seeking good, meaningful articles of any length. The subject matter can cover almost anything of interest and value to audio professionals.

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You don't have to be an experienced writer to be published. But you do need the ability to express your idea fully, with adequate detail and information. Our editors will polish the story for you. We suggest you first submit an outline so that we can work with you in the development of the article.

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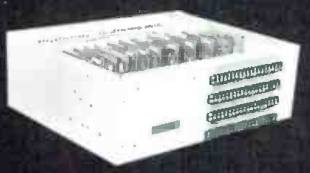

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RAMKO RESEARCH

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db theory&practice

NORMAN H. CROWHURST

● Once before, when I thought I had stated something quite plainly, but found I had cut corners such that I had to spend two more columns to clarify what I meant, after the first attempt, one reader, a professor at some college, commended me on how I could spin out words, explaining a very small point at great length. To tell the truth, that was how it seemed to me, too, but other readers showed that I had still used not quite small enough a "spoon."

This time, the editor forwarded a letter to me which reads:

The Editor: In response to Mr. Crowhurst's column in August 1974 **db**, *I must ask for further clarification. "Theory and Practice" did clearly state a generally overlooked fact (that of the basic differences in IMD measurement). However the analogy drawn in paragraphs 11 and 12 is either misleading or wrong.*

Indeed the waveform generated by two frequencies close together is complex. However (against Mr. Crowhurst's opinion) in free space such a waveform sounds (except for the predictable effects of the Fletcher-Munson curves) exactly the same regardless of the distance from the speaker. Further, if it is reproduced by a single driver with small excursions (such as a horn) it sounds like two frequencies close together, not vibrato or tremolo. Such effects can be caused by non-linear (distorting) processes in electronics or speakers, not by the ear or by relatively small amounts of air between the speaker and the listener.

Did my paragraphs 11 and 12 in the August issue cut corners too much? I did not say that the waveform would *sound* different, but that for frequencies close enough together to simulate vibrato or tremolo, which the letter writer precludes by saying that two frequencies close together never sound like vibrato or tremolo, but always like two separate frequencies.

The point I was making, in referring to two frequencies radiated from the same loudspeaker, is that, having different wavelengths, they cannot, at the same instant, have the same phase relationships all along the path they pursue through free space. Was that wrong? Or was it misleading?

SYNTHESIS OF THREE

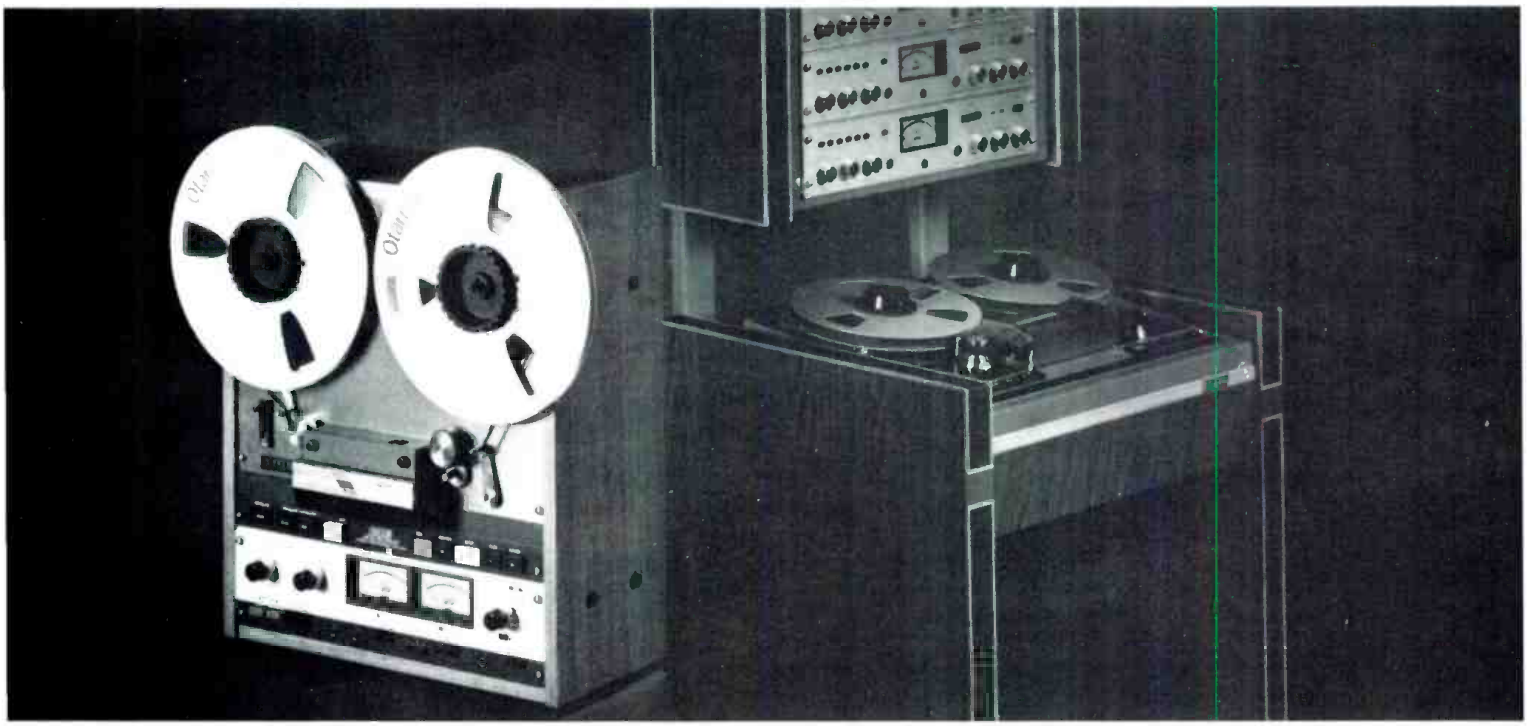
Maybe I skipped a bit, to keep within a reasonable space for one month's column, in not pointing out that both frequency, or phase modulation, and amplitude modulation, are a synthesis of three frequencies, not just two. But before elaborating on that, I should point out that organ makers produce the "wavery" (I use that word to avoid either "tremolo" or "vibrato") quality of "celeste" stops, by using either two sets of pipes, or two sets of oscillators, tuned very slightly differently.

Now, to the comparison of amplitude and phase or frequency modulation. In the August column, I mentioned that this is true for small amounts of either, but that deep modulation of either kind prevents it. Amplitude modulation consists of a carrier, with two frequencies, one above it by the modulation rate and the other below it by the modulation rate.

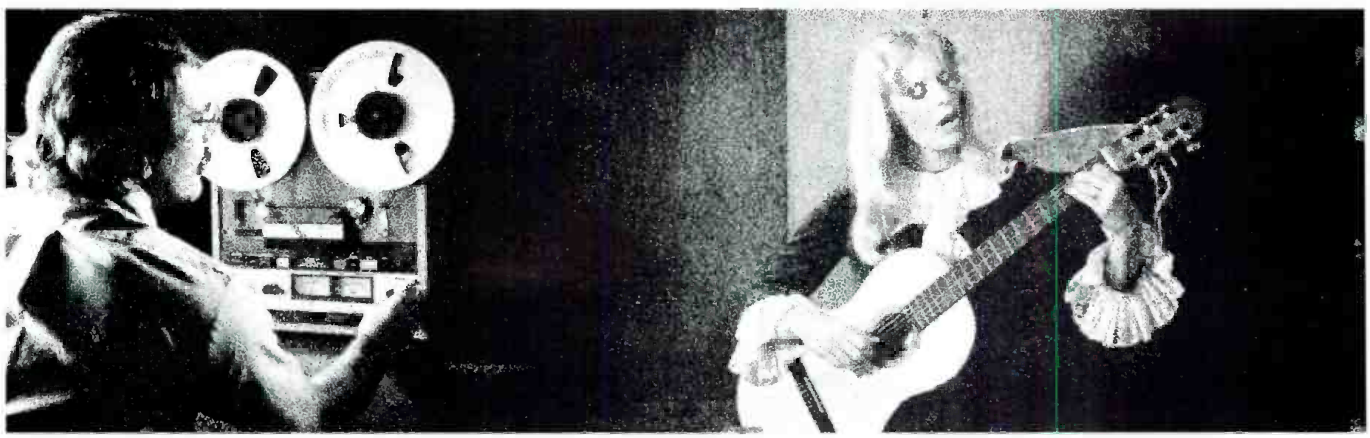
Thus, if we are talking about a 1000 Hz signal, modulated at 6 Hz, which is a rate used for vibrato or tremolo, it will consist of a big 1000 Hz signal, with two smaller signals, of 994 and 1006 Hz. According to the letter-writer, these would be heard as three separate and distinct frequencies. Rather than argue the point, I can only suggest that he try it. But to pursue the point of identifying the difference between the forms of modulation.

In a neutral position of amplitude

MINI-PRO!



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



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

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

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

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

OTARI

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

In Canada:
Noresco Manufacturing,
Toronto

Circle 17 on Reader Service Card

theory & practice (cont.)

modulation, one "sideband" leads the carrier by 90 degrees, while the other lags it by 90 degrees. Let us assume that the lower sideband leads, while the higher one lags. This means that 1/24th of a second later, they will all be momentarily in phase, showing an increase in amplitude. Another 1/24th second later, the sidebands will have swapped places from the starting point, so the carrier is unaffected by them.

A third 1/24th second will see the sidebands both out of phase with the carrier, reducing the resultant amplitude; and a fourth 1/24th second, making up 1/6th of a second, one period of the modulating frequency, will bring us back to the starting point. That is how amplitude modulation is synthesized with three frequencies of unchanging amplitude. A frequency of changing amplitude is never a pure, single frequency. The change is modulation, and represents the addition of other component frequencies.

Now look at phase modulation. If we take the same three frequencies, but start with one sideband in phase with the carrier, and the other out of phase, they still do not affect the carrier. If the upper sideband is in phase, 1/24th second later, both sidebands will lead the carrier by 90 degrees, resulting in a phase advance, with little amplitude change. Another 1/24th second later, the sidebands will have traded places from the beginning positions. After the third 1/24th second, both of them will lag the carrier by 90 degrees, resulting in a phase delay.

Thus, using the same three frequencies, but with changed phase relationships, will change the effect from amplitude modulation to phase modulation. Is this wrong, please?

MODULATE TWO WAYS

In my previous column, I tried to explain how circuitry or other components can modulate the higher frequencies by the lower ones in two possible ways. The better known, because it was the basis of the original SMPTE form of measurement, is amplitude modulation. Because of nonlinearity, somewhere in the system, the larger amplitude low-frequency wave modulates the higher frequencies present, in amplitude.

In those days, frequency or phase modulation of the higher frequency by the lower was unlikely. But now we have cleaned up linearity, reducing

distortion to unbelievably low levels, there is a possibility, and even an increased probability, that phase modulation will occur.

The reason I introduced these analogies, was simply to show that phase modulation of higher frequencies by lower frequencies will be equally audible with corresponding amplitude modulation, although, by the very nature of the measurement, the SMPTE test will not catch the phase variety. Was my analogy misleading for that purpose?

It seems that some people get such strongly, and too often wrongly, entrenched notions into their heads. Or else they are capable of thinking only in such very limited "tracks," that everything is put into some context for which it was not intended.

To me, at my rate, the waveform generated by two frequencies close together is not all that complex. Its envelope is very like the amplitude modulated envelope, except that in the fully amplitude modulated envelope, every cycle has the correct period, defined by the frequency in Hertz. Two frequencies close together produce something that is neither pure amplitude nor pure phase modulation, but an unvarying combination of both.

But if, as I thought I explained, these frequencies are close enough together to simulate vibrato or tremolo —actually it would be more accurate to say they synthesize celeste—it will never sound like two frequencies close together, as the letter-writer insists.

In view of the fact that he introduces Fletcher-Munson effects, which relate essentially to fairly widely separated frequencies, and groups all such effects together, as happening in electronics or speakers, I wonder whether the letter writer—and that gets me wondering how many, who do not write—understood anything of what I was trying to convey, which I will reiterate.

SOMEWHAT INDISTINGUISHABLE

From the hearing point of view, frequency or phase modulation of higher frequencies by lower frequencies is indistinguishable from amplitude modulation of higher frequencies by lower frequencies. Different kinds of nonlinear effect, in electronics and in loudspeakers, including the Doppler effect, publicized by Paul Klipsch, can introduce these defects into the program that gets radiated.

But—the SMPTE test will only detect the amplitude modulated variety, and completely ignore the phase or frequency variety, unless perchance, it gets converted from one to the other, somewhere. At one time, I used to think that Paul Klipsch had a valid point, but why did he belabor it so? I'm beginning to see why.

If readers have difficulty unscrambling the mysticism I worked into my August column, quite unintentionally, mark you, then I can imagine the difficulty the same group might experience trying to see that the special movement of a diaphragm can frequency or phase-modulate higher frequency components produced at the same time, Doppler style, in the same way that a car horn coming toward you always sounds higher in pitch than one going away from you. Or is it only myself and Paul Klipsch who

imagine that effect? Are we being misleading to mention it?

If I seem feisty, please be assured that I am glad such people write. If they did not, I might never know that I am failing to communicate adequately. And it does not bother me that I fail to communicate. Rather, it gives me the opportunity to try to do better. But, as I re-examine what I wrote the first time, the reason why that failed to communicate does bother me.

Sometimes, when I receive such a letter, or perhaps hear about it over the telephone, I experience a shock: "Good gracious, did I say that?" Then I re-examine what I wrote, and find that it was all correct, that the reader had somehow misinterpreted it. In this instance, I know that two frequencies combined will make the same envelope, anywhere. Only the timing of the envelope will vary, along the path.

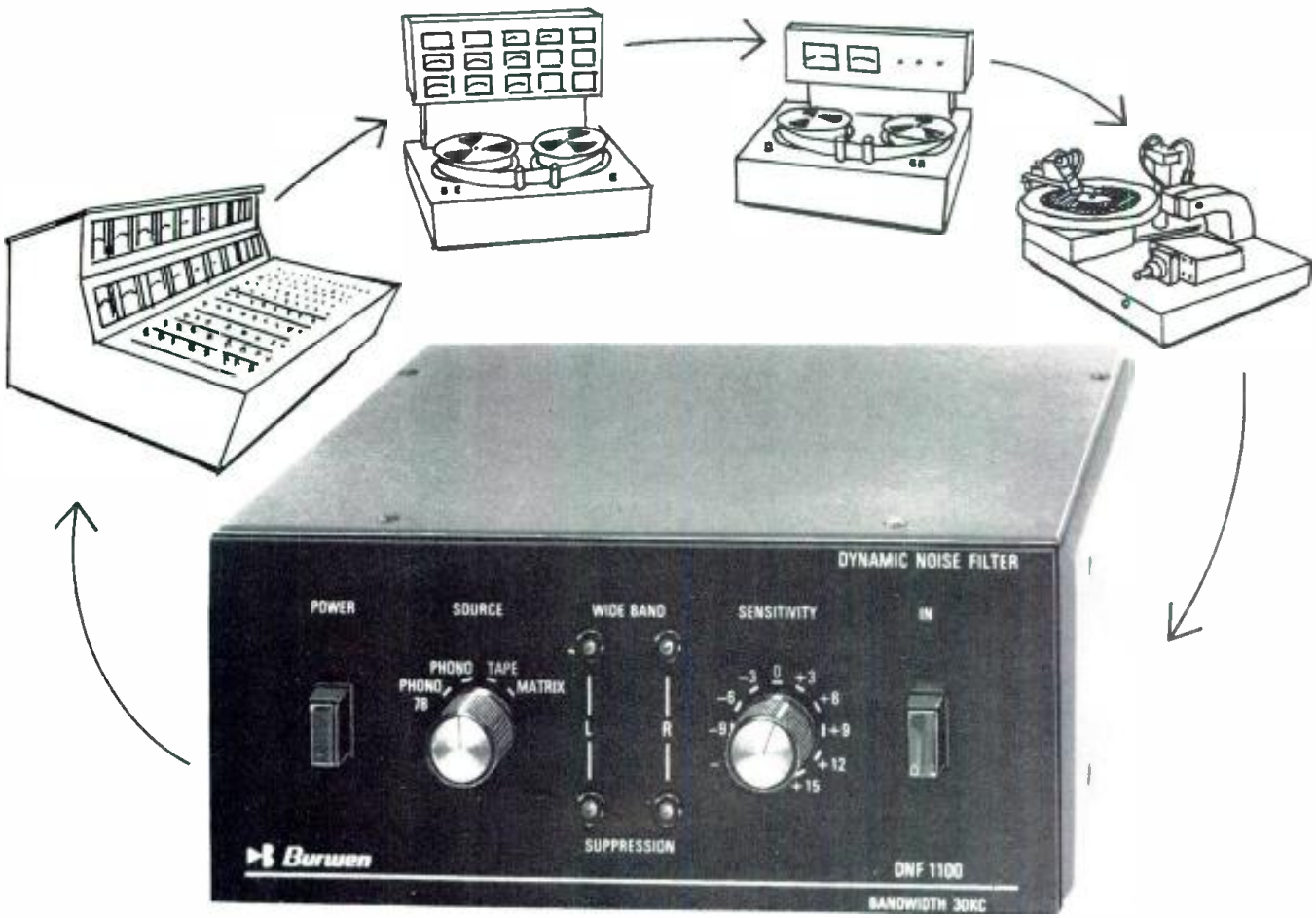
So when the writer's letter suggested that I had said they sound different at various points along the path, I was worried. Surely I had not said that? And surely enough I hadn't! So how could he read that into what I had said?

Because his education has not taught him to think analytically, or to follow a discussion that uses such thought processes. He insisted that my analogy must be *either* misleading *or* wrong. He did not know which he thought it was, because all he really knew was that what he thought I was saying contradicted something already in his head, that he "knew" because teacher told him it was so, or he read it in a textbook somewhere.

The column began with a paragraph that the editors altered for me, because they changed the sequence of publication. I refer particularly to the last part of the last sentence, about professional educators sharing a universal compulsion, to impress both their colleagues and the rest of the world with their erudition rather than their understanding of what is actually going on.

"Erudition" is a word I have heard many educators use. In fact I have been complimented, as I thought, as being erudite. But I had never bothered to find out what the word really means. Erudition means book learning. Thanks, whoever rewrote that for me. I like it! If they didn't have that universal compulsion, maybe my reader would have understood what I meant. ■

The Burwen 'Master' Dynamic Noise Filter.



Reduces Noise in Every Step of the Recording Process.

A reduction of 6 to 14 dB at every step of the recording process is now at your disposal. The new Burwen Model DNF 1100 Dynamic Noise Filter virtually eliminates hiss and high frequency noise on the outputs of your multi-track console, from your multi-track master tape, from your 2 channel mix and in your master cutting channel. The Model DNF 1100 is an automatically variable low pass filter which alters the bandwidth depending on the high frequency content of the material. Since it requires no pre-encoding it can be used at every step of the recording process.

A stepped sensitivity control is incorporated so you can reproduce the same effect each time. attack times can be selected depending on the program source involved.

All in all, for a cleaner and clearer sound than you have ever gotten before, ask your Burwen professional representative or call or write us for a demonstration.

Price: $1498.00 Stereo
$ 998.00 Mono

Rack Mount Adaptors Available

Burwen LABORATORIES
DIVISION OF OHMTEC CORPORATION
209 MIDDLESEX TURNPIKE, BURLINGTON, MASS. 01803 (617) 273-1488

Circle 36 on Reader Service Card

db new products&services

WAVEFORM GENERATOR

● A faithful reproduction of a waveform drawn or photographed on a small glass slide is converted into an electrical signal by model CS-1 waveform generator. The pattern on the slide is electronically scanned, amplified, and made available at the output terminals of the generator. This output is suitable for driving a power amplifier and loudspeaker if desired, or it may also be used as the output of any oscillator or pulse generator. The instrument will produce the sound of any musical instrument or human voice, including short words, any combination of fundamental and harmonics in any phase and/or amplitude relationship, tone bursts and other transients, sine, square, and triangular waveforms, and music synthesizer tones. Glass slides with many different waveforms are available.
Mfr: Electro-Physical Research
Price: $1,725.00
Circle 40 on Reader Service Card

SLIDE TYPE MODULAR CONSOLES

● Available in mono and stereo models, the Slide-Mod consoles have linear slide faders and completely modular construction with all active electronics on plug-in modules. The basic console frame assembly accepts up to ten input modules—either mike input or line input. All modules have momentary pushbutton activated solid state switching of audio to program audition, or cue amplifiers. Each module accepts three inputs with switching of any input to the conductive plastic linear slide mixer control. Both audition and program channels have transformer-balanced outputs exceeding +18 dBm peak. A built-in ten-watt monitor services three individually muted outputs. The three muting relays can each be wired to any mixer. Relay no. 1 mutes the cue speaker, and all relays control a monitor speaker output and a normally open contact for warning lights, etc. The cue amplifier, relay muted, drives an internal or external speaker. All Slide-Mod functions are operable by remote control.
Mfr: Broadcast Electronics
Circle 41 on Reader Service Card

DIGITAL VOLTMETER

● Model 3620A d.c./a.c. true rms digital voltmeter offers 1uV resolution. Spanning the range from 10 mV full scale to 1 kV full scale, the instrument features a 4½ digit (19999 count), backlighted liquid crystal display; a 4-terminal, guarded and floating input; overload protection up to 1 kV on all ranges; and a typical accuracy claimed of ± (0.1 percent of reading + 0.1 percent of full scale). It is capable of measuring at frequencies from beyond 1 mHz down to 1 Hz and d.c.; a response time requiring 300 mS to settle to within 0.1 percent of final reading for frequencies from 40 Hz to 1 mHz; and the ability to read true rms of a.c. signals or signals that have both a.c. and d.c. components. It features an illuminated digital display and an analog signal output suitable for driving a chart recorder. The unit computes the rms value of the input waveform without the need for a thermal converter or a thermopile, with, according to the manufacturer, resultant temperature stability of 50 ppm per degree C, and the ability to accommodate peak input signals with crest factors up to 50:1 down scale. It maintains full accuracy to 100 percent over-range (19999 counts). Additional options are available.
Mfr: Ballantine Laboratories, Inc.
Price: $1,395
Circle 42 on Reader Service Card

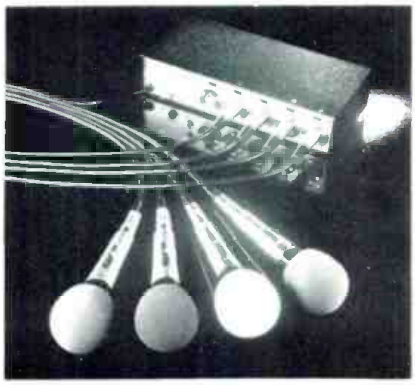
MODULAR EQUALIZER

● Shelving type low and high frequency families of curves produce overall balance changes in the musical spectrum, while the 3 kHz mid-frequency peaking curves specifically affect the presence range of music and dialog through model 553 equalizer. The high, mid, and low frequency controls are continuously variable with up to 15 dBm of boost or cut. There is a silent in/out switch with l.e.d. indicator and transformer isolated output to a maximum of +24 dBm. The unit is designed to fit interchangeably with other equalizers in the manufacturer's line.
Mfr: Automated Processes, Inc.
Price: $105.
Circle 43 on Reader Service Card

MINIATURE INDICATOR LIGHTS

● Tiny 62 series indicator lights minimize protrusion while offering needed brightness. Quick-insert lenses in red, amber, clear, white, blue, green or translucent colors are made of high impact transparent plastic. Lamps are high brightness neon with ⅓ watt series resistors for 125V and 250V. Subminiature incandescent lamps are supplied for 6V, 14V, and 28V applications. The lights mount on thicknesses ranging from 1/32 to 1/8 inches in panel openings, with no additional hardware necessary. Series 62 lenses are cylindrical; rectangular lenses are also available, designated series 64.
Mfr: Leecraft Mfg. Co. Inc.
Circle 44 on Reader Service Card

COLOR-CODED MIC WINDSCREENS



• Vari-colored microphone windscreens which not only give zip to the appearance of a performing group but have a practical application as well, are being produced by this manufacturer to fit over their ball-type microphones. Model A61WS colored windscreens are available in blue, red, green, yellow, orange, and brown. They are accompanied by matching self-adhesive color dots which can be used to keep track of the same microphone's input connection or control knob.

Mfr: Shure Bros. Inc.
Price: $4.95.
Circle 45 on Reader Service Card

STEREO SYNTHESIZER

• Any mono signal can be transformed into a lifelike pseudo-stereo sound with model 245E stereo synthesizer. The mono source signal is divided into five frequency bands. Three of these bands are placed in one stereo output channel; the remaining two are placed in the other channel. The filters are synthesized so that the sum of the two output channels is identical to the mono input. In addition, the sum of the powers in the left and right output channels is equal to the power in the mono input signal, guaranteeing that the stereo will have the same perceived frequency balance as the mono source. The manufacturer claims that the device adds no distortion nor change in spectral balance. 19-inch rack mount, requiring 1¾ inches of rack space.

Mfr: Orban/Parasound, Inc.
Price: $299.
Circle 46 on Reader Service Card

WIDE DYNAMIC RANGE TAPE

• An improved oxide coating on #250 tape is claimed to result in a reduction of tape noise, combined with higher output, to effect a signal-to-noise ratio 4 dB beyond that previously available. The manufacturer states that the improved shape of oxide particles and improved binder has produced a higher density coating with a smoother surface than their previous tapes, able to stand up to extensive overdubbing, shuttling, and multiple retakes without oxide shedding or powdering. An electrically conductive textured backing is designed to reduce static attraction of particles and to prevent high-speed wind scatter and cinching during handling.

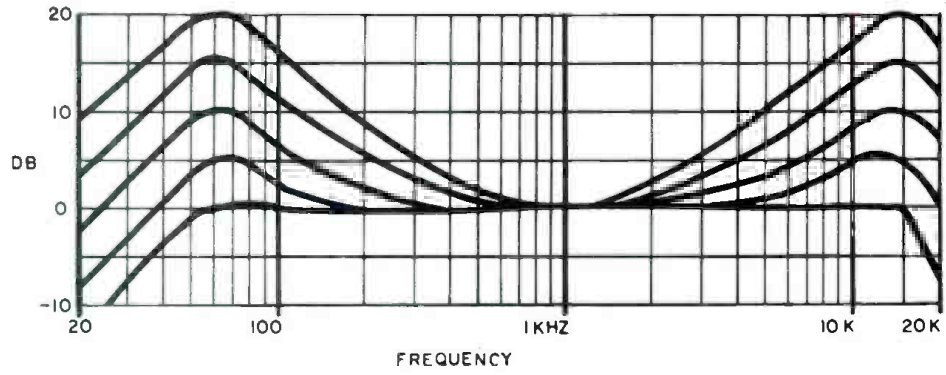
Mfr: 3M
Circle 47 on Reader Service Card

Broadcasters:

Here is an important new device designed especially for you.

TIMEKEEPER

Telephone Line Equalizer



How would you like a compact, self-powered telephone line equalizer for use in radio, TV or communications systems that helps restore signals lost in long transmission lines? One that could be adjusted to suit a variety of conditions—one that can easily be inserted into any existing system and which would provide additional gain when necessary? An equalizer that could have balanced input and output to assure complete line isolation?

The TIMEKEEPER MODEL TLE-1 is just such a unit. Using the latest OP AMP active filter design it provides excellent stability, low distortion and low noise. The extremes of the audio spectrum are purposely rolled off to reduce any further unwanted noise.

USES

Radio talk shows, remote pickups using telephone lines, even stations using their own lines will find this unit essential. Not only can it be used at the receiving end—it can also be quite useful at the sending end. If you know what losses to expect from the line you can pre-equalize the signal to improve response *with less noise!*

The TLE-1 is built to the highest standards in the industry and is unconditionally guaranteed for one year. If you find it does not improve your signal—return it for a full refund. You will find the TLE-1 a great buy at only $295.00.

It's a TIMEKEEPER product.

It's got to be good.

Telephone Line Equalizer Model TLE-1
PERFORMANCE SPECIFICATIONS

Gain, variable	unity—20db
Input impedance	600 ohms
Output impedance	20 ohms (designed to work into 150 or 600 Ohm loads)
Max. input level	+20 dbm (at unity gain)
Max. output level	+20 dbm
Frequency response	± ½db 50-15,000 Hz
Available boost (cont. controlled)	20 db max at the extremes of covered spectrum
Distortion	less than 0.2%
Noise	70 db below 0 db level
Isolation	transformer, balanced floating line
Power required	117VAC @ 1 watt
Dimensions	panel: 1¾" wide x 7" long chassis and transformers: 6½" deep, 6" wide x 1¾" thick 1.5 lbs. mounting rack available
Terminations	Barrier strip, screw terminals
Amplifiers	IC OP amps, plug-in
Controls	ON-OFF switch Gain control Low end boost High end boost
Indicators	LED pilot light

Send check to

TIMEKEEPER
Box 35
Great Neck, N.Y. 11021

Please send me _____ Model TLE-1 Telephone Line Equalizer(s) at $295.00. N.Y.S. residents add 7% sales Tax. I enclose $_____.

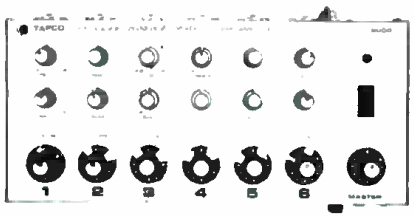
Name _____

Address _____

City _____

State _____ Zip _____

SIX-CHANNEL MIXER PREAMP



• The intense sound pressure levels reached in concerts can be handled by model 6000 six-channel mixer preamp, without overload distortion, according to the manufacturer. Each channel features a volume bass, and treble control. The master section includes a master volume control and a power on/off switch. Outputs include two power amp outputs of high level and two adjustable level outputs for monitor use and a stacking output for combining two or more mixers. All microphone inputs (either pin connections or Cannon connectors) accept microphones from 150 ohms to 50k ohms or higher without switches or external matching transformers. The unique input circuitry automatically adjusts for high or low impedance microphones, even if both are used in one mixer. An additional model is available, with reverb and special effects. There are also rack mounting kits.

Mfr: TAPCO
Price: Model 6000 CF—$219.00.
Model 6000 RCF—(reverb)—$326.00.
Circle 48 on Reader Service Card

DUAL EQUALIZED REVERB

• Each of the channels on this new dual spring reverb unit has input-delay time control, l.e.d. clipping level indicator, low and high frequency shelving equalization, and output drive level control. The electronics and the springs are complete in one rack mount package. A special input gain stage has been added to the unit, making it compatible with the Tascam series mixers.

Mfr: Multi-Track
Price: $550.00.
Circle 49 on Reader Service Card

WIRELESS SOUND VOCAL SYSTEM

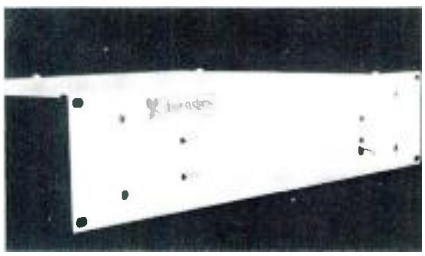
• A sound combination eliminating bothersome wires, useful for vocal entertainers, is provided by PM-5 wireless hand-held microphone and ST-3 Sensatuner, a portable, tunable solid-state receiver designed to be used with the microphone. PM-5 is a self contained, battery operated mic, incorporating a dynamic cardioid, high performance, pickup element providing sensitivity from 200 feet. The ST-3 provides high and low impedance audio outputs suitable for use with either existing amplification systems or the manufacturer's portable wireless sound systems. The system has all transistorized f.m. circuitry; a special noise squelch circuit eliminates background noise when the microphone is not in use.

Mfr: Edcor
Circle 50 on Reader Service Card

AUDIO CORD PLUG

● A momentary "pause" switch on the Q-G (Quick-Ground) f.m. cord plug enables entertainers and broadcasters to interrupt a broadcast for a brief time. The raised knob on the switch permits instant control of the microphone circuit without having to look at the microphone. The subminiature slide switch is built into the connector shell, made secure by a wedging insert screw. The cord plug has a flexible neoprene strain relief, accepts cables up to 0.25 inch diameter.
Mfr: Switchcraft, Inc.
Price: $9.80-$13.00.
Circle 51 on Reader Service Card

TWO-CHANNEL REVERB



● Featuring four special alloy transmission lines per channel, R-500 twin channel reverb unit is equipped with both high and low impedance connections, making the unit compatible with standard +4 dBm levels as well as low level high Z systems. There are l.e.d. level indicators on both channels and a S/N of 75 dB. The entire unit fits into 3½ inches high of rack space.
Mfr: Clover Systems
Price: $500.00 (two channels)
Circle 52 on Reader Service Card

CUSTOM DISC MASTERING CONSOLE

● The monitor system on this console is capable of selecting nine different points in the console system for immediate comparison of various functions without affecting the program or preview signal paths. The preview to program crosstalk is better than 82 dB up to 20 kHz. Featured on the console are graphic equalizers, ganged filters, and detented straight line attenuators.
Mfr: Sphere Audio Sales
Circle 53 on Reader Service Card

The new Volumax® Model 4300.

Anything else is a limited limiter.

When it comes to automatic peak controlling, the new Volumax is the smoothest operator around! It's the latest in our quest for the ultimate AM limiter. The only similarity between the Model 4300 and conventional peak limiters is that they both prevent overmodulation. And here the similarity ends!

Volumax patented control action assures maximum utilization of each watt of carrier power, without overmodulating the transmitter and with absolute minimal signal distortion. The Model 4300 features: more precise limiting at maximum allowable limits, easier set-up and proof-of-performace procedures, and extended control range of over 15dB, with less than 1% harmonic distortion.

With automatic peak phasing, negative speech asymmetry is silently inverted for positive modulation to the maximum allowable limit of 125%.

Try a 4300 and listen. You'll see why other limiters are limited. And why we think the new Volumax Model 4300 is the ultimate limiter.

CBS LABORATORIES
A Division of CBS Inc.
227 High Ridge Road, Stamford, Connecticut 06905

Circle 39 on Reader Service Card

new products & services (cont.)

ANTI-CORROSION CLEANER

● Aerosol spray cleaner and lubricator Kontakt 61 is useful in servicing equipment employing high and low frequency contacts vulnerable to oxidation. It's compounded for use on electromechanical driving gears, r.f. and audio-frequency sectors, autoelectric and precision instruments, meters, counters, calculators, etc. Free of silicones and inorganic acids, it can be used on all types of plastics, metals, and insulating materials.

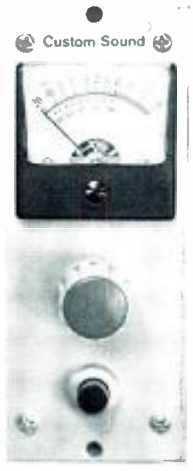
Mfr: Regmo Data Corp.
Circle 54 on Reader Service Card

DIGITAL RECEIVER

● F.M. digital readout selects any of a hundred channels, on the HR 150 solid state stereo digital receiver. Exact station frequency assignment is provided by four Nixie readout tubes. The readout count is corrected sixty times per second. The unit's knobs operate on ball-bearings. Greater than 100 dB selectivity with realignment never required is provided by a 9-pole Butterworth type toroid phase linear i.f. filter.

Mfr: Hervic Electronics, Inc.
Circle 55 on Reader Service Card

MICROPHONE PREAMPLIFIER



● Designed as a first-stage voltage amplifier, interfacing with professional recording microphones, this unit has a balanced input via a 3-pin XLR-type connector and a single-ended output into 8,000 ohms or greater via a single phono jack on the rear panel. The device uses a circuit built on a G-10 glass-epoxy circuit board, with tantalum capacitors and carbon-film resistors. A standard calibrated vu meter is supplied on the front panel, as well as an infinitely variable gain control. Power supply needed is 40V d.c. from an external power supply or battery, a 45V internal battery, or from a wide range of supply voltages below 40V. The manufacturers claims supply ripple-voltage rejection of −120 dB, THD typically 0.1 percent, total equivalent input noise better than −130 dBV, absolutely flat frequency response, short-circuit and reverse-voltage protection and thermal shutdown. Eight units will fit into 5¼ x 19-inch rack space.

Mfr: Custom Sound Productions
Price: $175, singly; $160 ea. for eight or more.
Circle 56 on Reader Service Card

AMPEX HAS A NEW, HOT-SOUND TAPE THAT USES YOUR SAME BIAS SETUP.

GRAND MASTER™ recording tape from Ampex gives you performance *and* compatibility. It's a brand-new, super-hot tape with 74 db S/N ratio and as much as 3 db extra sensitivity at 10 KHz. That means more shimmering presence at the high end than you've ever had before, and an almost-transparent, distortion-free quality to the sounds that peg your VU meters.

Best of all, GRAND MASTER Tape uses exactly the same bias settings you've established for 406/407 and 206/207 tapes. It's the only fully compatible high performance tape you can buy.

HOT OFFER **A FREE ¼-INCH REEL FOR YOUR OLD SCREWDRIVER.** Send us your old, beat-up bias adjustment screwdriver, and we'll send you a sample reel of ¼" GRAND MASTER Tape, along with full specifications, for free. (You won't need the screwdriver any more because GRAND MASTER is bias-compatible.)

Ampex quality means more than just a promise. Every reel of 2" GRAND MASTER Tape is tested end-to-end. If we find a session-spoiling drop-out, we don't ship the tape. You get a "pedigree" —the complete test printout —with every 2" GRAND MASTER reel.

So heat up your sounds and keep your options open. If you're already biased for 406/407 or 206/207, you're ready for GRAND MASTER.

AMPEX

Ampex Corporation
Magnetic Tape Division
401 Broadway
Redwood City, California 94063

Circle 38 on Reader Service Card

The 49th AES Convention

JOHN WORAM

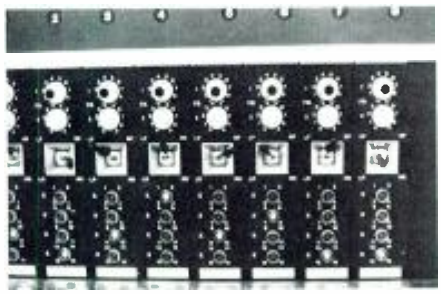
Photos are by John Woram and Larry Zide

If you've been with us for any length of time now, you know that every few months the AES seems to be having another of its conventions. There are three each year: one each in New York City, Los Angeles, and Europe (a different European city each year).

The question has come up, Why so many? Although there are always a few new products at each convention, there are hardly enough to warrant three shows a year. Actually, the exhibits should be considered as a side-light —albeit, a most important one—to the main business of presenting a forum for the presentation of technical papers. Each convention features a series of technical sessions, at which papers on a wide variety of audio-related subjects are presented. Often, these papers are given scant attention in our convention reporting, since it's a lot easier to simply photograph some of the exhibits, and then do a picture story.

So, by way of correcting this, let's begin with a very brief review of a few of the papers presented. More than

Four generations of disc recording heads by Neumann were shown in the Gotham Audio Room.



This is a closeup of Studer's bus assignment/quad panning module.

This is the little (in size) and big (in sound) Philips MFB speaker.

Xedit's 16 track deck fitted with Inovonics electronics.

Eventide Clockworks showed a new low priced digital delay line.

Xedit demonstrated their new flutter bridge, along with their existing splicing blocks and cable tester products.

Not everything was new. Gotham Audio displayed (in addition to many new things) an original German AEG Magnetofon tape machine.

Joel Electronics' new PhaseOmeter was one of several new products shown at the LaSalle Audio booth.

Audio Designs was demonstrating their real time spectrum analyzer that uses a t.v.-type crt tube.

Gately Electronics has a new Prokit; a six in, stereo out mixer available in kit or wired form.

60 papers were delivered, of which about 40 are available from the AES office as pre-prints. Single copies are available for 85¢ each to members, $1.00 each to non-members. To order copies, or a complete list, write to the Audio Engineering Society, 60 East 42nd Street, New York, N.Y. 10017.

Speed, Pitch and Tension Revisited—J. C. Strickland, *MCI*. This is an excellent presentation on the subject of getting tape from one reel to another. Mr. Strickland succinctly reviews the various systems (dual capstan, isoloop, pack sensing, etc.) To his, and MCI's credit, he resists the temptation to "conclusively prove" that his favorite system is the only one worth considering.

The paper is simply an over-view of the many systems, pointing out the need for speed matching standards, as tapes are moved from one studio to another, and therefore from one type of machine to another.

Design of a Digital Controlled Audio Level Indicator, T. M. Hay, *MCI*. Another paper from MCI, this one presents a brief discussion of a few level display systems, (other than the usual volume indicator type). The paper then describes MCI's approach to the problem of watching several dozen meters at once. Particularly interesting is the biological note on the implications of viewing many standard type meters.

No doubt the eye would be attracted to a flashing red light some 24 tracks down the pike, as in the MCI display panel. But 24 tracks of colored lights, winking and blinking through the night, could be a little hard to take, especially on an empty stomach.

Design Criteria of a Universal Compandor for the Elimination of Audible Noise in Tape, Disc, and Broadcast Systems, Duncan, Rosenberg & Hoffman. The title may suggest that the authors have just built a new compressor/expander which they would like to tell us all about. However, it turns out to be a rather detailed description of the classical compressor/expander parameters. In a footnote, it is explained that the paper is derived in part from a master's thesis presented by one of the authors.

As stated in the title, the paper discusses the noise reduction potentials of the compandor, rather than the signal processing use of either element when used separately. It's very good background information for those interested in noise reduction systems. In fact, the paper concludes with a brief discussion of the Dolby, Burwen, and dbx approaches to noise reduction.

Applications and Design Considerations for a High Quality Unidirectional Line Level Microphone, Schulein, Seeler, & Smith. This interesting paper describes a battery operated microphone with line level output and a built in limiter. Perhaps not what every studio is searching for, but it should make life a lot easier on some remote sessions, and for broadcast use.

BRIEFLY NOTED

100 dB Dynamic Range Disc Recording, R. S. Burwen. A discussion of the Burwen Noise Eliminator System applied to disc recording.

Professional ¼-inch Cassette and its Range of Application—K. Goetz. The new BASF ¼" cassette system has attracted considerable interest, and the paper describes and illustrates its construction.

Advance Head-Less Variable Pitch/Variable Depth Lathe Control System, H. S. Holzer. This one is a little too heavy on the sales pitch, and glosses over what could be a very important contribution to the art of tape-to-disc transfer. Tragically, Howard Holzer died recently in a plane crash, just as his company was beginning to ma-

ture. I hope his survivors will carry on his work for him.

THE EXHIBITS

Some time ago, former A & R Studios' Chief Engineer Irv Joel began Joel Electronic Products. After "chief engineering" for a number of years, Irv had some pretty good ideas for some gadgets that seemed to be needed. He was on hand at the LaSalle Audio booth, with his new PhaseOmeter and 'A' noise weighting network.

Some sort of phase detecting device should be standard equipment in any studio. But, unfortunately, its just one of those things that has a way of being ignored, which is a pity.

What with multi-miking of drums, pianos, and such, a certain amount of cancellation is no doubt inevitable. However, there comes a point at which things begin disappearing in the mono mix, which is generally considered to be an artistic no-no. A meter such as this one may warn you in advance of impending catastrophe. Full scale meter deflection indicates good mono, or center-predominant information. Center scale indicates completely random program, and a consistant left-of-center reading means you're going to be in big trouble later on.

The A weighting network simply plugs on the front of your voltmeter (you *do* have a voltmeter, don't you?) and lets you make A weighted measurements of noise. Manufacturers use A weighting in making their measurements, so this little black box will be a great help in verifying performance specs.

Also at the LaSalle booth—the Aengus Console was again shown. Aengus is now 'Aengus Electronic Products' and is located in Marlboro, Mass.

And speaking of consoles, notice the clever arrangements in the close up photo of the Studer board. Four pushbuttons select one of four groups of four buses each. Then, the joy stick just above allows quad panning within the group selected. In case quad is not required, the operator merely selects the appropriate four-bus group, and leaves the joy stick pointing at the appropriate bus within that group. And of course panning can be done between adjacent tracks, as required.

Upstairs, in the AKG demo room, the Philips motional feedback speaker system was demonstrated. The system is internally bi-amped, with an electronic crossover at 500 Hz. I've been playing with a pair of these in the Institute of Audio Research's control room for several months now. Although the high end is a bit much for my tastes, the over-all clarity is—to put it conservatively—staggering. If this sort of sound can eventually be put into a control room type monitor, the Philips people should corner the market with ease. (See our July '74 issue's Convention report for a photo of the system)

The Xedit product line is gradually expanding. Their original playback-only 16-track deck is now available with Inovonics electronics in a full record configuration. Also—a flutter bridge for less than $300, and of course their 2-inch splicing block that really works.

Crown International has come up with a handy Stereo Output Control Center that allows monitoring and/or metering of three separate speaker systems. Metering is switchable between vu and peak reading. And, the peak readings may be "held," so that the meter retains the highest peak during any program. Since most consoles don't provide for speaker switching, and most studios use at least two different types of speakers, this control center should be a great help.

But now, on to bigger and better things, like flying off to London for the next AES convention. It's cheap, and after all it is a business expense. Well, isn't it? See the box for details. ■

1975 LONDON AES CONVENTION
SPECIAL TOUR PACKAGE

A complete travel package has been created for the 50th AES Convention to be held at the Cunard-International Hotel in London, England on March 4, 5, 6 of 1975. The airline is not yet set at this time (it will be a standard major carrier operating a 747).

Departure will be from New York's JFK on March 1 (evening) and return to JFK will be on March 9 (London departure in early afternoon). The package will include 7 nights at the Cunard-International with continental breakfast, transfers to and from Heathrow airport to and from the hotel, all gratuities and service charges, and lots of extras such as a car for one day, free drinks, discount coupons for use in London stores and restaurants, etc. The room you get will be a twin with private bath.

Total cost from New York City is $439 plus a $3.00 departure tax. A single supplement is $20 extra (all prices quoted are double occupancy).

Space is strictly limited—we have only a fixed amount of seats on the planes, and rooms at the hotel. So get your reservations in early.

To ensure participation send a deposit of $100 per person by no later than December 15. (Take your wife along; an exciting group of special activities are being planned—more on them in the next issue.)

The balance owed for the trip will be required by December 30th. Make checks payable to Mirque Travel Inc. and endorse them for AES-London Tour. The address to mail to is Mirque Travel, 350 Fifth Avenue, New York, N.Y. 10001, attn: Bob Lewis.

Are you coming from somewhere *to* New York? If you are planning to buy this package, tell us where you are coming from, and a substantial package saving is available by taking advantage of what is known as ad-on fares. For example: the regular round trip from N.Y. to L.A. or S.F. is $374. As an "add-on" to London it would be only $315. The saving from Chicago is $17 round trip. Bon Voyage!

WILLIAM E. ANDERTON

Professional Sound Recording— A British View, part 2

Under discussion here are noise reduction, decoders, mobile recording, pulse-code modulation, error-correction, cost of digital equipment, and deafness.

DEVELOPMENT OF MULTITRACK recording has necessitated the use of a noise-reduction system to code the original recorded tracks and to decode during the final mixdown of a master tape. The noise buildup involved in processing a 24-track tape for stereo is approximately 10 dB. The four-band compressor-expander used by the Dolby A noise-reduction system is now almost a standard compact fitment for a professional sound-recording studio, although dbx and Burwen are also producing similar systems. Over 8,000 recording tracks are equipped with A-type Dolby units.

An exciting development in the use of a noise-reduction system for discs is taking place now. Records have already been produced, processed with the dbx system. The disc-processing system is an extension of that used for professional tape noise reduction. It involves broadband compression during recording and expansion during playback but with the frequency weighting of the rms level-sensing circuit set to cope with disc noise—including rumble, high-level pops and clicks, as well as tape hiss from the master tapes.

Using the dbx system,[3] it is possible to achieve a dynamic range of about 100 dB, or some 30dB better than presently accepted. Production variations are also open to record companies using this system: Either getting more music on a record without degrading the normal signal-to-noise ratio or putting a 12-inch lp's worth of recording onto a 10-inch disc with no loss in quality, but with a 30 percent saving in precious vinyl. Or, the system can be used to overcome the high surface noise inherent in discs pressed with cheaper and inferior plastic compounds.

William E. Anderton is Assistant Editor of Wireless World *Magazine, London.*

DECODER MARKETED

A commercial decoder has been introduced, available for $200; hopefully, a consumer version will be marketed soon at about $100. The only apparent problem with the system is that processed discs are not compatible with reproduction when no decoder is available. It is therefore unlikely that the system will ever be universally accepted even though the results seem quite remarkable. The Pye Recording Company in England is presently evaluating the system.

A further development during the past two years has been the application of the Dolby noise-reduction system to optical sound tracks. Initial research by Dolby Laboratories[4] showed that much of the optical sound track's poor quality could be due to the way it was used rather than to any inherent defect in the optical- recording principle itself. Studies showed that wide-range, high-fidelity optical sound tracks can be made, the sole significant problem being the resultant relatively high noise level which increases with the use of the print.

A considerable amount of treble cut is applied when optical sound tracks are played back in the theater. This high frequency roll-off, set by the American Academy of Motion Picture Arts and Sciences' *Standard Electrical Characteristics*, first published in 1938, effects an attenuation of at least 20 dB at 9 kHz, with the statement that "each characteristic was arrived at by listening to a variety of studio release products in a number of theaters. . ." Films were made to match the theaters and the theaters to match the films. Therefore, we cannot say that the Academy characteristic was derived to create the best compromise beween noise reduction and high frequency response.

Dolby Laboratories concluded that "If a theater has a flat playback frequency response, optical sound tracks recorded and reproduced with the Dolby system will exhibit

an improved frequency response, decreased distortion, and a lower noise level. The same sound track is, however, compatible in a conventional theater." Further investigations took into account limitations such as theater loudspeaker performance and suggested an acoustical response approximately 6 to 8 dB down at 8 kHz.

A Dolby noise-reduction unit was consequently designed specifically for motion picture reproduction. Units of this type are being installed in theaters only after acoustical measurement of each auditorium has established the equalization or loudspeaker modification required to ensure that the frequency response of the entire system, including the theater acoustics, will be as uniform as possible.

MORE MOBILES

Large mobile recording units with comprehensive multitrack facilities and costing upwards of $150,000 seem to be springing up everywhere. The only major limitations involved with mobile recording are the amount of space available for equipment and the acoustics of the unit for monitoring purposes. Soundproofing is not necessarily as great a problem as it may seem, especiallly if the internal acoustics can be made just right. Most units are used for recording onto a multi-track master, but the final mix is usually done in more spacious studio surroundings. For $1,000 a day (plus tape) it is possible to have the use of a mobile unit containing 24-track console and record facilities, microphones, monitor loudspeakers, noise reduction, echo, limiter/compressors, equalizers, c.c.t.v., plus engineers, bathroom, toilet and kitchen sink.

If all this seems to be lacking in value, the main purpose is to supply full multi-track capabilities together with attendant equalization and remix facilities. A growing need, which the mobile fulfills, is to provide these sorts of facilities in the relaxed atmosphere of music-making in a country house or even in the open air.

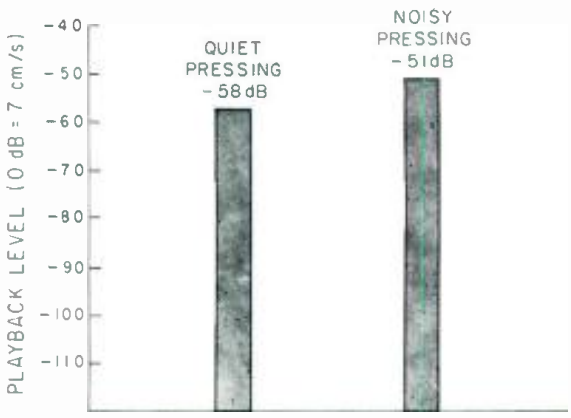
A major constraint on the achievement of normal control room conditions is the geometry of the vehicle whose width constriction is at 8.3 ft. With typical monitoring loudspeakers, this means an average distance of 5.7 ft. between speaker cones and an optimum listening distance to the monitor engineer of 8.3 to 10.6 ft.

Control console design varies little from current studio practice except in the need to conserve space. Auxiliary facilities are located in vertical panels mounted against the side of the vehicle to conserve space, but multi-track recorders are unavoidably of the standard studio construction and therefore occupy considerable floor space. Communication facilities must be more comprehensive than those provided in the average studio, so some system of closed circuit cable television should be included.

While mentioning the increasing number of mobile units in operation, it's worth noting another small industry within an industry which has recently developed as the result of commercial demand. Commercial radio advertising known as "spots" has meant the use of studios specifically making their bread and butter from producing spot recordings. To make a compromise between the type of sound quality normally expected from a pocket transistor radio and that obtained with a high-quality receiving system, spots are often recorded with bass and treble emphasis. The recordings are monitored by the normal studio monitor loudspeakers as well as by much smaller versions simulating transistor radio capabilities.

P.C.M. AND QUAD—THE FUTURE

Efforts are being made to improve the performance of recording systems. But present performance is so close to the theoretical limits of the magnetic recording medium that it has become necessary to develop a new recording system in order to break through this theoretical barrier. The choice is either to employ a recording medium basically different from the magnetic system, or to use the conventional medium with some modulation method not affected by the limitations of recording analog audio signals on magnetic tape. Pulse code modulation is adaptable for sound recording and has attracted great attention in recent years as an excellent transmission medium.



Comparison of surface noise on quiet and noisy vinyl pressings (RIAA playback, "A" weighted scale, unmodulated groove).

Digital systems for recording developed by the BBC and by Nippon Columbia, have been described in *Wireless* World.[5,6] Conventional audio magnetic recorders have a more than adequate signal-to-noise ratio for digital recording, but the frequency band is insufficient and the timing jitter is too large. These problems are overcome if a helical-scan video tape recorder is used as a wide frequency-band recorder, and if a synchronization system is used in combination with a buffer memory to provide high timing accuracy.

An error-correcting system is vital with a digital recording system. Dropout from magnetic tapes is usually caused by dust, peeling, or unevenness of the magnetic coating. Conventional audio recorders are not significantly affected by the dropout phenomenon, but a p.c.m. recorder would be seriously affected because the recording area for each bit of information is very small. A very small dropout causes a code error and the physical result is a clicking noise sounding like a scratched record.

One method of error correction and detection involves judging the presence or absence of the check pulse in each binary word; another involves watching the level of the reproduced f.m. signal to detect whether or not the dropout causes lowering of level. Although these methods are indirect, most errors can be successfully detected.

Recording by p.c.m. is never accompanied by the type of noise related to magnetic recording characteristics, such as modulation noise. That is because the p.c.m. signal comprises a binary pulse stream, and decoding the signals involves only the presence or absence of pulses. Most of the noise in a p.c.m. recorder is *quantization noise* generated when analog signals are converted into digital codes.

A further advantage offered by the p.c.m. recording process is minimum and constant phase difference between channels when multichannel signals are recorded on magnetic tape. Wow and flutter can be eliminated through the use of a pulsed-oscillator synchronous system and a

buffer memory which account for any timing variations arising in the tape transport.

WHAT ABOUT COST?

An almost universal cry against the future use of digital equipment is the fallacious one of high cost. Modern technology, however, permits the production of a completely digital studio barring input and output devices (microphones, preamplifiers and loudspeakers). The technique of multiplex scanning, used to read information from the large number of channels often now involved in a recording session, means that the number of control devices can be reduced with a corresponding reduction in cost. One equalizer unit can be programmed to cope with all channels, no matter how many there are. As each channel is scanned, the equalizers' characteristics are adjusted according to preset control, providing the correct equalization for that particular channel. This could equally well apply to limiters, compressors, reverberations, etc.

To back this claim for cost practicality, BBC most likely will soon be confronted with the question of updating their sound studio equipment with either standard analog systems, analog systems with facilities for the use of digital ancillaries or completely digital equipment. It is quite probable that the first fully digital sound studio will be in productive use within the next six years.

As for quadriphonic recording, so much could be and has been said in support or against the various coding systems and recording techniques that nothing more can be added here. Although all of the larger commercial recording studios have made allowance for the addition of quadriphonic facilities as required, very few have met demands from customer musicians for these facilities to be employed. Thus, much time will elapse before there are many high-quality quadriphonic recordings for sale.

DEAFNESS

There is considerable controversy over the sound pressure levels which are likely to cause damage to hearing. Monitoring levels in studio control rooms are often painfully and consistently loud when dealing with pop music. It became clear that there were two reactions to the situation: either to overstate the problem or to dismiss it as being non-existent. Although a deaf recording engineer has yet to be found, there must be many who do not realize the gradual effect of continued exposure to sound at high levels. Even though everyone need not have sensitive hearing extending above 16 kHz, such sensitivity must surely be an asset to anyone earning his living by judging and controlling sound quality. A sensible recommendation has been made by the Association of Professional Recording Studios: In studios where listening levels rise above 90 dB, facilities should be made available to staff members being subjected to these levels for regular audiometric tests to be carried out by a qualified audiologist. ■

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MICHAEL RETTINGER

Recording Studio Acoustics, part 3

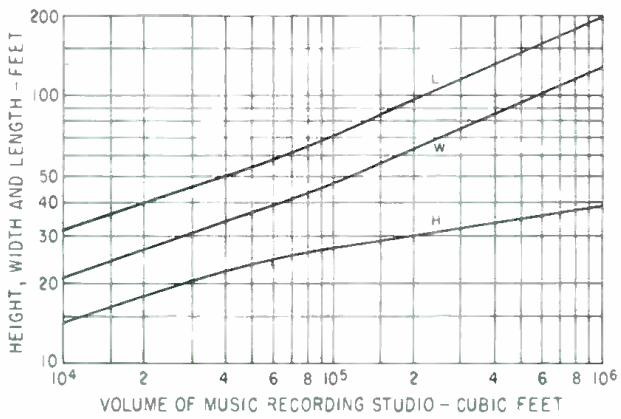
This third of a six-article series discusses optimum proportions of recording studios, reverberation time, ways to improve acoustics, and reverberation chambers.

THERE ARE NO hard and fast rules regarding the optimum proportions of a recording studio, only preferred or desirable dimensions, because the room must also meet the operational requirements of the firm. If it is a multi-purpose studio in which rock-and-roll is to be recorded one day and classical the next, if it is to accommodate six instruments for one session and thirty for another, if photography is to take place in it, if it is also to be used for a grand playback enclosure and other functions, the keynote for the acoustics is variability, not only in reverberation time but also in volume.

How does one go about designing a recording studio?

The very first task, as discussed in Part 1 of this series, is to make a noise-level survey of the proposed site; the second, is to make a predictive effort of the future aural disturbances to which the structure will be subject. Lest anyone think that these are minor efforts, it may be noted that the studios built by the Victor Co. of Japan (JVC America Inc.) in 1969 were preceded by a four-year study of the noise environment about Meiji Shrine in Tokyo, where the studio was to be located. The third task consists in determining the maximum number of instruments that the recording enclosure is to accommodate.

From a study of many studios it has been learned that, as a rule-of-thumb, the specific volume for satisfactory recordings comes to 1000 cu. ft./instrument. Thus, a studio that is to house a maximum of 30 musicians for multi-track recording should have a minimum volume of 30,000 cu. ft. For a motion picture scoring stage complete with wide-screen, a specific volume of 3000 cu. ft. is in order.



Graph gives recommended dimensions of recording studios and shows that the height increase is slower as the length and width of a studio are increased.

NO SPECIFIC RATIOS

There is no constant preferred ratio of studio height to width to length in relation to volume. The accompanying graph gives recommended dimensions of recording studios. It shows that the height increases slowly, and may even be said to approach a limit (45 ft.), because higher rooms would result in too-long a time delay between direct sounds at the microphones and the first reflection from the ceiling. Also, the construction costs of such a building increase astronomically with its height.

Michael Rettinger is a consultant on acoustics based in Encino, California.

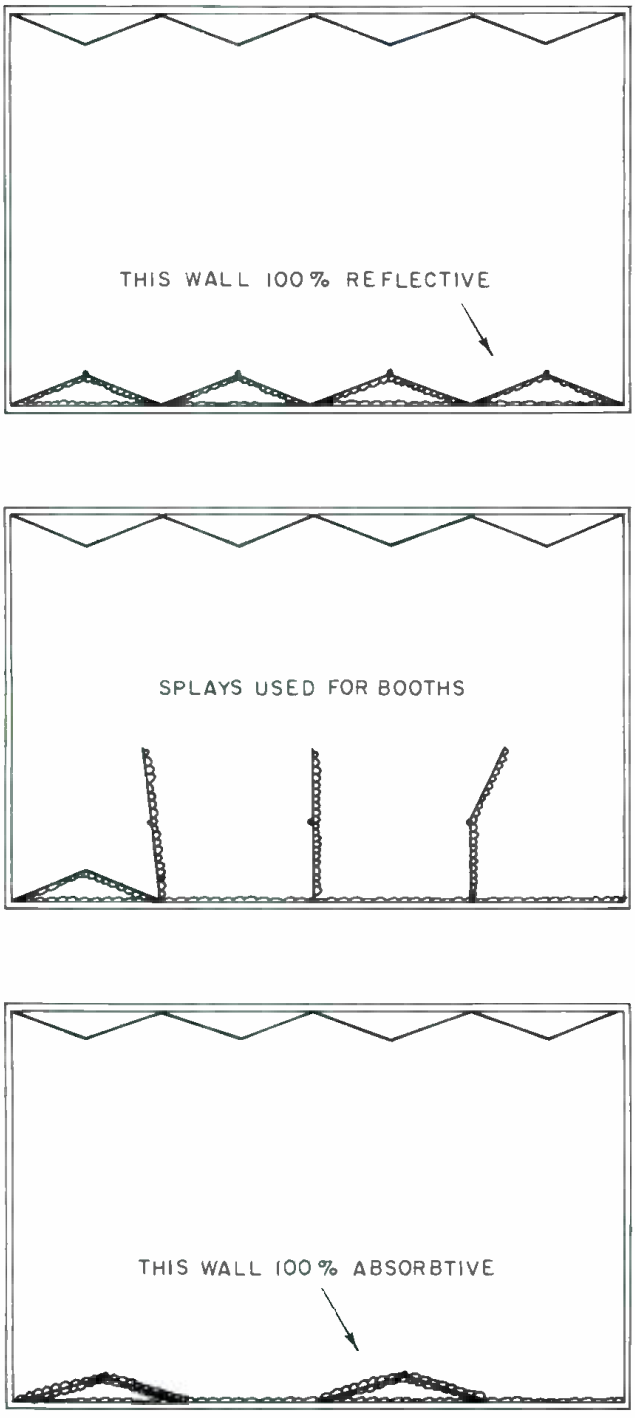


Figure 1. Illustration shows use of folding panels on sidewalls of a recording studio to provide (top) a wall which is highly reflective; (middle) to construct instrument calls; (bottom) to achieve a wall which is highly absorbent.

For a studio with a maximum capacity of 30 artists, a height of 20 ft., a width of 31.6 ft. and a length of 47.4 ft. is indicated. With a floor close to 1500 sq. ft. such a studio has a specific floor area A′ of 1500/300 = 50 sq. ft./artist.

Frequently, such a band may consist of six sections, of 5 instruments per group. Hence the alloted floor area A″ per group is 1500/6 = 250 sq. ft., representing a square close to 16 ft. to the side.

If the ceiling had been lowered to 15 ft. (the very minimum if video discs are to be recorded in the room) the corresponding A′ would have become 66.7 sq. ft./instrument and A″ 333 sq. ft./group, based on the assumption that the total volume of the room was also 30,000 cu. ft.

Since this analysis is aimed at providing general information about studio acoustics, specific types like the new RCA recording facility in New York with its variable volume arrangement will not be discussed here. Such large firms have sufficient acoustic engineering talent of their own to design such structures satisfactorily.

FINDING REVERBERATION TIME

Before the coming of the multi-track recording technique, the optimum reverberation time T_0 of a recording studio of volume V was given by the equation $T_0 = .2 \log V$. Now, this time is shortened so that we have

$$T_0 = .15 \log V$$

Thus, for a studio with a volume of 30,000 cu. ft., as discussed before, the period comes to .67 sec. for all frequencies below 4000 Hz. Because of air absorption in the room, it is generally not possible, even with copious amounts of water vapor injected periodically into the enclosure to reduce this molecular energy conversion, to raise this time appreciably above .6 sec. in such "dead" surroundings. Interestingly, no room—even one with solid glass or steel boundaries—can have a reverberation time longer than 1.25 sec. at 10,000 Hz, regardless of volume V and total boundary absorption A. Thus, the Sabine reverberation time equation, inclusive of molecular sound absorption, is given by

$$T = \frac{.05V}{A + 4mV} = \frac{.0125}{m} \text{ when } A = 0$$

where m = molecular air absorption
= .01 at 10,000 Hz and at 40% R.H., and larger for drier air.

$$\text{Hence, } T = \frac{.0125}{.01} = 1.25 \text{ sec.}$$

Note also that for a sound intensity level loss at any given frequency due to half the reverberation time in a room, the loss can be compensated for a 3-dB increase in the channel equalization, and the reverberatory character of the note can be regained with electronic reverberation.

WAYS TO IMPROVE ACOUSTICS

Recording-studio acoustics are concerned with: (1) the variability of recording conditions, including provision of isolated spaces for individual band sections, and (2) the establishment of a desirable reverberation characteristic, or change of reverberation time with frequency.

FIGURE 1 shows one possible scheme to make an entire wall either highly absorptive or highly reflective. The scheme also utilizes hinged panels, absorbent on one side and reflective on the other, for the formation of band cells in which the instrument groups can be placed for cleaner recording, that is, with minimum reinforcement by the music from adjoining sections. An instrument-group isolation of 15 dB is generally sufficient to ensure a desired mix for the ensemble or united performance of all instruments rendering concerted music. FIGURE 2 shows details of construction for multi-use panels.

The four-foot wide and eight- or ten-foot high panels, either ceiling-hung or track-supported, may be constructed by skilled carpenters or obtained ready-made from such firms as Modernfold, Box 310, New Castle, Ind. 47362; Richard-Wilcox Mfg. Co., 174 Third St., Aurora, Ill. 60507, and others. They can be obtained in hand-operated models or in electrically moved units. Unfortunately, most such folding panels are reflective, being made of wood or

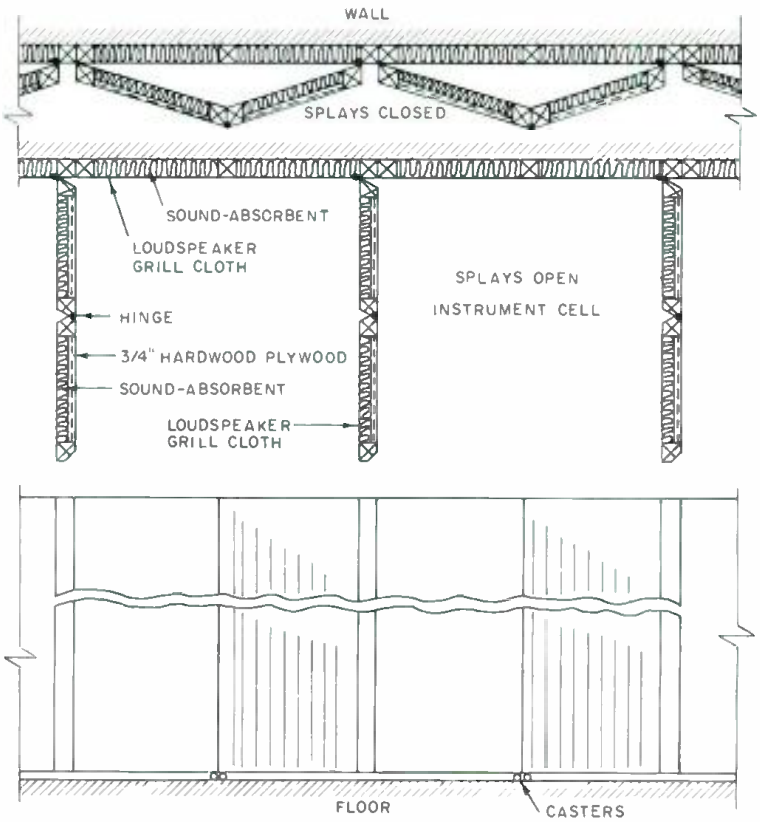
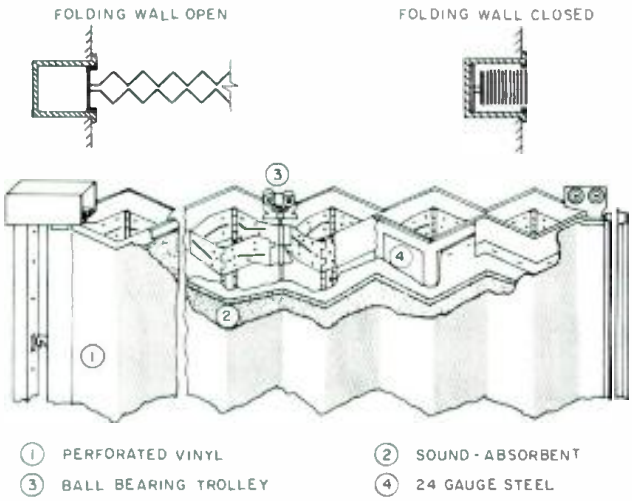


Figure 2. Details of construction of the folding wall panels shown in Fig. 1.

Figure 3. Details of construction of an "accordion-edge" folding partition.



steel and vinyl-covered, so that the required acoustic material must be applied to the (preferably unfinished) folding sections. Still fewer units are made with a window (musicians by seeing each other may be able to play in better time), so that such units have to be modified on the job.

Another convenient means for band-cell formation consists in employing portable "accordion-edge" partitions, which may be pulled away from the wall and stacked there like an accordion when not in use, as shown on FIGURE 3.

REVERBERATION CHAMBERS

Studio-acoustic discussion is not complete without adding an analysis of reverberation chambers used so extensively in the music-recording business. A treatise of the subject appears in the writer's *Acoustic Design and Noise Control* available through the office of **db**.

The term, echo chamber (in place of reverberation chamber), is to be discouraged, because the purpose of the room is not to generate discrete auditory pulses but a prolonged decay of the signal which is to be added to the original recording. For this reason also, tape recorders associated with closely spaced reproduce-heads (to pick up the music at definite intervals) do not produce the desired sound decay, only a number of delayed signals suitably attenuated in amplitude.

If a reverberation time as long as four sec. at, say, 500 Hz is desired in a room with average absorptivity $\bar{a}$ of 0.025 (concrete plaster), a minimum volume V of 1700 cu. ft. is necessary. This can quickly be proved for a cube (not the best shape) by writing the Sabine equation:

$$\frac{.05V}{S\bar{a}} = 4 \text{ or } \frac{.05x^3}{6x^2 .025} = 4 \text{ (x is side of cube and S its total area)}$$

$$\text{or } x = 12 \text{ ft.}$$

Hence V = 1728 cu.ft.

Similarly, the TL of the walls and roof of the chamber must be high when the external noise level is high to secure a suitably high signal-to-noise ratio in the enclosure. The pertinent equation for the desired noise reduction NR (difference between external and internal noise level) for a room exposed on all sides to the same din is:

$$NR = TL + 10 \log \frac{A}{S} = TL + 10 \log \frac{\bar{a}S}{S} =$$

$$TL + 10 \log \bar{a}$$

Since 10 log .025 = − 16 dB, for any desired NR the TL must be 16 dB greater—no simple achievement if NR is to be 60 dB. ■

db classified

Closing date is the fifteenth of the second month preceding the date of issue.

Rates are 50¢ a word for commercial advertisements.
Employment offered or wanted ads are accepted at 25¢ per word.
Frequency discounts: 3 times, 10%; 6 times, 20%; 12 times, 33%.

FOR SALE

DYMA builds custom studio consoles, desks, enclosures, studio furniture. **Dyma Engineering, Route 1, Box 51, Taos, New Mexico 87571.**

SOLID-STATE AUDIO MODULES. Console kits, power amplifier kits, power supplies. Octal plug-ins—mic. eq., line, disc, tape play, tape record, amplifiers, Audio and tape bias oscillators. Over 50 audio products; send for free catalog and applications. **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, Ca. 90038.**

B.B.C. REFERENCE MONITORS, pre-equalized J.B.L./Altec monitors; Dahlquist phased arrays; I.M.F. transmission lines; Infinity electrostatics; Crown/McIntosh **16Ω/bridged** bi-amps; Scully/Revox A-700 recorders; Micmix reverbs; Eventide phasors/omnipressors; Lexicon digital delays; dbx/Burwen N.R. companders; Little Dipper hum/buzz notch filters; Cooper Time Cube echo send, moving coil Supex/Ortofon; B & O straight line arms/cartridges; Schoeps/AKG/Sennheiser condensers; Beyer ribbons, U.R.E.I. comp/limiters/crossovers; Gately pro-kits; Q.R.K. t.t., **1,000s** more. **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**
→ **All Shipped Prepaid + Insured** ←

DYMA builds roll-around consoles for any reel-to-reel tape recorder. **Dyma Engineering, Route 1, Box 51, Taos, New Mexico 87571.**

SINGLE EDGE RAZOR BLADES, tape editing. $20/M. Flyer. **RALTEC, 25884 Highland, Cleveland, Ohio 44143.**

SPLICE FASTER, BETTER, BY SHEARING; replaces razor; attached splicing tape dispenser; quality workmanship; reasonably priced; endorsed by professionals. $24.95 prepaid. Guaranteed. Distributors wanted. **NRP, Box 289, McLean, Virginia 22101.**

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TASCAM MIXING CONSOLE; customized with 12 vu-meters and patchbay; Gately EK-6 reverb; Amplidyne SE-III monitor equalizer. This equipment never used—best deal ever. Save two thousand dollars. Contact **Ronald (215) 455-7192.**

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DYNAMIC MOTIONAL FEEDBACK mono disc cutting system. Complete amplifier system: drive, feedback, and feedback-playback monitor preamp; rebuilt, original factory parts. Guaranteed. **Albert B. Grundy, 64 University Place, New York, N.Y. 10003. (212) 929-8364.**

GOING OUT OF BUSINESS: MCI Console JH416-22; MCI 16-track recorder JH16; Ampex 2-track recorder; Crown DC150 and DC60 power amps; Eventide instant phaser; Eventide digital delay line; entire fully equipped 16-track studio equipment for sale. **Rocky Mountain Recorders, 6340 Olde Stage Rd., Boulder, Colorado 80302. (303) 447-9683.**

MONITOR EQUALIZERS for your Altecs & J.B.L.s are a steal at $75/channel
+
FREE ROOM EQUALIZATION with purchase of ⅓ octave filters. This is **not** a misprint. **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**
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LOWEST PRICES, fastest delivery on Scotch recording tapes, all widths. We will not be undersold. **Amboy Audio Associates, 236 Walnut St., South Amboy, N.J. 08879. (201) 721-5121.**

TASCAM REVERBS—$500; Tascam mixing consoles—$2,350; Tascam ½-inch recorders—$2,750; Tascam 8-track recorders—$4,600. All shipped prepaid/insured, including *free* alignment/equalization/bias/calibration. **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**

$1 MILLION IN USED RECORDING-PA-BROADCAST EQUIPMENT. Send $1.00 for list, refundable on first order, to **The Equipment Locator, P.O. Box 99569, San Francisco, Ca. 94109.**

BROADCAST AND RECORDING EQUIPMENT: Scully; Metrotech; Langevine; Electrodyne; Q.R.K.; Micro-Trak; M.R.L.; Nortronics; McMartin; U.R.E.I.; Revox; Crown; Byer; Lamb; Master Room; Stellavox; E.V.; A.K.G.; Sennheiser; Atlas; Ferrograph; HAECO; Stevenson; Gately; dbx; Advent; Altec; Fairchild; Audio Designs; 3M; Magnacord; Telex; Inovonics. Disc recording systems; package deals; installations; service. **Wiegand Audio, Middleburg, Pennsylvania 17842. (717) 837-1444.**

STUDIO SOUND—Europe's leading professional magazine. Back issues available from October '72. $1 each, postpaid. **3P Recording, P.O. Box 99569, San Francisco, Ca. 94109.**

SOLID-STATE AUDIO MODULES. Console kits, power amplifier kits, power supplies. Octal plug-ins—mic. eq., line, disc, tape play, tape record, amplifiers, Audio and tape bias oscillators. Over 50 audio products; send for free catalog and applications. **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, Ca. 90038.**

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AMPEX, SCULLY, TASCAM, all major professional audio lines. Top dollar trade-ins. 15 minutes George Washington Bridge. **PROFESSIONAL AUDIO VIDEO CORPORATION, 342 Main St., Paterson, N.J. 07505. (201) 523-3333.**

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BODE FREQUENCY SHIFTERS since 1963 . . . Advanced designs for electronic music studios and high performance P.A. systems. Carrier injection type, $795.00. Anti-feedback model: audio range 35 Hz-16 kHz for speakers, entertainers, bands, $575.00. Prices f.o.b. North Tonawanda. Delivery: stock to 6 weeks. For details and information on other models, write to: **Bode Sound Co., Harald Bode, 1344 Abington Place, North Tonawanda, N.Y. 14120. (716) 692-1670.**

NEW MODELS: Ampex AG440C 2-track; servo capstan motor; Scully 280B. Immediate delivery from stock. Used AG440Bs. **Malaco Recording, Jackson, Miss. (601) 982-4522.**

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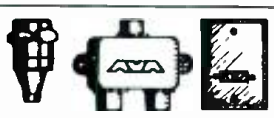

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FOR SALE: One Scully 284 8-track recorder with sync/master; one Scully 280 mono, in console; one Auditronic/Spectrasonic console, 16-in/6-out; all in perfect condition. Contact **George Clinton, (318) 861-0569.**

ONE AMPEX 440-4; includes two-track stereo head block IN CONSOLE; 7½-15 ips, $2,950.00. One Ampex 300—top plate MCI electronics; two-track; IN CONSOLE; 7½-15 ips, $1,950. Ampex 351—top plate MCI electronics; two-track; IN CONSOLE; 7½-15 ips, $1,850.00. Ampex 351—top plate MCI electronics in Scully portable cases; two-track stereo; 7½-15 ips, $1,750.00. MCI 16-track tape machine with matching 8-track heads and guides; autolocator; IN CONSOLE; 15-30 ips, $12,500.00. **Criteria Recording Studios, 1755 N.E. 149th St., Miami, Florida 33161. (305) 947-5611.**

ONE WAY NOISE REDUCTION for cutting rooms/tape copies; **retains** highs, rids hiss/surface noise & pops by a full **10-14 dB** and costs **$125 up** per channel! **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**

CUSTOM CROSSOVER NETWORKS to your specifications: 1 or 1000. Power capacities to 1,000 watts. Networks duplicated. High tolerance air and iron core inductors. Outline your needs for rapid quotation. **TSR ENGINEERING, 3673 W. 113th St., Inglewood, Ca. 90303. (213) 678-1979.**

AMPEX SPARE PARTS; technical support; updating kits, for *discontinued* professional audio models; available from **VIF International, Box 1555, Mountain View, Ca. 94042. (408) 739-9740.**

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TUNED ROCK P.A.s. Customized high intensity touring/permanent installation sound systems, including narrow band **(5 Hz!)** feedback suppression, detailed regenerative response Acousta-Voicing/environmental equalization (± 1 dB at your ears), room design/measurement/treatment, ≤ 15% articulation loss of consonants; **1000s** of customized professional products, including . . . fiberglass horns, consoles, comp/rms/peak limiters, 18 dB continuously variable electronic crossovers, digital/acoustic delays, omnipressors, phasors, reverb, echo, doubling/tripling effects, P.A. noise reduction; **piezo transducers;** frequency shifters from . . . J.B.L./Altec pro., Tascam, U.R.E.I., Eventide, Gately, Schoeps, Beyer, Crown, Community Light/Sound, Mom's Audio, McIntosh, Bozak, Allen & Heath, etc. etc. All shipped prepaid/insured. **Music & Sound, Ltd., 11½ Old York Rd., Willow Grove, Pa. 19090. (215) 659-9251.**
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WHATEVER YOUR EQUIPMENT NEEDS —new or used—check us first. We specialize in broadcast equipment. Write for our complete listings. **Broadcast Equipment & Supply Co., Box 3141, Bristol, Tenn. 37620.**

WANTED

WANTED: TIRED BUT REPAIRABLE 8-track duplicating equipment. **P.O. Box 764, Holly Hill, Florida 32017.**

WANTED: Donations of recording equipment. We are a school, building a studio; we can use anything. Tax deductible. We have a truck. **Skunk Hollow H.S., Concklin Road, Pomona, N.Y. 10970. (914) 354-9829 days, 354-7857 evenings.**

EMPLOYMENT

SOUND DEPARTMENT. One of the midwest's largest audio/video systems companies interviewing for the following newly created positions: ASSISTANT PROJECT MANAGER; must have an operational and technical understanding of PA, intercom, nurse call, telephone, and professional audio requirements and the ability to handle take-offs, read and write specs, design layouts, make surveys, and supervise installations; video and digital logic background helpful; major audio lines include DuKane; no drafting; salary and full benefits. SALES: Must be knowledgeable go-getter to handle leads in local territory; no overnight; ability to work with architects, engineers, contractors, and end users for the sale of audio communications and telephone systems; we represent the top lines, including DuKane; salary plus commission and full benefits. Write w/resume to **Dayton Communications Corp., 2971 Bluefield Ave., Dayton, Ohio 45414 or call collect 513-278-7937, Mr. McCarter or Mr. Sinder.**

db people/places/happenings

SINCLAIR

● **Edward H. Sinclair** has been appointed sales engineer, system applications, of the **Bogen Division, Lear Siegler, Inc.** of Paramus, New Jersey. Mr. Sinclair will be responsible for providing technical assistance to engineered sound customers, product analysis and assistance in new product concepts, as well as quoting on complete engineered sound systems according to specifications. Prior to joining Bogen, Mr. Sinclair was with **Strom Communications.**

● **T & D Industries** has purchased **Aengus,** manufacturers of professional audio recording consoles and components. **Bob Townsend** is serving as president of Aengus, and **Vincent De Rosa,** vice president and general manager of T & D Industries. Mr. De Rosa was associated with **Automated Processes, Inc.** before joining Aengus in 1973. The firm's new quarters are at 583 Berlin Rd., Marlboro, Massachusetts. Mr. Townsend also supervises operations from Old Brookville, Long Island.

● The ninth **MIDEM,** the International Record and Music Publishing Market, will take place in Cannes, France at the Palais des Festivals, from January 18-24, 1975. In addition to the customary exhibitions, entertainment is being planned, to be held in a 5,000 seat tent set up on an esplanade near Palm Beach. Information may be obtained from: Midem Information, 3 rue Garnier, 92200 Neuilly, France. Tel. 747-84 00.

● Concurrent with the establishment of a new national sales department is the promotion of **Ronald L. Braho** to the post of manager of national account sales in the communications systems division of **Dukane Corporation.** The new department will be responsible for marketing the firm's communications products to OEM accounts and to turnkey developers of national chains of stores, hotels, and other similar organizations.

● Enlarged facilities have been acquired by **Ramko Research,** located at 3516-C LaGrande Blvd., Sacramento, California. The new quarters will be used for metal fabrication, art and silk screen, and a complete paint and finishing department. The company is planning additional expansion within the coming months.

● **Prudential Communications** has imported, through **Cramer Electronics,** of Needham, Massachusetts, the first Sony 2850 editing videocassette system delivered in the United States. The system is being used as part of the company's audio/visual operation, which provides videotape, audio cassettes, multi-image audiovisuals, and special events staging, plus commercial and in-house software to 6,000 Prudential people in the New York/New England area.

● The newly created position of vice president, marketing/advertising has been assigned by **TDK Electronics Corp.** to **(Ted Takeshi) Shihazaki.** Mr. Shibazaki joined TDK in Japan and came to the United States in order to participate in its American operation.

● **Gotham Audio Corporation,** of New York and Hollywood, has been named to represent the Magnetophon professional tape recorders, manufactured by **AEG-Telefunken Company** of Germany. Complete service facilities for the tape recorders are maintained by Gotham.

● **Trutone Records,** formerly of North Bergen, New Jersey has moved to expanded new quarters at 428 Briarwood Lane, Northvale, N.J. Their new facilities include the installation of the sixth Capps Varipitch disc mastering computer, a new device which monitors the exactitude of disc cutting.

● **Advent Corporation,** of Cambridge, Massachusetts, announces the appointment of **Christopher B. Wright** to the position of manager of sales and marketing for its VideoBeam large screen projection television set. Mr. Wright will staff and direct all the operations of dealer sales, advertising, service, and dealer training. Mr. Wright previously held the position of director of marketing, planning, operations, and budget for **CBS Records.**

LOCKWOOD

● Specialized sound-video-audiovisual communications services including consulting, publication, and special products will be offered by **Lockwood Enterprises,** recently established in the Toper Professional Building, 1350 Buffalo Road, in Rochester, N.Y. According to **Kenneth Lockwood,** organizer of the new firm, the consultants will plan referenced communication systems of building paging, intracommuncation, CATV, MATV, and conference rooms. Mr. Lockwood was formerly with **Tel-Com.**

● The **1974-75 Directory of Electronic Representatives** is being offered free of charge by the **Electronic Representatives Association,** 233 E. Erie St., Chicago, Illinois 60611. Included in the directory are over 2,000 home office and branch office locations, as well as pertinent details regarding representative firms. In addition to an index of marketing services offered by ERA for the manufacturer, details about the professional management seminars sponsored by the organization are included in the directory.

● Marketing responsibilities of all products, including television sets, radios, stereo music systems, hi-fi components, cassettes, and business machines has been assigned to **Raymond J. Steiner,** senior vice president of **Sony Corporation of America.** Mr. Steiner joined Sony in 1969 as general sales manager.

● **Jon Hanson** has joined **La Salle Audio** as sales engineer. Mr. Hanson was formerly chief technical engineer at **db Studios** and prior to that, a systems engineer for the **Dukane Corporation.** La Salle Audio has recently moved to a larger facility at 740 N. Rush Street, Chicago, Illinois.

Entente Cordiale

A friendly understanding.

A phrase that perfectly describes the relationship between Revox tape recorders and Beyer microphones. One fine piece of equipment uniquely complementing another.

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Both Revox and Beyer are expressions of the same European dedication to meticulous craftsmanship and superior technology.

For example, take the new Revox A77 Mk IV. It's the successor to the critically acclaimed Revox A77, the machine that moved Stereo Review to comment, "We have never seen a recorder that could match the performance of the Revox A77 in all respects, and very few that even come close."

Or take the new Beyer M500 microphone. You've never used anything quite like it. It combines the sharp attack of a condenser and the sturdy reliability of a moving coil with the undupli-catable presence of a ribbon.

And Beyer makes a number of other microphones to satisfy virtually any broadcasting or recording requirement.

Together or separately, these sophisticated instruments provide the ideal solution to the problem of versatile, high quality, low cost recording.

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After that, you can arrive at your own friendly understanding.

For additional information and complete technical specifications, write: Revox Corporation, 155 Michael Drive, Syosset, New York 11791.

Illustrations may contain optional extras.

California: 3637 Cahuenga Blvd. West, Hollywood 90068. London: Lamb House, Church St., Chiswick, W4 2PB. Switzerland: Regensdorf 8105 ZH, Althardstrasse 146. Also available in Canada.

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Frequency response, ± 5 dB from 500 to 5000 Hz tailored for high intelligibility. Prove it to yourself. Test them in any noisy environment, with both speech and music, like we did.

Easy-access impedance switch matches transformer models to 25- and 70.7-volt lines with 5 level settings. No need to remove useless decorative covers.

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* 4' on axis, 15 watts input. 1200-2400 Hz octave band.

PA15A

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