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OCTOBER 1977
VOLUME 8 — NUMBER 5

Recording engineer producer

INCLUDING: CONCERT SOUND REINFORCEMENT

ZEN AND THE ART OF TAPE DECK ALIGNMENT

Page 50

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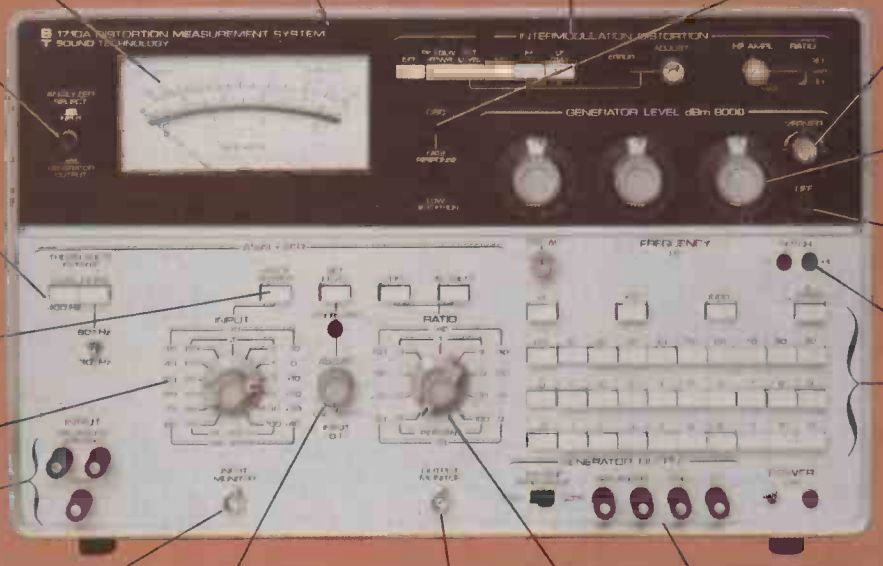

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– the magazine produced to relate . . . Recording ART to Recording SCIENCE to Recording EQUIPMENT.

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VOLUME 8 — NUMBER 5

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cover: another of *TRICI VENOLA'S* acrylic originals.

departments

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Letters & Late News

— *Cover Kudos* —

From: **PAUL F. MORROW**
Electro Acoustic Concepts
Irving, Texas

The original acrylic painting done by you [***Trici Venola,*** who is also the smiling reception voice on R-e/p's telephones, as well as having recently been appointed Circulation Manager] for the August 1977 issue of ***R-e/p*** is very interesting and unique. I was so impressed with your work that I desire to display a rendering of it in my office.

Have you, or do you plan to make available a large size print or poster? If so please advise accordingly.

Keep up the good work.

ed: R-e/p has received a fair number of such complimentary comments regarding the format change to original art for our covers, starting with the April 1977 issue.

Obviously, producing full color, poster sized reprints of Trici's extraordinary talent in small numbers would be economically impossible.

But, before answering reader Morrow negatively, perhaps we could take this opportunity to ask whether many more of R-e/p's readers would purchase sets of these prints in full color, without the type and headings which accompanied them when they were originally published as covers.

Sets of the first four paintings, reproduced on an excellent presentation stock, if the demand approximates 250 sets, would cost $25.00 per set.

If you desire that an order blank be sent to you, please ***circle number 120*** on the reader service card.

From: **WOODY SMITH**
Abadon/Sun, Inc.
San Antonio, TX

After the publication of our recent article entitled **Control Room Design For the Small Studio** in the June 1977 issue of *R-e/p* (page 51) we had a number of inquiries concerning our failure to mention **room equalization**. Our reason for avoiding the equalization question at that time was two-fold. First, we base all our preliminary control room design work on the premise that the room is a more significant factor in sound than is the electronic paraphernalia used to equalize the room for *flat response*. For that reason we like to emphasize the *sound* of the room as well as proper design procedures to control that sound, rather than approach the design with the feeling that we can "correct the problem later." Secondly, we felt the article in the June issue was long enough without injecting additional complex concepts at that time.

However, since then we have not been idle. After lengthy testing of our own, we have come to the conclusion that most people's first impressions (or expectations) of the result of room equalization are far in excess of its true value. To review a bit: Most early work in equalization was conducted by such people as Boner and Davis* as attempts at feed-back suppression in sound reinforcement systems. Feed-back was found to occur whenever one frequency (or a small range of frequencies) was higher in amplitude than the surrounding frequencies and in proper phase with the sound reinforcement system. From their findings came the narrow-band filtering technique (or narrow band equalization technique) now commonly used in sound reinforcement systems, whereby suppression of these feed-back prone frequencies could result in an overall higher level of sound being delivered to the audience. The important thing here is that this technique is a suppression approach to flattening response strictly as a necessarily corrective measure and not something based on improvements possible in ***open loop*** sound systems, such as recording studio control rooms, where there is no possibility of feed-back. It is also oblivious to the very audible effects of decay time vs. frequency. *("The EQ Myth", Alan Fierstein, R-e/p, June, 1977.)*

But, once upon a time someone decided that it would be a good idea to apply this type of suppression approach to *flatten out* a studio control room. So, they proceeded to *correct* the room response. The major discrepancy, we feel, was the application of narrow band filtering to correct abnormalities present in an acoustical environment very different from that for which the technique and equipment had originally been intended.

As we discussed in our earlier article, an untreated room exhibits several resonant

**Dr. C. P. Boner, C. P. Boner & Associates, Austin, Texas. Don Davis, Syn-Aud-Com, Tustin, California.*

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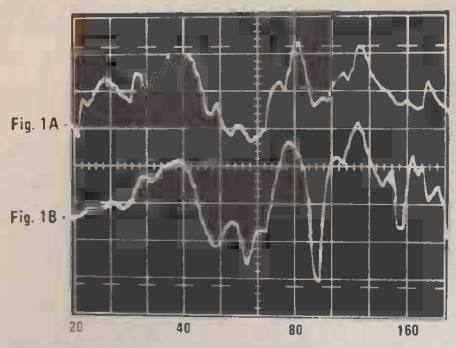

Figure 1A: Slow reponse pink noise, 20-200 Hz., B.W. 1/10th octave.

Figure 1B: Slow response sine wave 10-second sweep of receive filter. Fast RMS, 20-200 Hz.

modes, particularly noticeable at the low end of the frequency spectum. Figure 1B shows the slow sine wave response of a small room in the range of 20-200 Hz., 5 dB scaling. It can be seen that there is at least one major room null resulting in a narrow and severe dip in the response at 95 Hz (and a smaller one at about 150 Hz), as well as a rather broad dip in response in the 40 to 80 Hz range. Figure 1A is the same response measurement made with a digitally derived pink noise source using a 10 second sweep of the recieve filter with 1/3rd octave window (slow RMS response). It is evident that the pink noise response is very similar to the sine-wave response but with less definition of the room nulls (in large part due to the random level of pink noise and the necessarily slow response time of the recieve section required for analysis of pink noise). The point here is that pink noise analysis does not eliminate the effects of room resonances in the indicated response, regardless of its random nature. The sine wave response is given in Figure 1B for comparison. It can be seen that the room nulls are only a few Hertz wide, but very deep. This response anomily is strictly a room dependent phenomenon which cannot be corrected through the use of equalization. Were we to increase the level in this band we would simply increase the magnitude of the signals prior to their interaction — but, when they interact with the room the nulls would appear just as before. A change of this null can only be accomplished by altering the room design, the monitor placement, or a change of the location of the measurement.

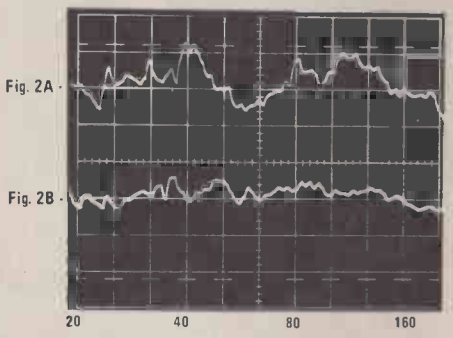

Figure 2A: 1/3rd octave, slow response as in Figure 1A. 20-200 Hz.

Figure 2B: 1/3rd octave slow response as in Figure 1A. 20-200 Hz. after octave equalization.

In trying to correct room resonance by equalization we are merely changing the magnitude of a band of frequencies, which will not correct the resonance problem. Boosting the 1/3rd octave control covering the area where the major resonance occurs (for example 95 Hz) will simply boost the skirts of the dip, actually resulting in a greater magnitude of deviation rather than a lesser deviation. The equalization process can also lead to severe taxation of the monitor system by attempts to drastically alter the acoustic output of the monitor system in a very narrow band, overpowering a specific driver in the system.

The main advantage of room equalization will be to correct for deficiencies in response due to excessive bass trapping in the room, monitor placement problems and response irregularities in the monitor system itself.

Figures 3-A/B, 4-A/B and 5-A/B have been included for interest only. In the room under test we used a calibratred shot-gun mike to plot the measured response in the long and short room modes (3A, 3B respectively). Interestingly, there is quite a difference between the two and even a greater difference between them and the omni-pattern response shown in Figure 1A.

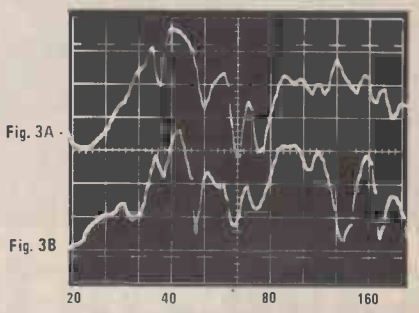

Figure 3A: Long room mode response, 20-200 Hz., sine wave sweep "8".

Figure 3B: Short room mode response, 20-200 Hz., sine wave sweep "8".

Figure 4A is a 20-20 kHz, 1/3rd octave omni sweep of the room while Figure 4B is a 20-20 kHz, 1/10th octave omni sweep of the room. It is evident that the more refined measurement results in a more complex

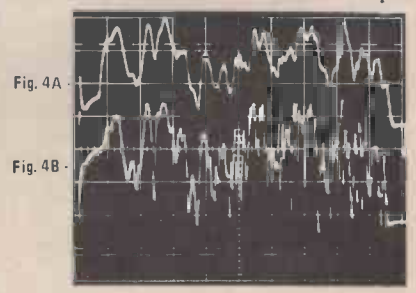

Figure 4A: 20-20 kHz sine wave sweep, 1/3rd octave.

Figure 4B: 20-20 kHz 1/10th octave sine wave.

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Fig. 5A
Fig. 5B

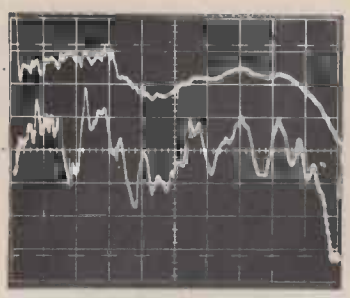

Figure 5A: 20-20 kHz octave wide sweep, pink noise.
Figure 5B: 20-20 kHz 1/3rd octave, pink noise.

product to evaluate . . . frequently hopeless. Figure 5A is an octave analysis of the room which we use as the starting point for room equalization. By comparing the octave and 1/3rd octave response plots (Figure 5B — 1/3rd octave) simultaneoulsy (using an Amber 4400 Test Set) we can determine the desired center frequencies for equalization(from the 1/3rd octave plot) and what levels of equalization to start with (from the octave plot).

The conclusion we have reached is that sonic quality is not achieved by virtue of great quantities of equalization. Equalizers are very limited corrective instruments which have their own inherent problems including phase-shift/time anomolies and transient distortion products. For that reason, we recommend only the amount of equalization that is deemed absolutely necessary to insure reasonably flat response. The recent introduction of equalizers such as the Crown EQ-2 (11 band with variable octave centers) and Audio Design Recording ParaGraphic (6 band with variable centers and bandwidth) allow a much finer tuning of the room response with fewer bands than are common to 1/3rd octave equalizers. We have found that such equalizers are more than sufficient in a majority of cases. Referring to Figure 2A, the major response deviation is a dip in the 40 - 80 Hz region which could be smoothly compensated by octave wide equalization with reasonably uniform phase response deviation over that band.

Any bounded room (i.e., any room with walls, floor and ceiling) will exhibit an infinite set of response deviations characterized by its size, shape and treatment. This leads to the logical conclusion that it is virtually impossible to completely "flatten-out" a room's response — and greater quantities of electronic equalization cannot correct the problem. It might be possible to succeeed in flattening the response by one method, but a different or more refined measurement will usually indicate errors in previous response measurements. We feel a compromise is an absolute necessity to provide the best solution to the monitor response question — specifically using only what is found to be essential, not what is convenient, and realizing that other factors are of great significance in determining the sound of the control room.

From: **MICHAEL FRASER**
Independent Engineer
& Consultant
Hollywood, CA

Manufacturers of equipment usually cover all real and imagined uses for their equipment for their sales techniques. This allows them to maximize the use of their product, profit and, in all but this case, give value received for their prices. It's more than unusual to find an application that a manufacturer never dreamed of, particularly one with such wide appeal.

FRAP, i.e., Flat Response Audio Pick-up, has been gaining wide acceptance as a quality pick-up for acoustic instruments such as guitars, etc. However, a new usage is to apply the FRAP contact on EMT reverberation units, instead of, or in addition to, the ceramic pick-up already existing in the EMT.

EMT Reverberation Units have for quite some time rendered excellent service and are therefore popular. There are several generations of these devices — going from tube to transistor and mono to stereo —

leaving a fair number of mono tube units available at reasonable prices on the used market.

By adding the stereo model FS-200 (pictured) FRAP device to a tube mono EMT it has been found that performance can be upgraded to the point where the user has viurtually a new unit. In addition, because the FRAP pick-up is a flat device, it requires no compensating equalization in the amplification. The FS-200 also has variable high pass filters for each channel.

Additionally, the FRAP differs from the originally installed ceramic pick-ups in that it is three-dimensional. The EMT ceramic pick-ups respond only to in and out vibrations. The FRAP unit is up and down, right and left, in and out; allowing it to retrieve even the most subtle vibrations of the plate.

Frequency response of the pick-up is from 5 to 100,000 Hz with no overload for even massive levels.

The actual application involves utilizing the original exciter driver section of the EMT and then attaching the FRAP pick-up to the plate. It is possible to experiment with any number of different sounds by placing the FRAP pick-ups anywhere on the plate temporarily, using the FRAP wax. Permanent attachment should be done using a thin layer of epoxy. The FRAP may also be used in addition to the existing ceramic pick-ups allowing multiple returns.

The output of the FRAP is transformer isolated low impedance and at microphone level, which necessitates returning at mike level or adding amplifiers which can be easily done with a number of good pre-amps available. Or, because the FRAP utilizes integrated circuitry it is possible to change the feedback loop of the final stage and have a line output, although a price will be paid in noise.

On those we have retrofitted, we have listened with some pretty knowledgeable groups, and the concensus is that the results are definitely superior to stock units.

More on page 105 —

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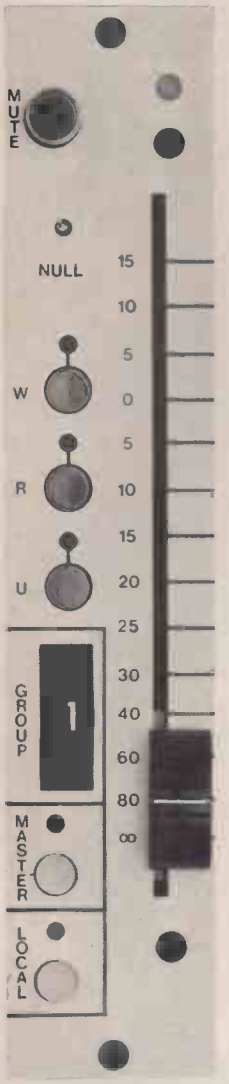

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So far this year, we have delivered around 60 systems, a number which clearly defines the 65K* as the only game in town. We might add that each of these systems has operated flawlessly, with essentially a zero failure rate, since initial turn-on.

Congratulations, Sphere, for doing a top notch interface job. Your automation mode control circuitry is straightforward and understandable — no small achievement in view of today's trend toward confusing over-complexity.

Surprisingly, in spite of its operational simplicity, your system offers an unrivaled degree of program accessibility, together with rock-steady accuracy. (We're happy to see that you achieved this accuracy via a well thought out control signal path, rather than a zillion trim pots).

What more can we say? It's a great system. Congratulations and thanks.

*Allison Research 65K Automation also available in consoles from:

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There are those who think that a record is basically a reproduction of a live event . . . something that should be performable on stage . . . something that could be done on stage?
Phil Ramone: Right. Well, to answer that honestly I think you have to deal with what kind of artist you're doing. I mean, if one was producing *Queen* — an act like that — it's pretty hard for them to perform what they do on record. It's almost impossible. Or even *10 cc*, and yet I've seen these acts, in person, and it's believable. I don't particularly go for saying, "Ah-ha, time to shine and show new tricks of the trade". But if the song deserves 12 voices on it, you're gonna put 12 voices on it, if that's the kind of background it requires. I generally hold the line of not thinking about whether it's performable although I am considerate of that factor. For instance, in Billy Joel's new album, you can listen to it and see that everything is performable. In other words, if strings were needed to support something, or a horn line, then I used them, but I think of the song first and what the *artist* is about, and I tend to try to stay away from clutter. In general, for my taste, when you listen to it back after five or six times it just doesn't wear well when you've got too much going on. It tends to get boring if it's done — to fill a track. And I will refuse to do that.

R-e/p: *Well, I find a busy rhythm section extremely irritating.*
Phil Ramone: Well, a lot of dates are cut with just a rhythm section. Almost everybody cuts a date that way, so they leave very little space, if any, to be filled in by a lot of other instruments. Very few tunes do you start off saying, "Ah-ha, that's a string tune," or, "It's a horn tune". I don't think you can make up your mind right away about that till you've at least done the vocals, and finished all the vocal *ideas* for the record. And *then* if it needs something, *maybe* I will

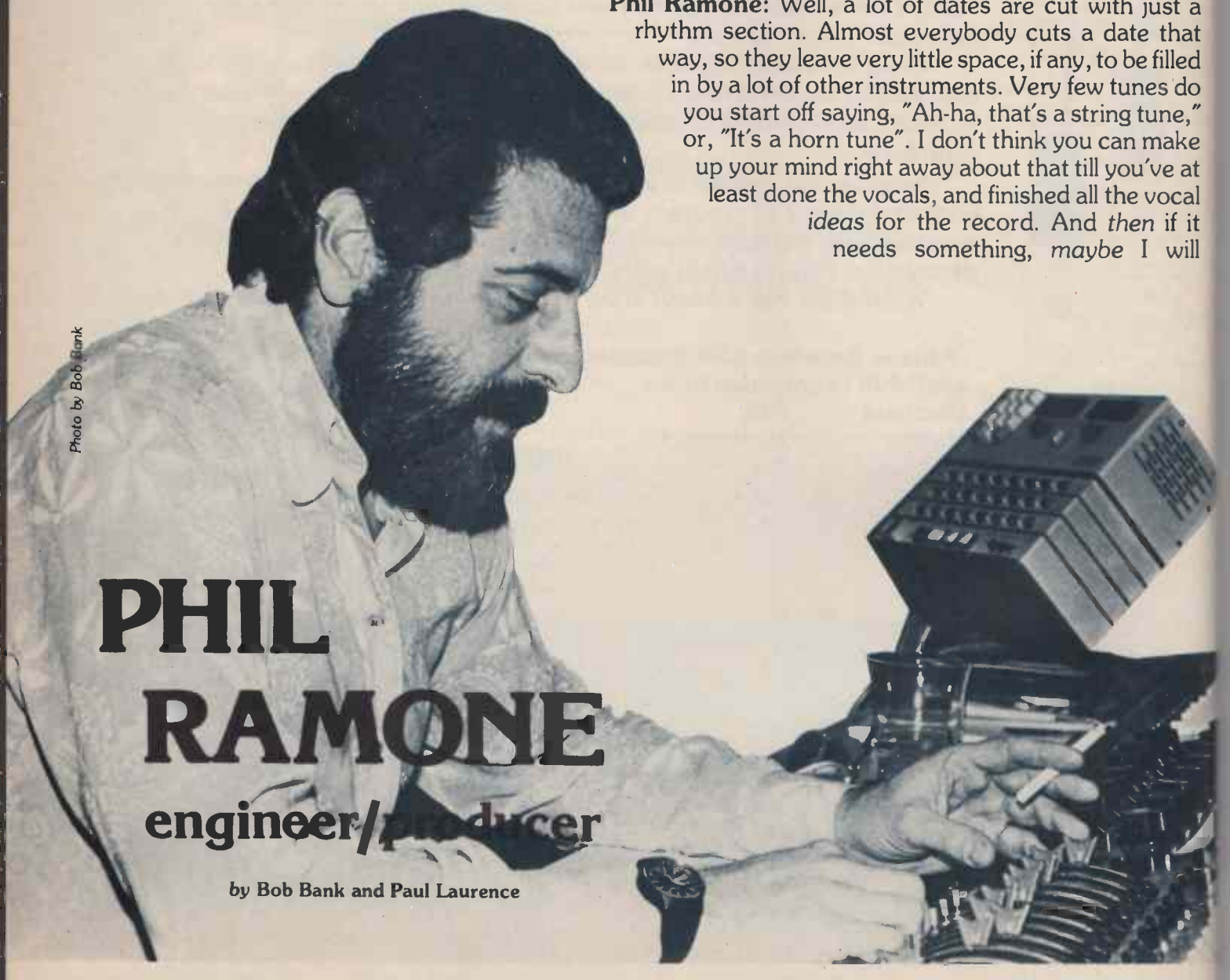

Photo by Bob Bank

PHIL RAMONE

engineer/producer

by Bob Bank and Paul Laurence

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put some chocolate sauce on it, but generally I would say no. I don't think of it as "this has got to be performed", although I must admit that in Kenny Loggins' case, we did consider that a lot, and yet it has a great deal of production in it.

R-e/p: *Can you think of a specific instance where you did something different because you didn't think it would work on stage?*
Phil Ramone: No, I did something I knew might not work on stage by using mandolins. They are not exactly something you carry on the street with you. However, in performance Kenny's been able to simulate it with a synthesizer and an electric guitar so that it sounds *enough* like it. The song *called* for it mandolins, there was no reason not to use them. I don't think of the limits — I think you have to treat the art form as it is. It's like making a motion picture. You really can't put a motion picture on stage.

I think that what happened for many years was a lot of people became afraid because many of the records that were made were *not* performable. A lot of groups just played with the toys of overdubbing, but when they got themselves in front of an audience, there they were, just four people. But you hear *Fleetwood Mac* — to me they sound as good in person as they do on record, even though there's a lot of production there.

I think the performance level of acts, for the first time, has reached a new peak, so people are not that worried about it. Nobody's hiding behind any frills unless they can perform.

R-e/p: *And also great strides have been made in that people are able to make these more complex records, what with synthesizers, and string synthesizers, and high-speed delays, etc. So they've met each other halfway.*
Phil Ramone: Right. But I think that the whole art form itself has changed. Producers and musicians are much more interested in eclectic ideas, but also are more interested in the *form* — dealing with the song. They're competing at much higher levels than they were before. The marketplace is tighter, and there's more selectivity in what people buy now. And the artist *has* to perform in order to promote his records. I mean they gotta get out there. James Taylor's out there touring, *everybody's* out there working. And it's wonderful, actually, because I think it gives them a chance to write better, too. They bring home something after a long trip, even though they're beat for a couple of months. But there's something else that happens to the performer. I see Billy Joel . . . I mean, I worked with him immediately after he just finished his 101st concert, and we started the album. But he had a lot of things ready, *because* of that, I think.

Are there any people whose recordings in any way shaped your own values — the way you look at it. Do you have a "mentor", say?
PR: Well, I would say that there are people who have *influenced* me — I mean, in style. Tommy Dowd is certainly an influence, and a model of a lot of other things that I like. Both from a producer point of view and his technique of engineering, when he did engineer, or when he does, it doesn't matter — you know what Tommy's doing to the record.

I think Tommy considers the song and the basic rhythm structure to be the meat-and-potatoes of the record. And, after that, it's, taste. But he will fight for that and I sense it in all of his records. Rod Stewart, and Eric Clapton they are individual people and he *never* inserts himself into it, which is the key point. You can't put your ego into someone else's record. You can bring their ego *forward*, but you shouldn't take your own in there.

To take it one step further . . . I guess you're saying that you don't think there should be any recognizable sound of a producer or an engineer.
PR: Ah . . . I think that's almost impossible to do. I mean, you can't help but bring certain things to your records. Certain players play certain ways, and I think engineers and producers do certain things. But I'm very conscious of not trying to do the same thing on a record if I'm on another record. If I liked something I did on one record, I will never recommend it to another artist. I might have liked it for that *month!* But taste is taste. I won't use a lot of the same arrangers, for instance, with the next album — it just doesn't make sense. You get formularized, which is what happens to people. So your records, *may* have a "shine" or a "sound" to them. But I assume that, when you were talking about Glyn Johns or Bill Szymczyk or any of the strong engineers that are also producers . . . Roy Halee, they certainly have a sound — I can recognize his records. Roy Halee's bright, clean . . . expansive — *explosive* sound, let's say — versus somebody who gets a tremendous "thump" kind of a groove going on a record. But, you know, that has to do with the style of the band, too. If you're doing the *Stones*, you're gonna get a certain sound. And you better believe that if it's *not* their sound, you just blew the whole production.

Yeah. Ever since Bill Schnee told me that Andy Johns went for a slightly zippier sound — i.e., more 10k and above — than Glyn, I've really had my ears open for that and I'm starting to hear it. Say the drums, I'm hearing an Andy sound — "Exile On Main Street", Led Zeppelin's fourth album — versus Glyn, who's got a darker sound.
PR: Right. But you know, I would say that's almost as unpatriotic as saying a camerman always shoots the same. Though you can certainly spot the eye of certain camera people.

A certain continuity, that's all. It's not to say it doesn't change for them every album. But a certain . . . you know, underlying fabric, I guess you could call it. It's just the way they like to hear things. To please their own ears.
PR: Yeah . . . if you didn't start with that, somebody wouldn't come to you in the first place. Nor would you hire Richard Tee on piano or organ unless you liked the way he played. And he *does* play different for a lot of people. And I don't think, as a producer, you should try to insert more of yourself, . . . just 'cause you like a glistening string sound, because it may not work on the next guy. You may want a real dry, right present kind of string sound and, if you limit yourself — that's what I mean by ego. That's what I'm saying. If you like brass with a ton of echo on it and the guy says, "Oh, I like Memphis kind of brass but no shine on it — I want it real bristling, but I don't want any echo", and, if you object to it because of your basic instinct of having recorded big bands with a big sound . . . I've come through two eras like that. But I never stop thinking about what it is that I want to do for that particular song, and that's what keeps it fresh.

Do you find that you can adjust to something like that? To very dry brass, say, when you're used to wet?
PR: Yeah, but then you make it more interesting — you're gonna do something to it to make it more interesting-sounding.

If you're mixing with the artist you've gotta bring *his* taste to it, and then you've gotta show *your* taste with it too, and if the respect is there for you as a producer, he's gonna give you your head. If he *doesn't*, you've got a stubborn situation that probably won't survive. So my answer to that is you try it both ways. You have time to evaluate — nobody's perfect. You should give it a week to listen to both versions — if you're adamant about the point. And I try to keep that kind of open thinking with both the artist's viewpoint and mine, because if you tell the artist straight to the point that this is something you'd really *like* to try, but he's closer to the forest than you are — maybe he sees it that way 'cause he's always heard the song that way — I've managed to influence writers or songwriters just by suggestion. If they have a feeling that you're not out to do some damage to the song, and that you say that the feeling of the tune was this way or, "Have you ever thought of doing it another way?", it's a diplomatic way of saying, "Let's try something else". And — being honest — a week later saying that the song didn't work that way, we should try recording it again — is the way to get these things done. So when it comes to a mix, you're pretty much in agreement. My attitude is, I keep mixing as we're going. As

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on the transition to producer . . . trying new things —

we add an element or change an element, that night I generally make a pretty good rough mix for both the artist and myself to evaluate.

There are no surprises at the end. I used to do the old thing of just letting it ride on the tape without seeing much action until the very end where I made a real nice mix. Or worked towards making an absolute finished mix which was the shock from where it had been dry all the time with no echo or gimmicks. I go the other way now. At the end of the day, or the end of the basic rhythm tracks, I put those rhythm tracks into shape. One, because I think it's easier to evaluate what you should add instead of thinking, "Hey, maybe there's something wrong with this thing 'cause there's not enough foot"; or not enough thump happening, and what happens is that you didn't mix the original 2-track as you were recording, and you only heard it *after* the date. Or, you overdubbed a tom-tom to go with the foot, you know? Suddenly the whole record is full — you don't need anything. All you need is maybe a double-tracked voice or something like that and then the record's finshed. Well, you would never know that until the end and then it's too late — you probably have added strings, horns, girls, for no reason. And I won't do that.

It's a participation — you've got to be willing to give and take all the way down the line, and if you *do* that, as I said, it's no great surprise at the end. The artist says, "Wow, it doesn't sound too much better than the mix we had two weeks ago". I say, "No, of course not. But at least we knew where we were and what we were after". And all we did was perfect the EQ and the inner balances and make 'em a little more refined. But *that's* what I was after. There are no arguments — the final mix usually takes a lot less time than most people's *because* of that. At least that's been *my* change of attitude over the last three years.

Are you an "idea man"; are you a "technical genius"? How do other people see you — how are you seen by your peers, or those who've worked with you?

PR: I don't really know. You know, I *don't* do that much product — I limit myself to the amount of product I do a year. Somebody says they like a Paul Simon album, they come to me . . . I'm sure they don't want me to make another Paul Simon album for them.

I think that the inner sleeve of this dialog is that . . . my empathy and my emotions are with the musician, from the beginning to the end. I don't play the game of "He's only a musician", which is where I think a lot of producers have made mistakes for years. You know, when I sat in the engineer's chair for years and years, watching other producers — which was the learning tool for me, I watched for diplomacy, and what *I* sometimes saw was a bunch of guys who *weren't* treated very well.

That was back when the engineer was considered as a more mechanical aspect, than artistic, I think.

PR: Yeah, if you contributed something in the early 60's to somebody it was done *through* somebody else so you didn't get . . . blasted for saying it. But if a guy was having trouble with a musician, I always found it easier to talk to him than the producer sometimes did. Or they'd say, "Oh, he's an idiot". And meanwhile, they never realized how he might be scared, or he wasn't being told what they really wanted . . . You know, the clarity with which people talk in the record business is as garbled as some of the sounds you hear. It takes a lot to translate what you really want, and you have to have patience with people. It's inhuman the way records used to be made: Come in and cut three songs in "x" amount of hours. And not only have they not seen the music, but they don't even hear the song or the lyric! And I refuse to work that way.

I want the band involved, and I work very slowly. The *performance* isn't slow, but the time it takes to get people familiar with the product sometimes is. By product I mean the song, or the attitude of the song, or the attitude of what we're *trying* to come up with. So that you get the contribution of the musician. And I think that I grew into being a producer strictly because I had such a strong relationship as an engineer with the musician.

It sounds very similar to how Gus Dudgeon made that transition.

PR: Yeah, certainly the record companies didn't help. They didn't want to know about it. And they wanted me to stay as an engineer. They didn't want to have to deal with royalties. 99% of them all said, "Oh, no, he's a fine engineer but what does he know about producing?"

It wasn't until Paul Simon came along and let me . . .

You sought him out in this case?

PR: No, he came to me. He found a working relationship with me because he had had one with Roy Halee. And Roy got busy at that particular time when Paul wanted to begin cutting, so we did one record together, and then we started to do more sides and eventually . . . he decided that I was more than just an engineer to him — that I was somebody who was co-producing with him. And when *he* laid that title on me, it was more than just a title.

I can't believe that they would put you through that.

PR: Oh, yeah! For five years it was very difficult to get any product. I'd get some jazz artists and some off-the-wall things . . . I think it was Jerry Wexler at a party a few weeks ago who was very complimentary, 'cause we were talking about those days and times that went through the 60's, and he said, "If people understood how many times engineers ghosted records . . . Really ghosted production." You know, he's talkin' about Tommy and myself and other people who just hung in there till 4:00 or 5:00 in the morning with *the artists* while some of the other people went home. And that's a difficult role to switch over to. It took Rock & Roll and those kinds of big-name artists to turn it around for people like myself. Otherwise I would have been relegated to being a Top 40 engineer — which doesn't pay off, by the way.

So you don't think you have any sort of sound at all. Can you recognize anyone else's sound? Could you hear, if I told you this is a Glyn Johns record, the Glyn Johnsness in it?

PR: I would say I *used* to. I don't know about that anymore. I think that Glyn or anybody else is as conscious of not repeating himself as I am. As I said to you, you can't take away your style.

You *mix* to the style, like when Guercio — Jimmy Guercio — called me to remix a couple of Chicago albums. You know, there's a definite sound to that group. And I brought whatever I could to it, but it's basically their sound. Maybe I gave the brass a more interesting sound than it had ever had or maybe the drums, but . . . I never think of me having a particular sound. I'm very afraid of being static so I'm constantly searching. I never go into the studio without trying something new.

Like what kinds of major things will you try new at the outset of a project? All new mikes?

PR: At least that — at least one or two new mikes — not all. You always have to give yourself a path to retreat on — you know, if you don't like it you've got to be able to change it. And in the old days you didn't have time. I can sit there and work on a snare drum and try three or four things with it while somebody's just brought me a new digital delay unit or some interesting toy that I'd like to play with for an hour and evaluate it. And if I say, "Eh, another new Tinker Toy, it doesn't work for me", at least I've had the chance to do it. Or I might try the drums in a totally different part of the room.

So you systematically expose yourself to new ideas and products. To sum it up, that's very much part of your approach.

PR: Yes, I'm really afraid of repetition except for the good things. You confine that to the normal basics of making a good-sounding record, — that's all I try to do.

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PHIL RAMONE

on his peers . . .
his beginnings . . .
the sound —

Well, who do you think is someone who's been able to do that very successfully, either as an engineer, producer, or an artist?

PR: Oh, I think George Martin does it all the time. I think Gus Dudgeon has done it. There's certainly Tommy Dowd. The heavyweights in this business always manage to maintain something very steady, even though the artists change all the time. You can call that a "sound" or "production value" if you like. Arif Mardin has a certain way of working. It's a little more elusive, but at least *I* think I can spot it. Working with the Muscle Shoals rhythm section automatically gives you a certain kind of sound. Now there is a definite *identity* to that sound. Then you're talking about a "Nashville Sound", a "New York Sound" . . . I stay away from that game — that doesn't work for me. I may go to Muscle Shoals *because* of something, but I don't want to go there just for that sound. Frankly, I want to go there for the musicianship. But you *do* get a sound that happens to come with the package.

With the musicians as much as with anything else. You could bring them up to your place and you're well on your way to a "Muscle Shoals Sound" in New York.

PR: Yeah. As a matter of fact, if you listen to the song *Still Crazy After All These Years*, there is the same rhythm section, which we cut in New York, and *not* in Muscle Shoals.

I'm not so sure that a lot of the studio mystique isn't . . . mistaken.

PR: Well, I think there's also a getting-used-to. I have a room that I remix in that I'm used to. So I know, what the values are that are coming in and out of it. Maybe you're able to bring the same echo chamber sounds to it. People have asked me about these kinds of things . .

That's certainly an important determinant of the sound of the records you make — your echo.

PR: That's probably one of the identifiable sounds in some of the things I do. And I also go for a very hard, "thumping" kind of record on the bottom. I like a gut kick — I just happen to like it. I don't like music that's pedantic, and yet I like delicate things, so when I *do* something delicate I still want it to have some *force*. I don't like a ballad to just fly by with nothing but frills and super echo and a lot of high end — it doesn't do any good. And yet if you're cutting an aetist like Phoebe Snow, you don't want a lot of . . . heaviness around the top end of her voice, but you'd want it *underneath* her, and you've got room to do it.

Again, it's technique — it's a matter of knowledge of what the artist is about, and how they see themselves and how you see *them*.

How did it all begin for you?

PR: I grew up in New York City most of my teenage years. I was a musician and was interested in why sound was not doing what the music was doing. 'Cause if you went to hear that stuff live and then you heard the records, they weren't quite the same. And I don't think there's anyone to blame because the technology was just coming about. Also, the start of indepedent studios was beginning around 1960. That's about where I really got going.

How did you happen to choose to be a recording engineer, and where did you start?

PR: I started in a small demo studio with three other musicians who owned the studio. J.A.C. was a little studio on 58th Street, in an apartment! What they did, and what I ended up doing, was to learn how to be creative with demos, because at the time the business was getting away from piano-and-voice demos. Neil Sedaka and Carole King and all these young people were starting to emerge. We were doing things with multiple overlays, putting production ideas into songs so that many times they sounded as exciting as the final product.

What type of equipmemt was used at J.A.C.?

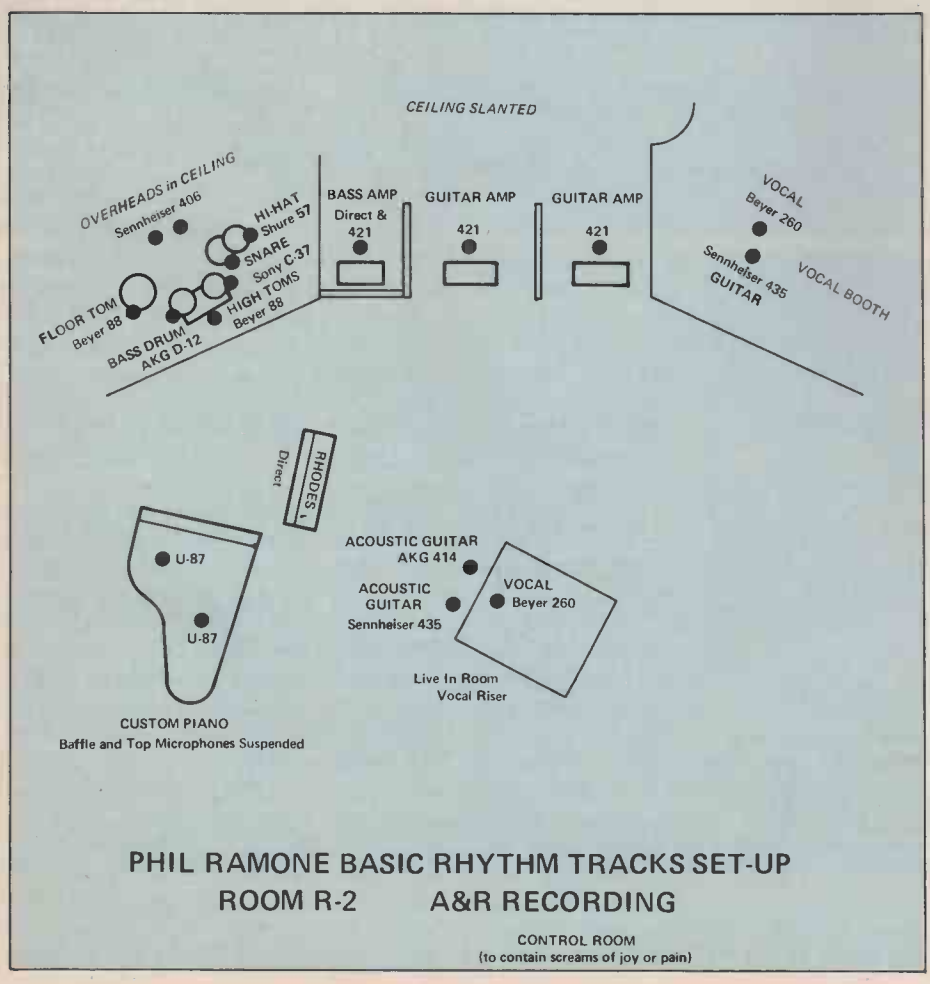
PR: Basically mono. We had a tremendously interesting echo chamber. Sometimes when you have no money, you find out that you can do more than when you have money.

More creative.

PR: Yeah, because you're stimulated to try anything.

So how did you end up at A&R?

PR: I realized that my life at a demo studio was not going to go any further than that. I was jealous of the fact that new small studios were starting to open and *that's* where the guys went to make



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PHIL RAMONE

on the early days . . . his relationship to A&R Recording —

the record of the demo we'd just made. And a lot of times the demo was better than the record! So, I got together with a small group of guys with no money, we rented a space and that's where A&R started. We worked on the mere fact that the sound of our studio was more unique, or let's say the *attention* toward that sound was more unique. We dedicated ourselves to try to make something sound more unusual than the slick products that were coming out of the big studios at that time.

In the earlier 60's, people didn't do multiple-track in the way we do it now. Everything was done at once. Everything had to be quick and everything had to be worked within the budget. Within the confines of that room, engineers had to be able to work with many arrangers and bands, with many things not written, to be in natural balance. But then again, we didn't have that many "electronic toys" going — the Fender Bass was just emerging. We used to sit at night and do unusual things to make a record grow toward the funk that was coming. The bass drum was not an important sound in the record at the time, and you couldn't really hear the bass. You never heard the foot. So we used to stamp our feet on wooden platforms to add more dimension to the record. Or double the acoustic bass with a six-string bass guitar — anything to get more down-to-earth sounds.

What records were you involved with? Can you give me a partial listing?

PR: Well, I was working with Burt Bachrach and Hal David; there was a whole series of hits with Dionne Warwick . . . and Jerry Lieber and Mike Stoller, from *The Drifters* to *The Coasters*, Tom Dowd, the Ertegun Brothers. These producers really laid the groundwork for me to learn producing. It wasn't until the age of the independent record — not just the independent studio — that you could try something new, find someone who would spend time experimenting. As time went on, the relationship between the engineer and the artist became closer even than the one between the artist and the producer from the record company, because the producer was more of a *representative*. He was not necessarily in the style of the traditional A&R man. The rock 'n roll groups resented company reps. It was an era of rebellion, of saying, perhaps, "I don't relate to him because he wears a shirt and tie." I don't know. What I'm sure of, though, is that the guy who could bring about the guitar sound for the artist, who would spend the hours trying to get that guitar sound, is the one who became the artist's friend rather than the guy saying, "Come on, come on, let's go, let's go." And when you went in and made an experimental record with somebody, and then it was sold as an independent production — that was the start of a new era. I joined that group of people very slowly because my reputation was still in the sound field, and I got more calls to design things or work in the grandiose fashion with the mania kind of 50,000-seat concerts. But I realized I wasn't going to be satisfied until I could make records my way, with the help of the artist . . . Make a record that we both believed in.

What was the first session you did as producer?

PR: I don't remember offhand which specific record it was, but there were little records along the line. Some of them became minor hits. My real emergence came when I started to work with Paul Simon, then Phoebe Snow and artists like that. Paul's record was the first recognition I had as a co-producer and from there, a producer in other situations. Sometimes team producing is far more interesting and better — more healthy — because you can't just sit and feed your ego, saying, "I am the sole producer of this product," because you're not. It has to do with a lot of things — with your working knowledge of the studio and of studio techniques, what you can bring to the record in this area, whether you can be a stimulant to the artist and musicians on the production level, and then to bring the musicality out in a way other than just using tape delays and all the other gimmicks that are available.

What is your relationship to A&R today?

PR: At A&R I started with two people, but I basically have removed myself from the picture, because, as a producer and engineer, I can't be involved in the politics of the studio. I don't have the time anymore. I did for ten years, but I don't any longer.

I've brought along a lot of nice people who have become great engineers, and trained a lot of tremendous assistants. And that's vital to me. I think one of the most underplayed people in the recording industry is the strong, non-comic-reading assitant — the man who's gonna become your next producer. *That's* what I'm interested in, not just an engineer behind me, I'm breeding someone who's really a companion to the product. If you look at the credits on the records I do, I play that up to be a very important point — it's not a token credit. There's no *tape machine operator* in my room. My assistant is very deeply involved in the making of the record, his opinions are heard, he is learning the process of what the artist is going through. That relationship is vital to me.

Who have you trained or worked with so far?

PR: There are a lot of people that started early on with me — Shelly Yakus, Roy Cicala. They all started around A&R Recording, because everybody had the same concept. It was the one freewheeling studio in New York.

What was freewheeling about it? What did it do that the others didn't?

PR: We did anything for a sound. At the beginning, that was my rule: "Do anything you can to make a sound." Roy made a sound one night I'll never forget — he dropped a Sparklett's bottle down a seven story stairwell to get an effect for a group. You see that's inventive, it was not for fun. It was that they really wanted the sound of a crashing window. The point is, nobody would stop spending to make a sound for an artist. This was during the days from '65 through '69, and that era was when rock and roll records had everything but *the kitchen sink*. You know, phasers, glazers — anything they could come up with.

Now that you are out of the front end of the studio, wouldn't you like to have a room of your own, even a little 8 track studio?

PR: I'm not interested. What I do have are some personal microphones, some equalizers, a couple of limiters . . . maybe a $20,000 investment.

I have about 10 microphones, ranging from Sennheiser 435's to Beyer mikes . . .

Beyer 260's?

PR: Yes, I like the Beyer 260. I buy a pair of almost everything I like.

How about M-49's?

PR: No, I don't have them. I wish I did. Actually, the sudio had a lot of old Telefunkens, and I had two of them rebuilt, which I keep in the studio. I have an old 251 Telefunken, which is a rare

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PHIL RAMONE

on microphones, acoustic guitar . . . musicians —

microphone nowadays. I have an old Sony tube mike that just happens to be fine for one or two instances. But the studio has bought that over the years. Even so, I've managed to put some of them in closets where people don't find them. The battering and things people do to a microphone is horrendous. When you look at it, it's very sad. It's like looking at your piano with the drinks spilled on it, the cigarette burns. People are just not that careful about equipment in the studio.

I look at it this way: There are certain tools of the trade I need. The two basic things are that the tape machine be in shape, and in alignment. And two, that with the console I'm working on, I know that what I'm getting is what I'm hearing. There's a third point; I carry maybe four or six microphones with me, so that when I take them off the boom, *I've* taken them off, and if there's something wrong with them I'll know about it. Just because someone gives you a list of microphones when you go into a studio it doesn't mean they are going to work. I've learned the hard way: Bring a few of your own tools. Also, I carry my own little demo tape of stuff that I know, so that when I walk into a room, if I don't like the monitor system, at least I know how to handle it, or change it. I have a set of equalizers to use when I go to a strange studio for a month, or I'll ask for a certain set of speakers I know I can use. After that it's up to me to get what you want, and I've had to do that. That's why I feel that studios don't really matter that much.

But I do care about a few instruments being nice, the obvious ones.

Drums . . . Piano . . . Acoustic Guitar?
PR: Yes, that's up to the artist. You know, you can't rent the good ones. You hope that he has a good sounding Martin, or something like it. But then again it's the player.

Do you often run into bad sounding instruments?
PR: No. Not really. But there are times when something has happened and you have to borrow one or something's gone wrong. But generally there's nothing so bad that I can't get around it.

I've heard Paul Simon play about 10 guitars, certainly his own sound better than most, but we have played around with some others . . . like when one of the manufacturers presented him with one of their first acoustics. Actually it didn't have a great sound, but he played it so nicely that I was able to record it well. The level on which he plays, on which he picks, and the way he plays gives you a certain kind of sound so regardless, you're automatically ahead of the game.

Speaking of Acoustic Guitar, do you have any sort of basic approach towards it? A way you like to hear it, perhaps? or some things you dont like to hear, or . . .
PR: Well I think there is a truism to recording a 6-string or a nylon. If you really want to do something that sounds good, you should use fresh strings. There is no question about it. They just sound good for about an hour. And after two hours, if your playing a hard song — a tune that's really pulling — those strings will go dead.

Does Paul change every two hours?
PR: Yes, if we are doing something that's critical. It depends on the song. What I'm saying is, if you're doing something that really requires a strong solo, if you are doing *Kodachrome*, for

instance, if you did that for three hours, at the end of the third hour, if you listen to the tape, you can tell the difference with the same microphone in the same position.

Your talking about that little riff guitar there?
PR: Yeah, the acoustic lick.

It is very bright . . .
PR: Yes. But that's a specific thing though. You know, that was done a specific way. There's no formula for that either. You know nylon tends to get boomy on the low strings. Nylon is one of the tougher ones to record. The fret noises and stuff are strictly a matter of the bridge height, and the guy that's moving his hands. Some people use spray and stuff to get the strings smoother. But the thing is how are you going to record it. If you are going to be three inches away from the guy, you're going to pick up those noises. If you are going to go for the ambience of the instrument then you should try to place it where you can get back a few feet, using a quality microphone. Obviously, if you are troubled by leakage in the room, then you're forced to go in close.

Which is the case, when he plays out there with the rest of the musicians?
PR: In Paul's case, as with almost everybody I work with, I use the studio for the lighter instruments. And, I have large booths, they are not the typical teeny, tiny booths. They are really nice size rooms. The drum booth is not what you see in most studios, which is what I consider a tiny room. If a guy plays a drum that loud why should you put him in a corner, with blankets around him? With rock and roll, you are defeating what you are trying to do. Maybe I shouldn't use just rock and rool, you are defeating what you are trying to do with drums. Why not let the guy play at his level.

With the guitar or the acoustic piano, I'd rather get the room sound around the instruments. You *can't* record an acoustic piano with tons of blankets all over it, on gobos. Suddenly the piano sounds like its in a tiny box. I much prefer to have room for the sound to expand. It's just a theory of mine, and it seems to work well for me.

The other thing about the drum booth is it is located so that you can put Paul on a stool in front of it so he has eye contact, so there isn't any leakage.

The biggest problem is a live vocal with an acoustic guitar, where you may want to change the vocal later.

PHIL RAMONE

on recording methods . . . acoustic guitars —

Most of the time you couldn't avoid redoing both of the parts?

PR: Well, you can't recut the guitar part, it's impossible. What we will do . . . Paul and I will talk, and if he feels he's vocally not in shape, or the guitar part is that complicated, he'll just sing the key lines, where he knows he will be in tune. What that does is still give me a chance to have the room. If it gets to be really difficult, then he'll go into the booth.

But, he starts out in the room?

PR: Well the way he and I work together is that the musicians sit around and tap pieces of paper, blocks of wood, anything around. You live with the song for a couple of hours before you actually start to play it. So everybody just kind of gets motivated by being around the person that's performing it. There is no substitute for that kind of contact. If everyone went into their own little room, you might as well phone the parts in; there wouldn't be any starting point. So that's how we get started.

We work pretty much on a six hour day — straight. And the guys know that if we don't like it, so what, it isn't a reflection on their abilities. If we don't get it today, we'll get it tomorrow. Just as often it is our inabilities to make the right decision, or make the right groove happen.

A drummer, say, is automatically gonna go to his book of tricks when he comes into a strange session. Whereas a Steve Gadd or any of these guys we use will sit there, and use their hands on their knees until they find a pattern, all the while listening carfully to what he's playing. When you're listening to him sing and play with no amplification, your *sitting on top of it*. You get a much different feel than you do if you just shove him in a booth, feed the earphones hot, and nobody knows why. There's no relationship to anything.

It's different with a group that plays together every day, a band, for example Billy Joel's basic rhythm section is just a bass, a drummer, and a saxophone player. But the guitarist has always been an outsider. The way I have found to record them was to work them together as close as possible, in about the same proximity as they work on stage. Where they can hear each other, and feel it. So when they put the earphones on there's no major change. Just a little more detail, and a little more clarity, so they can hear each other better. The thing about working physically close is that you play to the level of what you're hearing. That's not to say the drummer *cannot* play soft when somebody's playing an acoustic guitar. When the beat of the song is that heavy, why should he play ridiculously light? He just can't do that.

Steve Gadd, for instance, has been on the road with Paul. We took that whole band on the road with the last tour. So we had to find the level at which he could play on stage and yet

still not ruin his style . . . and the same for Paul. A lot of that has to do with the knowledge of what you're doing in the studio, letting the people around him really feel what he's trying to say.

Going back to recording different strings, what are the differences between the way you record a steel string and a nylon string acoustic guitar?

PR: With the nylon string, the bottom is usually boomier, depending on the axe itself. I tend not to try to eliminate the low end until I've found the right position for the mike, and I'm careful about where I put the instrument in the room. If your room is crummy then you've got a real problem. Some people like to put those nylon strings in a very dead area, and they don't *speak*, so you end up going in for more detail from the microphone, which is gonna exaggerate all the imperfections in the instrument. In other words, if you have a chance for it to have some air around it, then you can get back. For every six inches that you can get back, you know you are going to get a more rounded sound and probably less action out of one string or, one more than another. The tighter you get, the thicker the fundamental you are going to get. Some of the overtones are gonna be missing, you'r goona get the fundamental so thick. The instrument is designed to be heard at least a foot or two away. When you are back and you hear a nylon string, your sitting, maybe, in the first row, you start to hear the overtones of the instrument. And that's the beauty of it. It' the same thing as, "How tight do mike the piano?" It all depends, do you want to hear every hammer and every string. If you can go back about six inches or a foot, you get another sound out of it.

So you would not use a different mike on a nylon relative to a steel?

PR: There are times when I've gone for a dynamic mike on a steel string, and gone for a strong condenser on a nylon. That's versus just saying "Okay, I'm gonna stay pat on one or another".

I think the instrument is the key to it. If the guy's instrument is a particularly bottomy instrument and yet it has a smooth top end, but not enough of it, you have a choice of whether to use a super high-ended kind of mike where the low end is'nt that critical. Or, if the cardioid pattern of the microphone is such that it gets boomier and boomier, you know you are asking for it. People don't realize that each condenser microphone that's made, or any mike

that says *cardioid* on it is a totally different creature by its own cardiod pattern, That same microphone, which blows up really fat and big when they are right on it, and then you push them back from it, three inches, you won't hear any low end. Again, it's critical to the instrument and the player.

All things being equal, would you approach the steel string and the nylon string with the same mike to start off with?

PR: Okay, I'll give you the best approach for me, and it works on almost everything I do: I go out and listen to it, where it is happening. My decision is made from that viewpoint. I know basically what three or four microphones will do for me. My ear tells me immediately what I'm in for. By sitting out near the instrument, not listening in the control room, I can immediately say: "Uh-huh, this is a dull instrument" or "it's bright". If it's bright I can go for a more rounded microphone, if it's dull, I'm gonna go for a more high-ended mike. But regardless, I may be looking for a totally unnatural sound, anyway.

But, if you have to go in close, you want to make sure you aren't doing it with a brittle mike. To discuss the individual characteristics of each microphone is boring, I think. A U-87 definitely has its characteristics versus a Sennheiser. But you can't win in that game, because there is too much disagreement. It's like, choosing between a Mercedes, a Jaguar, a BMW.

How great is the influence of the individual acoustic player, his dynamics, and all . . .

PR: . . . That's vital! That has to be as vital as, say, somebody who plays the piano in a certain style. I mean, an Elton John plays it with a tremendously hard technique, somebody else might play it with a very soft technique, and the instrument will speak totally differently. The same as a drum, any acoustic instrument. Like Dave Sanborn gets a sound on an alto sax that's totally different than anybody else's, and yet it's still an alto sax. Somebody else picks it up, it's not gonna sound like Dave Sanborn. It's definitely the player's technique and his approach to the instrument.

You mentioned you used two mikes to record the acoustic guitar?

PR: Well, I try to use two mikes, and not get into a phase thing, or get cute with stereo. What I'm trying to do is get one that can give me some distance. Then I can choose between the two or marry them at the same time to the same track. Or, if I think it's something I might want to play with later, I'll use two tracks at that point, so that I can finesse it in the mix. I don't think that you get too much of a left and right from a guitar. Stereo guitar is kind of a joke.

Again, if I've made a decision that I might want to change — say, the song has become such a hard, funky thing that the nylon is not speaking well, I am better off using the close-miked signal since it marries well to the whole track. I've got the option right from the beginning.

You use one mike over the hole and one over the left hand, or one over the hole and over the back?

PR: . . . One out at least two to three feet, faced cross-angle to the hole. Looking at it from the front, it is aimed a little bit more toward the fingerboard and across it, rather than trying to get a direct shot from the hole because you can do that with the close mike. In other words, if you're the player and you are looking at the two microphones, one will be directly in front of you somewhat away from the hole, but in line with it — a little lower than the higher strings. The other one will be aimed at the player's fingerboard, almost parallel to it but maybe turned in ten degrees to the fingerboard.

What microphones do you lean toward?

PR: Well, in that case I would use a 435 Sennheiser for the outside mike, then try to find a good dynamic or ribbon mike for the close one, depending again if it's nylon or steel. I seldom use two condensers — it just doesn't seem to work for me.

Do you ever put one mike around the back?

PR: Sometimes, when I have the room. When I am doing a straight overdub, I might put the mike up in the air about six feet to see what it sounds like. Again, when you are trying for a particular effect, if you stand around the instrument placed in a specific spot in the room, you should know what it is going to sound like. Then you can pick a spot for the microphone. I do the same with electric guitar — all kinds of crazy things with the electric guitar for a particular sound. But with an acoustic

continued on page 39

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Continued on back page

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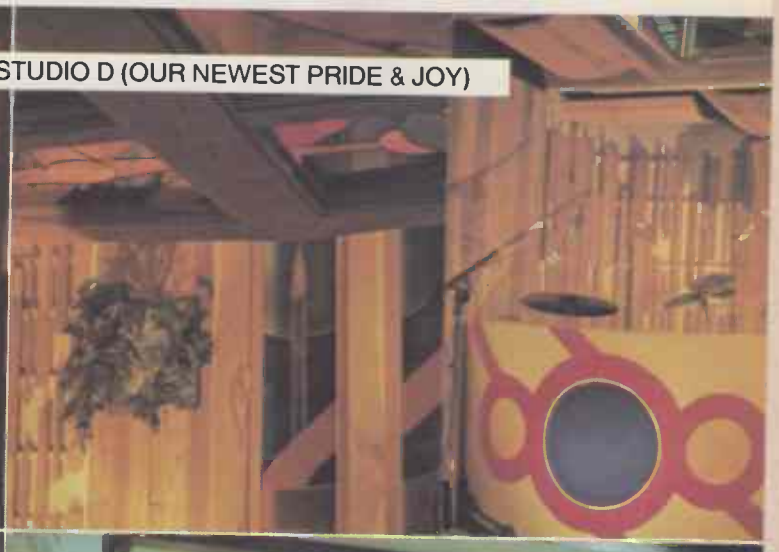

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HOME AT LAST

Continued from page 2

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Phil Ramone . . . continued from page 34 . . .

you are somewhat limited. Only so much sound is going to come out of it and the musician's body is blocking a lot of it.

As a matter of fact the difference in getting a different sound out of it has more to do with putting the player on a piece of wood, or putting a wooden chair in there instead of a metal one . . . you get a totally different sound.

What have been the most often used microphones on the acoustic over the years?

PR: Starting back 20 years ago, the U-47 was the basic. In its original form it was pretty much a *distance* mike. Then the U-67 was followed by the U-87, and these are favorites. Those who still own the original 67's swear by them for their difference in *color* from the 87. They were tube models.

Which has more high end now?

PR: Well, they claim the 87 does but I still question it. There is the tube mike versus what it's looking into. If it is looking into a transistorized board it's going to give you a different sound. Get hold of some of the original older mikes before they have been re-padded to American standards. The European standard was to actually use the mike as its own pre-amp, which is the logical thing to do. It has so much gain in it anyhow. Why we knocked it down I have no idea. That was because we came from broadcast standards to recording. Strangely enough, broadcasting was what influenced recording rather than the other way around.

And now it's ludicrous to see the return of people trying to use a microphone in the most direct form, directly into the tape machine. Why not! Putting the signal through the consoles we have today which are so complicated that the signal is destroyed and distressed — ***the microphone may not mean anything,*** as far as I am concerned.

What mikes did you use for acoustics on "Rhymin' Simon"?

PR: Mostly 87's. In some cases a 47. It depended on the studio, too, to be honest with you. But I have used a Sony C-37 with Paul, and had tremendous luck with it. Generally, we switched between the C-37 and the 87 during that period.

What is your terminology for talking about sound qualities with the artists?

on terminology . . . drums . . . equalization . . . limiting —

PR: The word *shimmering* is one I happen to like. I also like *punch* describing the low end of the six string, the lowest two strings that give you most of the total bass line.

The intensity of the song will create the amount of shimmer that is in the guitar.

I guess I am talking in terms of equalization more than anything else.

PR: We never talk in those words. We talk in coloration of the sound. I don't like people to just simply say, "I need more at 8k and a little more at 3." I prefer people to say, "It feels too *thick*. It needs more *punch*. It's not *bright* enough." That's what I mean by coloration.

I've seen guys equalize an acoustic at 12,000 cycles and said to myself, "I wonder if they really know where the overtones end", and on a piano, too. I've taken all of the markings off of an equalizer and asked the guy to use his ear — which is better in the first place.

The important thing is that you are not committing yourself to a *grave* amount of EQ . . . you don't want to do anything you'd resent later. As the hours go by and the high-end goes down, fatigue sets in, you don't want to lose perspective. Also I love to be able to change my mind later.

What microphones do you use on Paul Simon's vocals?

PT: Well, I have changed Paul several times in four albums. I started with the U-87, then I went to the Sennheiser 435 for a while. On certain tunes we use a Beyer Dynamic, the 260, and on other tunes it doesn't work so well. I'm using an AKG 414 at the moment. If it's a particularly harsh song, then you have to be careful that the microphone you choose doesn't get the sibilance or a lack of low end, depending on the energy level of the song. Paul's vocals are very sensitive, so you need a pretty good gain mike. At the same time, you need one that doesn't have a tight pattern because he tends to move around the mike a lot, as he's working.

How about drums?

PR: I like *air* around the drums. As I said before, I have a room that the drums are in. It's not a booth, it's a large room. It's built somewhat like a control room. It is set up to have resonance and help the drums to sound like a set of drums, has glass and slanted walls, a tilted ceiling, wood as well as a variable in the wall so that you can deaden it or make it livelier.

Drum mikes?

PR: I have two mikes for the snare that I like. If I am doing a fat rock kind of thing, I'll use a Sony C-37, close-miked and padded down a lot at the pre-amp, so it doesn't overload. It's dangerous to use a condenser in that proximity but it does have a unique sound when the pre-amp is good. It hits you right in the lower gut. The other mike I use for the snare is the 441 Sennheiser.

For the Kick I have an old EV-666 that's been around, but it's in good shape. Or a D-19 AKG, or a 414 Sennheiser, or E-V's RE-20.

. . . the High-Hat?

PR: Depending on what is being used on the snare, I use a Sennheiser 441 or a Shure SM-57. Overheads are a pair of 435 Sennheisers.

On the tom-toms, Beyer 160's. I use them reasonably close. From the drummer's viewpoint looking out at the drums, not the other way.

The cymbals are being done by the 435's, really. That gives you the spread

as you open the pair up, and they're really a stereo pair . . . aimed in a stereo cross cardioid pattern. There are a lot of times when I don't even bother with it, though. To me the fact that you have control for the remix by having the snare well isolated is more important than the stereo effect. Once you get the tom-toms balanced you can sometimes use just one mike for the overhead — you can get just as much spread. As a matter of fact, you get less phase cancellation and you don't have those hollow *holes* you hear in records where the musician went across the drums, or it sounds like he's in a tub. However, it is really a matter of the drummer; the more balanced the drummer is, the easier he is to record. I take the attidude that if the drums sound right where he is, then I'd better stand and listen, then go into the control room and capture them that way.

Do you ever use limiting on drums?
PR: No! Never

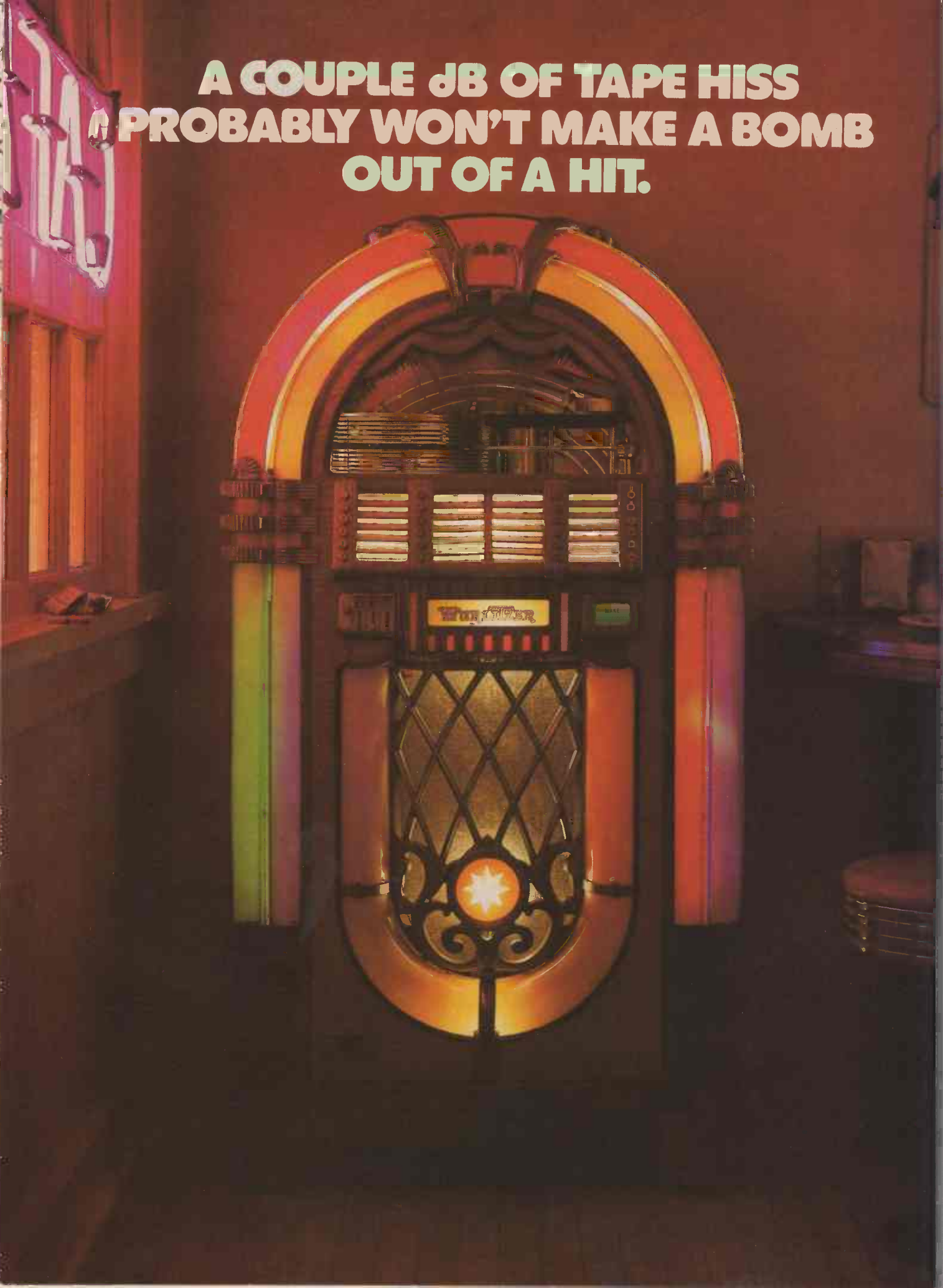
The only time I'll use a limiter in the initial recording is when it's set for peak and not compression. I'll use a dbx, or I have an old stereo tube Fairchild unit which is pretty good for catching peaks on the vocal. But I set it very minimally.

Again, I stress the point, the microphone has to be in condition and the pre-amp and the board had better be the best. But, basically your hands should do the job. If you want to just protect the tape from a sudden jagged peak, you keep the limiter at a minimal peak. You can always compress or limit on the way back on the remix.

On a live date I do set the limiters ahead of time. Since the live concert is going on, I know that at any given moment if the bass player suddenly turns up, he is liable to flood the audience or he will flood me! I have two or three settings pre-marked ahead of time, so that I don't have to search and blow 10 seconds. Then, in your hurry, if you over-compress you suddenly dump the bass. Then you have troubles in the remix. I always carry a tone oscillator with me, and feed it from the bass amp output direct or the bass direct from the guitar itself. I set it in advance because I know what 5 or 10 dB of limiting looks like coming from the stage; I know it's a given number and I can protect myself.

Every job, every date — I don't care how prepared you are — there will be surprises, and you rapidly realize you are only as good as the crew around you.

A COUPLE dB OF TAPE HISS PROBABLY WON'T MAKE A BOMB OUT OF A HIT.



BUT SOONER OR LATER YOU'RE GONNA HAVE TO CLEAN UP YOUR ACT.

WHY LIMIT YOURSELF WITH MASTERING TAPE?

You won't catch a professional racedriver putting cheap gas into his Lotus. It's just dumb.

And the same holds true in the studio. With all that heavy machinery and expensive talent, it makes no sense to compromise on your mastering tape.

TODAY'S SCOTCH 250 IS THE STATE OF THE ART.

With 250 you get far less tape noise. Considerably more high end clarity. Our exclusive oxide formulation and application reduces Mod noise. And when you add all that to dbx or Dolby it's positively the cleanest sound around.

SINCE WORDS ARE CHEAP, WE PUT 250 TO A ROUGH TEST.

Whatever the numbers or the meters say, it's your ears you should listen to. So we went to a very fussy, very fine engineer and asked him to devise a test to demonstrate the difference between 250 and our nearest competitor.

The guy first thought we were nuts.

"You're serious?" he asked. "I use 250. What if my test proves the other tape is cleaner?"

We gulped a little, and told him to go ahead. This test was bound to be expensive. But it would also be worthless, if everything wasn't above-board. That's why we chose Tom Jung of Sound 80, Minneapolis, to put it together. You may have heard of him.

THE TEST PROGRAM WAS RECORDED—ON TWIN MACHINES.

Jung, as we expected, left nothing to chance. On April 18, 1977 he recorded an original music program simultaneously on two 24-track MCI's fed by one console. One recorder was carefully optimized for 250. The other, just as carefully, for the competitor's tape.

Jung used NAB equalization at 15 ips. He really packed both tapes at 6db (370 nWb/m) over standard operating level—without a shred of noise reduction.

THE TRUTH CAME OUT FIRST AT THE AES SHOW.

It was May 10, 1977 at the LA Hilton. For playback we set up identical machines (our own M79 24-tracks, this time) with Altec 19 speakers. Then we opened our doors.

For each group of engineers we played not only the full mix, but individual tracks, first on one machine, then the other.

THERE WERE SOME WHO COULD NOT BELIEVE THEIR EARS.

"Play that bass track again," they'd say. And we'd play it.

"Are you sure both tapes were recorded at the same level?" We assured them they were.

"Lemme hear the strings with the horns."

In three days close to 600 people heard our 20-minute demo.

AND THE TRUTH IS...

We didn't find one engineer who didn't hear the difference in L.A. Ditto in Nashville, where the demo was repeated July 13 and 14.

You can simply pack more sound on Scotch 250 and still stay clean.

So the bottom line is this. Scotch 250 is cleaner tape.

DON'T TAKE OUR WORD FOR IT. BRING YOUR EARS TO NEW YORK.

We'll repeat this "head-to-head confrontation of mastering tapes" at the AES Show on November 4 and 5. Hear for yourself that heavy sounds don't have to be muddy.

3M COMPANY

CLEAN UP YOUR ACT WITH "SCOTCH" 250.

A MODIFIED 'MS' RECORDING TECHNIQUE FOR LOCATION RECORDING

by Leon E. Weed

The fine art of MS (mid-side) recording is a relative newcomer to the semi-professional in the recording field. Very few papers have dealt with this subject, as most information is gained through first-hand experiences of recording companies that offer little or no information on their techniques. This author has bridged this gap by reporting on some very interesting results of a modified approach to Mid-Side recording of which any serious recordist, broadcaster, or professional may take advantage.

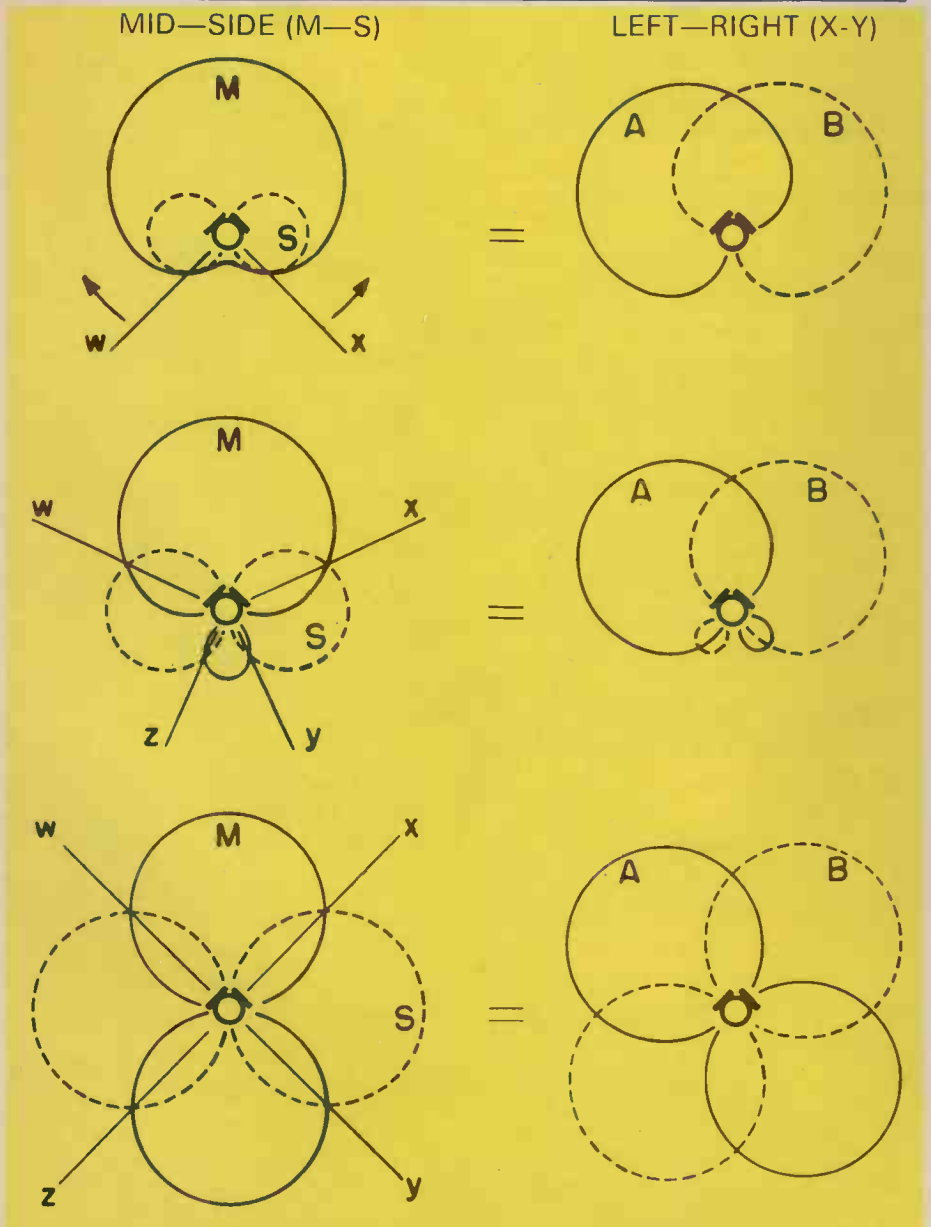


Figure 1. *Polar diagrams for a pair of coincident microphones, with various directional characteristics, showing* ***MS*** *to* ***XY*** *transformation due to the matrixing of a sum and difference circuit.*

Early stereo recordings as far back as the 50's pioneered some of the developments in this technique but found little use for them in studios as the acoustics in these anechoic environments produced few advantages. Multi-tracking became almost universally adopted as the prime medium to capture all the various rich tones and harmonics produced by an orchestra. Location recording companies almost invariably use the "Time Domain" method using a multiple array of microphones and mixers to achieve the re-creation of the natural tonal balance in its original acoustic environment.

Until recently not much was known of how this MS technique could be utilized. Mathematically an array of formulas is needed using phase angles, quadrants, and square root functions to better understand how this phenomenon occurs. However, it is not in the scope of this paper to delve into the myriad of mathematics, but to show how a modified system can be used with your existing equipment by using a little Yankee ingenuity.

The ability to hear and discriminate sounds is one of the most remarkable attributes of the human body. An individual can hear distance and direction at almost all wavelengths in a near perfect 360 degree radius. The sensors are only a few centimeters apart which is proof in itself that the phase sensitivity of the human brain is quite remarkable. The MS-XY technique is closer than any recording system yet devised that attempts to duplicate the human auditory perception.

In the XY system, the microphones are placed in such a manner as to simulate the human auditory perception. An MS microphone pair,

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properly adjusted, will provide the same left-right signals, after matrixing, equal to that delivered by two XY microphones set approximately at ±45 degrees from the source of sound. In principle, both techniques of MS and XY recordings are equivalent and each signal can be transformed to the other by means of matrixing. The MS system has an advantage in that the scale of width of left-right can be varied by attenuating either the mid or side signal before matrixing. This means that there is less equipment in the recording chain and hence less distortion. (See Figure 1.)

In the author's Modified MS recording technique, the "raw" MS signal is recorded directly on the tape. This preserves all the original mid and side signals picked up at the performance for later mixing through a sum and difference matrix. Certain precautions must be taken in order to achieve the proper XY equivalent from this tape during playback. Proper phasing of all components in the raw chain is of the utmost importance including the microphones, cables, and tape recorder. A pair of matched high quality condenser microphones is a must for best results. Cable lengths are fairly critical and should be measured and cut to the same length. The tape recorder has to be checked and if possible, adjusted or compensated, for phase and amplitude shifts throughout its entire range.

In conventional MS recording the signals are matrixed before the signals enter the recording medium. As described earlier this resultant XY signal can be altered again even though it is in a left-right format. The main disadvantage is that there must be two matrices to produce the same width control of a single MS system.

In most instances the location recording engineer has had very little time, or even choice in selecting the best position for his microphones. Sometimes, even after several attempts to record in the same environment the results are still unsatisfactory. The Modified MS Recording Technique solves all these problems, by saving time and allowing freedom to choose the right location. Since the microphones are all on one stand, only two steps are necessary: location of the

MS (mid-side) microphone assembly showing the extreme close tolerances between the microphone outer cases, as well as the crossarm, counterbalance and adjustable clamp assembly.

approximate center and, adjustment for height and angles. At this point his work has been cut in half. All now that remains to do is adjust the input levels for proper modulation, and the job is done. A word of caution here — *LEAVE THE SETTINGS ALONE!*

Once back at the studio, "mix down" the MS master tape in an environment that allows sufficient time, solitude, and access to appropriate equipment to make the precise adjustments. One good hint is to have a test tone at the beginning of the tape on both channels, adjusted for 0 VU, for logging in your final setting. In addition, have the channel number and location of the mid and side signals written on the master tape.

One of the most visible aspects of this system that can be seen by reviewing the block diagram (Figure 2) is the simplicity by which the components can be constructed. The microphone supports and the matrix are the only two items to be considered. Several commercially available systems offer a complete package. However, few studios and semi-professionals have the capacity to invest in one binaural system. The likelihood of having two microphones such as the RCA 77DX or similar in your facility will increase the chances for experimentation in this area. If the microphones have been committed to other needs, the investment in a binaural system would probably pay for itself in the long run.

There are several advantages, however, in using two separate microphones. One, of course, is that they can be split and used for the universal "Time Domain" recordings or other jobs such as small groups and announce jobs. With the two microphone approach, the flexibility of the investment increases tremendously. Another plus for this type of split system is the ability to rotate the capsules to an unlimited number of

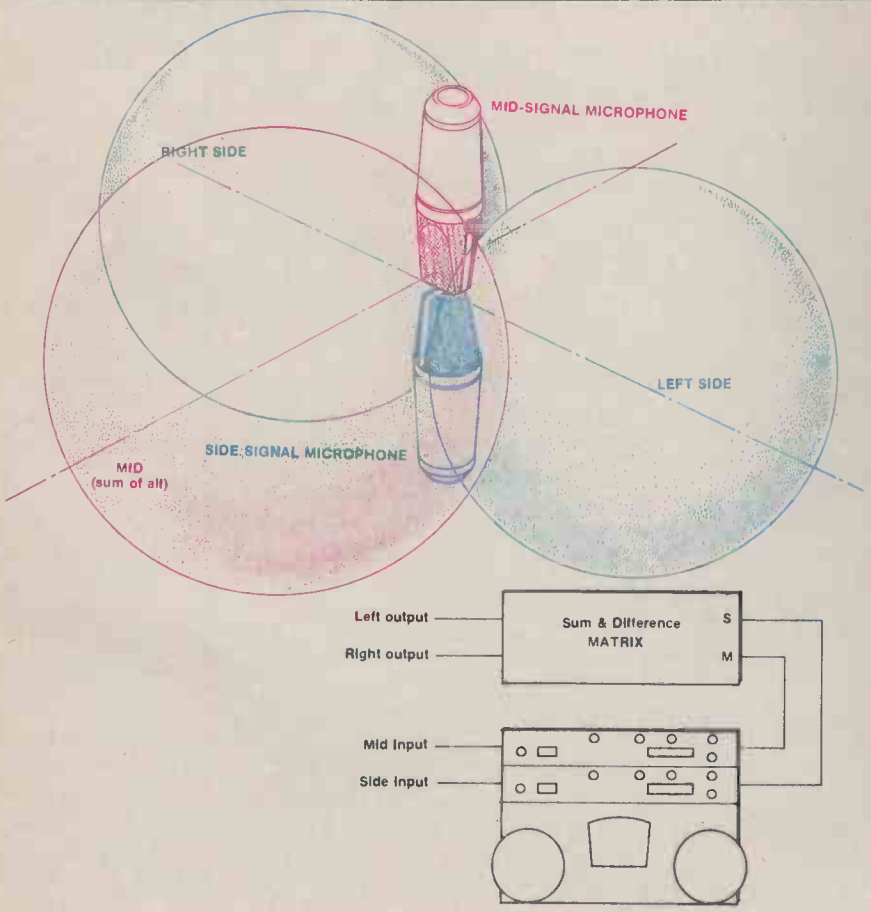

Figure 2: *A simplified block diagram of a modified* ***MS/XY*** *recording system using two separate phase and amplitude matched microphones. The* ***mid*** *signal is picked up using a true cardioid pattern, and the* ***side(s)*** *by using a figure-of-eight pattern. By varying the controls the width of the sound source can be varied through a 0 to 65 degree arc.*

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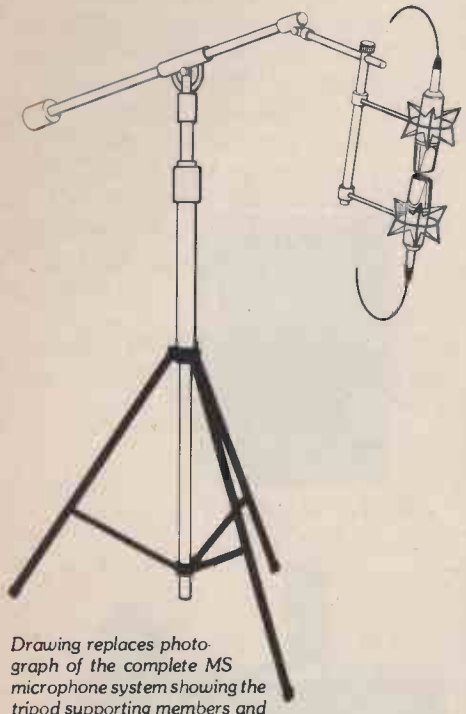
angles and patterns to achieve a variety of direct XY techniques suitable to your acoustic environment.

As seen in Photograph 1, the author's microphone system consisted of two Neuman U-87 microphones on the Z-48 shock mounts. A tripod stand was used to support the crossarm and the specially designed supporting members. The matched pair of input cables are fed through the clamps of the assembly and secured several places on the 1-inch pipe when it is extended to it's full 18-foot height. Custom mounts such as this one are relatively inexpensive to build. Shown in Photograph 2, the support system was designed around an Atlas SS-2 speaker stand. A 10-foot extension pipe can be purchased from an electrical supply house. It is advisable to shock mount the microphones, since the tubing has a definite resonance which can be set off by structureborne noise from the floor causing severe low frequency blocking.

Construction of the sum and difference matrix is relatively simple. Details of the transformer type are in



Drawing replaces photograph of the complete MS microphone system showing the tripod supporting members and the adjustable telescopic 1 inch piping.

Figure 3: A Typical Transformer Coupled Sum & Difference Matrix

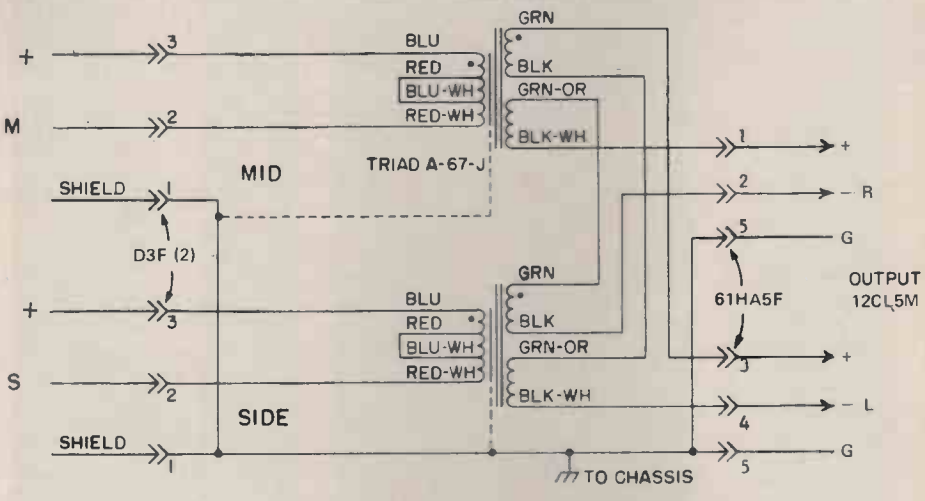


TABLE 1

TRANSFORMER SELECTION GUIDE FOR MS/XY MATRIX*

Tape Recorder Output Impedance	Input Circuit Impedance	Transformer Type	Maximum Level dBm	Frequency Response Hz. +/- 2 dB
600 ohm Balanced	600 ohm Balanced	UTC-A-43 Triad A-67J	+15 +10	20-30,000 30-15,000
600 ohms Balanced	10K-100K Unbalanced	UTC-A-34 (Reversed)	+15	20-20,000
10K ohm Unbalanced	600 ohm Balanced	UTC-A-34	1w	30-20,000
10K ohm Unbalanced	10K-100K Unbalanced	UTC-A-18	+15	20-20,000

*In practice, any transformer can be used as long as they are of high quality and are matched to within .5 dB or less, and has one or two (2) split secondaries of equal impedance. In all cases, refer to the wiring diagram supplied with each transformer paying close attention to the phasing of each of the split secondaries. To calculate the minimum load impedance, multiply the impedance of one split secondary by four (4), i.e., 150 ohms X 4 = 600 ohms. For best results, the load impedance should be within 1% of the calculated value and be matched to each other by no more than 1%.

The output circuit can be balanced (floating) with no apparent losses in frequency response or distortion. For unbalanced circuits, ground the two negative (-) L and R output leads to one common. (See Figure 3.)

The author's portable MS/XY matrix system showing separate output module featuring a bypass switch.

Figure 3, with a photograph of a very compact portable unit. Layout of the wiring should be in a neat and orderly fashion and enclosed in a good quality housing. If the recording equipment is not of the broadcast type, 600 ohm impedance, then different matching transformers should be used. (See Table 1.)

After the system is complete and checked for all possible bugs you are then ready for the road. This author contacted several schools and colleges which were all more than willing to have their orchestra recorded, especially when there was no fee. The Modified MS Technique was tried out on a large symphony orchestra in a nearby college concert hall with a seating capacity of approximately 1,000 people. One hour was allowed for preparation. The orchestra's chairs were set up allowing the experienced recordist to visualize the center of the sound source. Most standard set ups group the front chairs for the strings and woodwinds in a semi-circle facing the conductor. This set up is almost "studio perfect" for the MS-XY system. The microphones when placed on the boom extended to a height of 14-feet above the orchestra. As seen in the photographs, the microphones angled slightly downward about 30 degrees. The cables were run to a nearby lighting room and the rest of the equipment was set up. Within 30 minutes all was ready. During the orchestra's tune up the levels were adjusted and remained at that position until the end of the concert. The matrix was brought along, but not needed, to monitor the playback. As was expected the results were much improved over the formerly used direct XY and "Time Domain" systems.

The final excitement came when this author had a chance to play back the master MS tape through his own home system. The surprise was the extraordinary number of mixing possibilities that could be obtained from the recording, in fact it was very hard even *then* to decide on a final mix.

ZEN and the ART of TAPE DECK ALIGNMENT

by Peter Butt
Heider-Filmways Recording
Los Angeles

Lest anyone assume that this is another one of those articles treating routine biasing and level setting of a multitrack tape machine, let us declare that the subject under discussion here concerns the type of deck alignment that involves verification and adjustment of the tape deck mechanism itself. We are about mechanics firstly, and electronics as they may affect that primary subject.

The past year has brought me in intimate contact with two-inch tape machines of several species: The Ampex MM-1100 and MM-1200, the 3M M-56 and M-79, and the Studer A-80. Let it be known that I am fully aware of the existence of such things as MCI's, Stephens, Telefunkens, and Lyrecs. Those makes of machines, and any others not specifically mentioned, have not yet crossed my path. They are excluded here only because I have not had the opportunity to perform an overhaul on even one of them, let alone four or five.

The information and techniques to be shared with my fellow tape deck therapists will not be comprehensive with respect to any specific machine. I have noticed that over the time in which I have overhauled no less than five M-56's, numerous M-23's and AG-440's, four MM-1100's, two MM-1200's and four A-80's, that there are certain methods given in the applicable service manuals that can be improved upon with practice.

Comprehensive tape deck overhaul is infrequently undertaken in the course of recording studio maintenance. The job takes about three to four man-days, barring interruptions, parts shortages, and loss of interest. The subsequent utility of the tape machine hinges entirely upon the care and thoroughness with which the task is performed. Experience has shown that defects in the deck mechanics cannot be surmounted by bandaids applied elsehwere after the fact.

The similarities between rebuilding of the tape deck mechanism and overhaul of an automotive engine are patently obvious. Those who have done very much of either have regretted temporary expediencies, taken in the interest of minutes saved, after the job has become only a memory. The time and care taken to insure that each detail of the task is performed yields dividends in the future experience of that task, even though the nearest term benefit of such pains at the time they are taken is obscure, if perceptable at all. This, then, is about as far as we will delve into the teachings of Zen. Those familiar with the fictional work by Robert M. Persig,* after which this article is facetiously entitled, may be moved to read deeper meaning into the following text.

What follows has been derived pragmatically in the interest of expediency. Employment of the information will contribute toward achievement of tape deck performance resembling that of a new machine.

Let us now proceed to the nuts-and-bolts portion of this presentation. The first operation to be considered is the orderly disassembly of the deck

---

* *"Zen and the Art of Motorcycle Maintenance", R. M. Persig, William Morrow & Company, 1974.*

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mechanism. Before this is even attempted, preparation should be made for the orderly storage of the parts removed. Styrofoam cups make fairly adequate containers for small hardware such as screws, nuts, washers, springs, etc. They may be sealed with masking tape and written upon easily with ballpoint pen.

It has been my habit to return screws to their original positions, with their accompanying hardware, if any, as a reminder of how things came apart. Service manual illustrations are not always very explicit in the precise orientation of assemblies relative to one another. The 3M manual is particularly austere in this respect. Memory joggers in the form of grease-pencil index marks and written identification can be invaluable when the time comes to put it all back together again.

Reel Motor Assemblies

The first assembly that presents itself for convenient removal is the reel motor and brake assembly. In the case of the MM-1100/1200, an index mark should be made showing the relation of the assembly mounting flange and the deck plate. As the motor is removed, its identification as to supply or take-up function should be noted, and inscribed on the side of the motor casing. The accumulated dust should be removed and the entire assembly moved to a clean bench area for inspection.

The primary area for attention, as far as the Ampex reel motor assembly is concerned, is the brake mechanism. Wear and/or hardening of the asbestos brake band surface material will make it difficult to achieve the proper braking torques necessary for reliable deck operation.

At this time, it has been found valuable to thoroughly clean the surface of the brake drum cylinder and to remove any evidence of hardened lubricant present about the moving joints of the solenoid/brake spring lever mechanism. Removal of the link pin that retains the spring lever to the brake housing casting will facilitate this cleaning and permit inspection of any wear occurring at this point. Application of a small amount of a moderately heavy grease such as Lubriplate will contribute to more reliable operation of the brake mechanism.

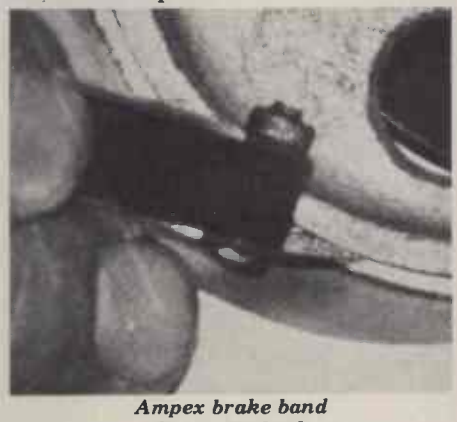
This type of brake has been susceptible to failure in the form of mechanical binding that prevents the application of the braking torque upon release of the brake solenoids. In one case the cause appeared to be permanent magnetization of the solenoid slug. The remedy for this is to replace the entire solenoid and slug. Binding due to the accumulation of dirt within the solenoid itself and within the moving joints of the spring lever arm pivot and the brake housing can be corrected by thorough cleaning.

Lubrication should be reserved solely for the spring lever/brake housing pivot. Under no circumstances should the brake solenoid be lubricated. If a simple cleaning of the solenoid parts does not result in an unmarred, smooth slug surface, replace the entire assembly. Even if the slug is polished it will quickly revert to its damaged condition after a short time of service.

Because of the relative inaccessibility of the Ampex reel motor assemblies when installed in the machine itself, preliminary adjustment of the brake mechanism on the bench is highly desirable. We are primarily concerned with the amount of solenoid slug travel required for proper brake operation and release and the amount of clearance between the brake drum circumference and the brake band asbestos surface itself. The dimension for setting of the solenoid slug travel, from bottom to maximum extension, should be about 0.75 inch, ±0.02 (19 mm ±0.5). Figure 1 shows this dimension being measured and adjusted.

The clearance between the brake band and drum, in its released condition, is very important in insuring that the brake can indeed be released completely. If the clearance is too great, it will not be possible to develop sufficient braking torque when the brakes are applied. An empirically determined band clearance that has worked well in practice is 0.010 to 0.007 inches (0.25 mm to 0.18 mm) with the solenoid bottomed. This dimension can be measured with a common feeler gauge. Figure 2 shows the technique used to determine this clearance. Any adjustments necessary can be accomplished loosening and re-tightening the two socket head cap screws that retain the brake band at the solenoid end of the band. In the case of the installation of a new band, take care to see that the band has been formed into an arc that conforms to the brake drum at all points of contact. Otherwise the band will drag at one point while showing acceptable clearance at another. The result will be a periodic wow due to non-uniform reel tension. Remember; if it isn't right when it is installed in the deck, it won't get better after use. Hopes and dreams give cause for contined progress, but this is one whose fulfillment should not be counted upon.

Ampex brake solenoid travel adjustment
Figure 1.



Ampex brake band clearance check.
Figure 2.

While we've got this assembly out on the bench, we may as well check into some other aspects of its performance. The eccentricity of the motor shafts here is not as critical as it is in the case of the capstan motor, but it does matter. Removal of the brake housing permits measurement of the brake drum eccentricity. Use of a dial indicator that reads in tenths of thousandths of an inch (0.0025 mm) will permit direct measurement of eccentricity. A peak-to-peak eccentricity of 0.002 inch (0.05 mm) is tolerable here. The hub platform eccentricity can be as great as 0.010 inch (0.25 mm) peak-to-peak without causing trouble. Eccentricities greater than this should be investigated as to their source. A bent motor shaft pretty much precludes repair at this level of maintenance. The entire motor assembly should be returned to Ampex for repair in this event.

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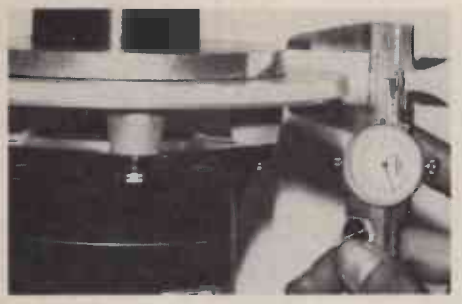
indicators are available having travel ranges of 0.008 inch (0.20 mm) or more are readily available in the $50 to $70 range. This has been found to be more than adequate for servicing tape equipment normally encountered.

Another problem that sometimes crops up is a change in the elevation of the hub platform assembly relative to the assembly flange plate. This problem is caused by dropping of heavy reels of tape onto the hub platform, resulting in slippage of the entire motor shaft downward. There have been several cases of this in my experience. The short term remedy is to fashion a shim of appropriate thickness, to make up for the slippage, and place it on the rubber or cork turntable platform pad.

Positive evidence of shaft slippage can be obtained by measurement of the distance from the bottom surface of the assembly mounting flange to the upper surface of the turntable platform pad. Figure 3 shows this measurement. The



Ampex reel platform height measurement.
Figure 3.

dimension, according to Ampex, should be 0.896 inch ±0.003 (22.75 mm, ±0.08) for the MM-1200 and 0.912 inch ±0.003 (23.16 mm, ±0.08) for the MM-1100.

Shaft slippage cannot easily be remedied without the aid of the appropriate pulling tool for removal of the hub assembly from the motor shaft. Any attempt to pry the hub from the shaft will result in a bent shaft that will certainly make the motor unusable. Makeshift shimming is the only remedy for sinking reel platforms, short of return to the factory. If the platform should sink far enough to interfere with the mounting flange, there is no real alternative.

Reel motor assemblies used on the 3M M-56 and M-79 transports are considerably more simple than they are in the case of the MM-1200 and MM-1100 machines. The hub assemblies are easily removed using appropriate socket-head hex wrenches. Reel height can be determined easily by raising or lowering the hub assembly to the proper height on its shaft after reel motor installation.

Removal of the direction sensing mechanism requires only a screwdriver and socket-head hex wrench. Replacement of the motion sense flag bearing is done easily with a small arbor press and is not much more difficult using a drill press and a 9/16" wrench socket as a driving tool. Motor shaft eccentricities are not very critical and can be tolerated to as much as 0.005 inch (0.13 mm) peak-to-peak with no trouble. I have never actually attempted repair of the motor itself, as Los Angeles has a very reliable factory repair center for the Bodine motors used in the 3M machines. No Mincom reel motors have failed in my experience. The cost of Bodine motor repair has been about $30 per unit and turn-around times have been running about three days, typically. There is clearly no great incentive to undertake motor repair personally in this case.

The flag arm bearing should be inspected to determine if it shows cogging due to internal wear and/or high resistance to motor shaft rotation. Looseness of the outer bearing race that permits movement of the plane of flag arm rotation is highly undesirable. This sort of thing makes the proximity of the arm magnet to the sensing reed switches an uncertain proposition and results in deck control problems.

These motor assemblies are so simple that there is very little more to say about them. The exact positions of the mounting plates can be recorded by marking the edges of the plates on the main casting surface prior to their removal for convenience in repositioning upon installation. Even that is a relatively minor matter.

The Studer A-80 reel motor assembly is a bit more complicated than the 3M. Studer does provide suggested brake band setting dimensions for brake band and solenoid travels. The way that the settings are shown in the Studer manual implies use of a special gauge device for the purpose as use of a dial caliper is awkward for setting an inside dimension. The travel between the brake lever and the lift pin, shown in the manual Figure 4.1.-1, dimension no. 1, should be 1.0 to 1.5 mm (0.039" to 0.059"). This dimension is much more easily set if the thickness of the lift pin, 0.156" (3.96 mm) and the thickness of the brake band at the point of contact, 0.055" (1.40 mm) are added to the directly given dimension as shown in Figure 4. The required clearance is correct when the distance from the outside surface of the pin and the outside surface of the band is 0.260" ±0.010 (6.60 mm ±0.25), with the solenoid slug fully extended.

The lift pin travel is checked by depressing the solenoid slug to its bottom and moving the solenoid until the brake band is released sufficiently to permit free turntable rotation. Check for reliability of the brake release action and re-adjust if necessary. This entire operation can be performed outside of the machine if desired.

The condition of the frictional material on the circumference of the brake drum itself may be inspected by removal of the reel platform from the assembly. Cleaning can be done with a cotton swab soaked in alcohol solution. Many noisy brake and fluctuating brake tension problems can be cured by simply cleaning the frictional surface. If replacement is necessary, the entire drum must be ordered.

Tape Guiding

All tape decks are designed to handle tape at some specific distance above some reference surface. Knowledge of what the designers had in mind in this regard is a great help in bringing guiding tolerances back within original limits.

The Ampex MM-1200 and MM-1100

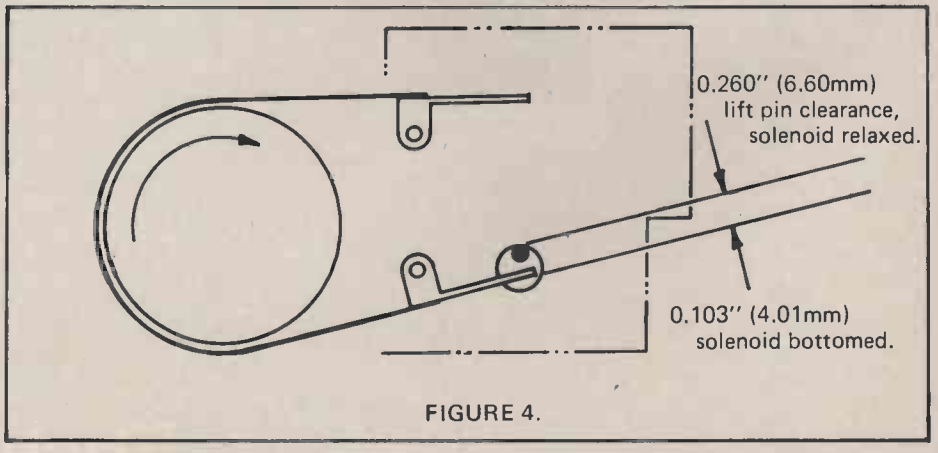


FIGURE 4.

Top view of Studer reel motor and brake assembly showing critical dimensions.
Figure 4.

continued on page 58

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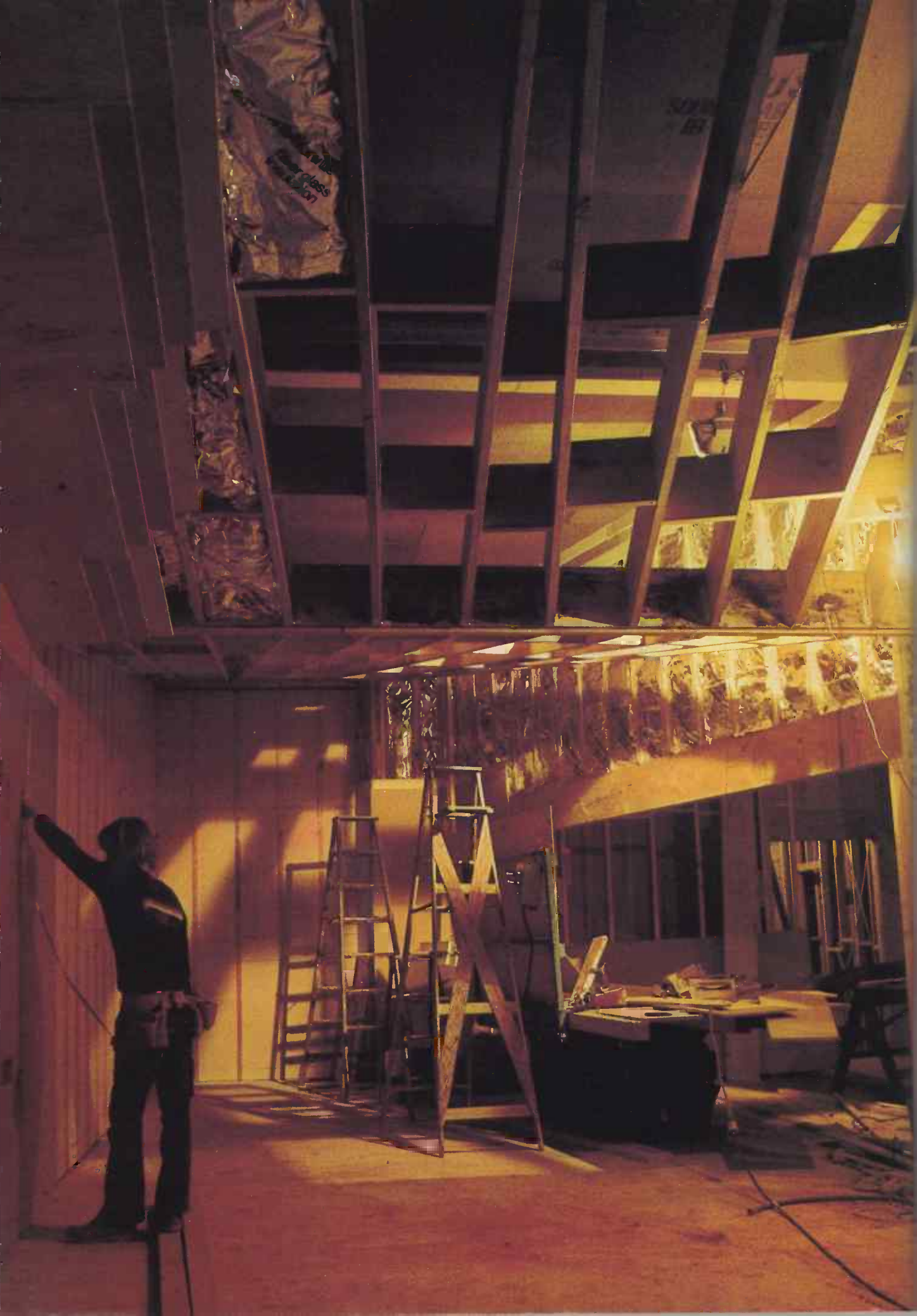

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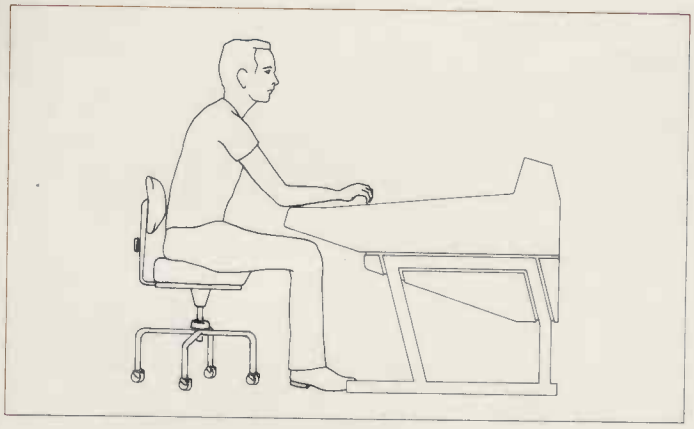

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. . . continued from page 54:

decks are designed to carry the bottom edge of the tape at a height of 1.000 inches above the aluminum deck plate. Since the deck plate itself is only accessible after removal of the head assembly, reel motors, tensioning transducer, tape guides, tape metering mechanism, capstan motor, pinch roller assembly, and tape-break arm assembly, it is not generally convenient to have access to the entire deck plate. All of the necessary measurements can be made indirectly.

Removal of the two rotating guide assemblies and the head assembly will expose the reference surfaces of the deck plate. Since warpage of the plate itself is fairly unlikely, we shall presume that the plate is flat and smooth over its entire surface, exposed or otherwise. Disassembly of the rotating guides will permit measurement of the combined height of the idler base and the spacer below it. The combined heights of these two pieces, measured from the guiding surface that contacts the bottom tape edge, to the surface of the milled circular surface on the bottom of the spacer, should be 1.000 inches. Figure 5 shows this measurement.

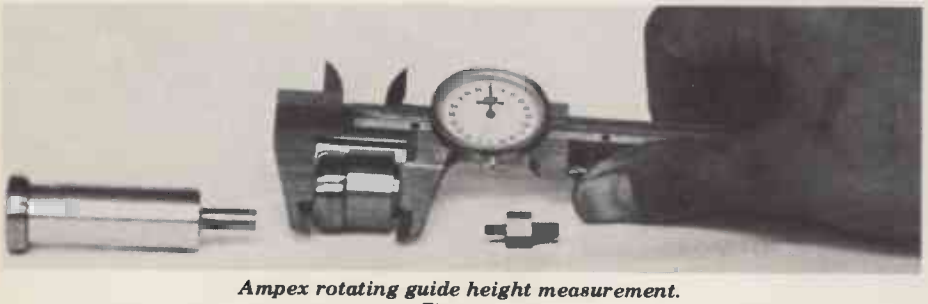
I have always found this dimension to be correct as installed. Repair actions necessary have been limited to replacement of the idler base or simply rotation of it to expose an unworn guiding surface to the tape.

The same indirect method can be used to establish that the stationary guides on the head assembly are at the proper height. The milled lands on the underside of the head assemly mounting plate should measure 0.6400" (16.25 mm) to the top surface of the plate. Removal of each of the stationary guides, in turn, will permit measurement of the base heights. These should measure 0.3600" (9.14 mm). The sum of these two measurements should be 1.000" ±0.001 (25.400 mm ±0.025). Again, except for the need for replacement, shimming should not be necessary. Figure 6 shows these dimensions relative to one another.

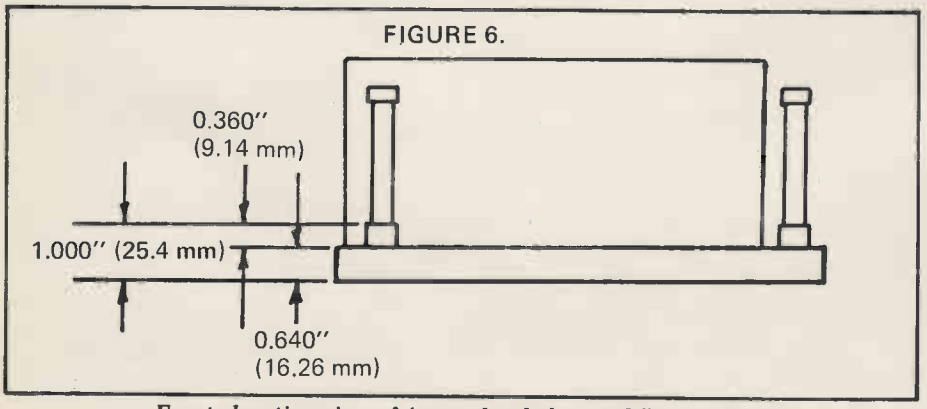
The 3M deck was designed for a lower edge tape height of 0.8125" (20.64 mm) above the milled surface of the deck casting. This dimension may be verified in the same way as for the MM-1200. Removal of the tape guide retaining studs permits the entire guide assembly to be removed from the deck. Measurement of the guide base height is done as shown in Figure 7. The M-79 models seem to have guides that are within 0.001" (0.025 mm) of the specified value. M-56 machines frequently require some shimming.

The base height for the incoming and exit guides is the same. The clearance between the lower and upper guiding surfaces is 2.000" +0.001, -0.000 (50.80 mm, +0.025, -0.000) in the case of the incoming guides. The exit guides have wider clearance of 2.015" (51.18 mm) typically.

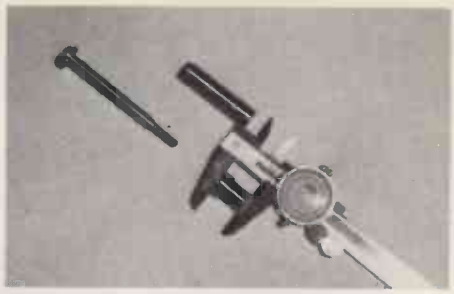
As the guide retaining studs are removed, observe that there is no eccentricity evident as they are removed from their respective threads. Any eccentricity apparent to the eye indicates a bent retaining stud which must be replaced with a straight one. No cheating here, please. A bent guide will cause bowing of the tape and possible creasing. The tape path through the Isoloop will fluctuate causing an excessive amount of dynamic skewing. A bent guide cannot be adequately corrected for with pinch roller adjustments later on.



Ampex rotating guide height measurement.
Figure 5.



Front elevation view of Ampex head plate and fixed guides.
Figure 6.



3M M—79 guide height measurement.
Figure 7.

Tape height for the Studer A-80 seems to follow just naturally. There is no published specification for the height of the tape relative to any reference on the deck. Measurements of several head assemblies show that the lower tape edge rides about 1.616" (41.05 mm) above the plane defined by the three milled bosses at the head assembly mounting screw holes. There is a gauge block available from Studer for setting the head height, however, there aren't many of those around. The only time it has been necessary to be concerned with head height is in case of head replacement. This is not an everyday occurrence. Studer, Nashville seems to be agreeable to providing loaner head assemblies while the owner's heads are being replaced. That is probably the best route to take if head replacement does appear necessary.

The heights of the rotating guiding surfaces all along the tape path are determined by the shimming of each individual assembly. A shim kit is available from Studer as an aid to the user. 3M likewise will provide a kit of shims for a fee. The last resort (or is it first resort?) for shims is your local machinist's supplier. They should be obtained in thicknesses of 1, 2, 5, 10, and 20 thousandths of an inch. I'm not sure what the equivalent metric increments would be, but they should work out to be about the same increments.

Since the height specifications for each of the Studer guiding components is not available, and hard to measure

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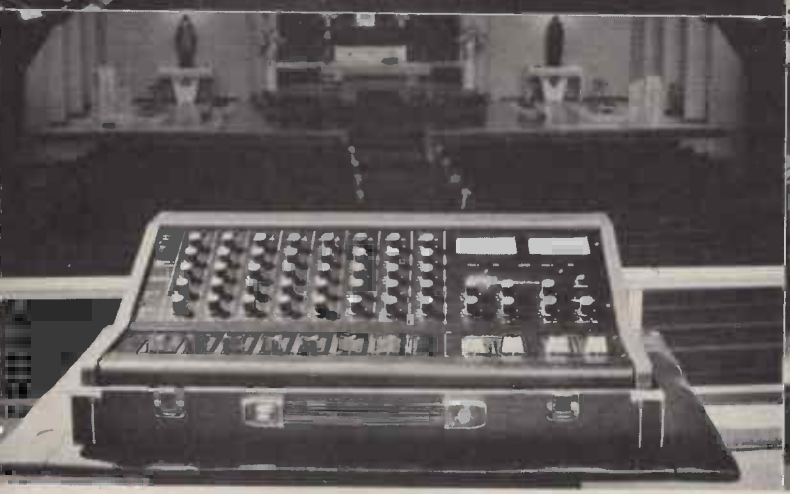

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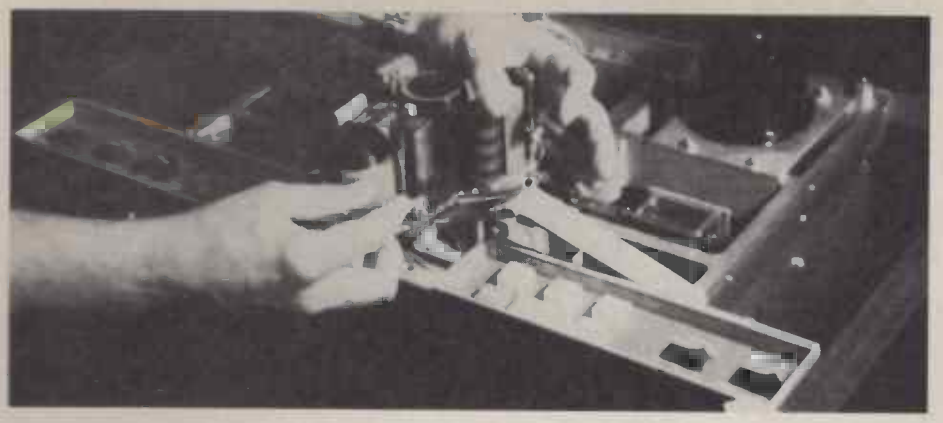

3M pinch roller tilt adjustment.
Figure 10.

because the feeler gauge tends to not fit well into the low contact valleys of the capstan.

The effecacy of this method may be checked by slipping a piece of onion skin paper backed with a piece of fresh carbon paper through the energized capstan-pinch roller interface. A uniform print indicates uniform pressure over the width of the pinch roller. As an added bonus, this method results in less breakage of the upper pinch roller shaft support bracket.

The Studer A-80 pinch roller mechanism is the most complicated of all. The procedure given in the manual is generally fairly adequate with some minor variations. The relaxed pinch roller/capstan clearance adjustment is easier if the tires are removed from the pinch roller assembly and the relaxed clearance between the exposed drum and the capstan shaft is set to 1.325" ±0.010 (33.65 mm ±0.25). This dimension is arrived at by taking the tire thickness into account. This process is shown in Figure 11.

Setting of the clearance between the Studer pinch roller arm and the pinch roller tensioning arm is an important as well as awkward operation. The difficulty lies in measuring the clearance as it is being adjusted. A spark plug wire gauge works out nicely for this task. The use of the gauge is shown in Figure 12. A clearance of 0.022" (0.56 mm) is most convenient as that is the smallest dimension represented in the set of wires in my gauge. It is reasonably close to the 0.5 mm maximum value given in the manual.

The Studer pinch roller tension specification of 2.6 to 3.3 lbf (1.2 to 1.5 kgf) works fine. I tend to favor the higher limit for 2-inch transports.

Vertical end play clearances for the pinch roller and compliance roller assemblies is typically less than 0.002" (0.05 mm). This value seems to be consistent with acceptable tape tracking tolerances.

Studer pinch roller-capstan clearance adjustment.
Figure 11.

Adjustment of the Studer edit solenoid position presents somewhat of a conflict on some of the A-80's of my experience. At times the solenoid plunger-connecting rod coupling pin clearance specification and the subsequent pinch roller/capstan clearance in edit mode may not compliment one another. Adherence to the plunger-connecting rod pin clearance specification can result in an edit mode pinch roller clearance such that the moving capstan will contact the oxide of the tape.

Studer pinch roller tension arm clearance adjustment.
Figure 12.

The Studer manual calls for an edit mode capstan-pinch roller clearance of about 0.157" (4.0 mm). This is consistent with my intuitive tendency to avoid tape abrasion wherever possible as this clearance does not cause the tape to contact the capstan. An acceptable compromise that has stood the test of a short time is to adjust the edit solenoid so that the tape is brought to a distance of about 0.015" (0.4 mm) from the capstan in edit mode.

Pay careful attention to the adjustment of the Studer pinch roller assembly. Take care, also, to avoid exerting excessive torques on the solenoid retaining screws. Aluminum threads are not tolerant of macho adjustment techniques.

Tape Tension Transducers

The Ampex MM-1000/MM-1200 tape tension sensor is a spring-loaded, cantilevered arm which is deflected by the action of the tape under tension. The movement of the arm causes the distribution of light from an

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incandescent lamp to change between two photo detectors. The procedure for alignment of this mechanism is given in the Ampex manual and works well. Take care to verify that the tape guide post that contacts the tape is vertical (i.e., parallel with other tape guides that are supposed to be perpendicular). See that the cap screws that secure the sensing bar are tight enough to prevent drift of the guide.

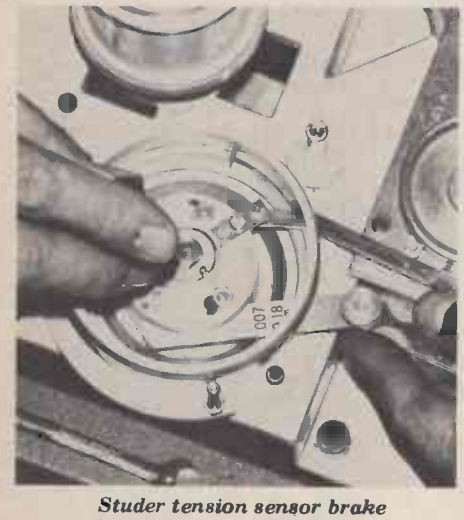
Also, see that the cylindrical sleeve that slips over the tension sensing arm vertical post does not easily slip up on the post. Secure the sleeve to the shaft with a drop of Loctite compound to prevent mis-alignment of the sleeve that could cause creasing of the tape on the lower edge of the sleeve.

The procedure for calibrating the tension sensing mechanism given in the Ampex manual is otherwise adequate. Sensor calibration should at least be checked to verify that the reel servo system will be operating close to the center of its dynamic range.

The 3M machines have no tape tension servo system and therefore tape tension sensing is a moot point.

The Studer A-80 uses a spring-loaded, viscous damped, turntable mechanism to determine tape tension. Within the turntable assembly is a solenoid operated clutch that holds the assembly in a static position when energized by the edit logic.

The reliability of clutch operation is affected by the geometry of the armature disc. Studer's armature adjustment method can be verified by use of a 0.007" (0.18 mm) feeler gauge. The relaxed armature — solenoid clearance is given as 0.0059" to 0.0079" (0.15 mm to 0.2 mm). The adjustment is shown in Figure 13. Note that the feeler gauge blade is held toward the circumference of the clutch armature disc. This is because the contact points of the armature with its solenoid occur along the periphery of the disc, and therefore this is the place to measure it. Also, the three studs that are adjusted to determine the armature clearance protrude slightly on the underside of the armature. Contact of the feeler gauge with the protruding studs will yield a false indication of armature clearance.



Studer tension sensor brake armature clearance adjustment.
Figure 13.

The clutch clearance adjustment is very important in the proper operation of the reel motor servo system. Any interference with the free rotation of the tape tension sensors will obviously cause unreliable servo system operation.

The tension sensor damping element return spring should now be set for sufficient force to gently return the sensor mechanism turntable fully to its rest position after being deflected to its maximum tension position. Check this repeatedly to verify that the return actuation is reliable.

The electrical part of the Studer tape tension sensor is located at the bottom of the assembly central shaft. It is a precision potentiometer whose output voltage is proportional to the amount of tape tension sensor deflection.

The Studer manual presents us with a minor case of cart-before-the-horse-ism at this point in the deck alignment procedure. We are instructed to check for the presence of a 20 Volt drop across the potentiometer body terminals prior to the adjustment of the 20 Volt regulator that supplies this voltage. Clearly, there are advantages to setting the proper power supply rail voltages prior to making other adjustments that are dependent on them.

As far as the calibration of the zero tension potentiometer reference position is concerned, the method given in all the Studer manuals I've seen has another disadvantage: that method does not appear to be physically possible. Access to the potentiometer coupling arm set screw is difficult at best and impossible in the remaining cases, without disassembly of the lower portion of the tape tension sensor mechanism. If that were not enough, the potentiometer shaft is too short to permit any controllable rotation of it relative to the coupling arm even if one successfully loosens the coupling arm set screw.

A more workable method is to loosen the potentiometer bushing retaining nut, as shown in Figure 14, and rotate the entire body of the control until the specified wiper voltage of 2.6 Volts is achieved. The potentiometer bushing nut is then tightened and the wiper voltage is then checked again. Not only is this method easier and faster, it contributes to one's mental hygiene in a positive way.

Studer tension sensing potentiometer adjustment.
Figure 14.

Tape Lifters

The Ampex MM-1100 and MM-1200 tape lifter mechanism has been known to cause some trouble if not carefully installed and adjusted. Removal of the head assembly is necessary for access to the "C" clips that retain the two mechanism pivot shafts to the deck plate. The lifter assembly is also retained by two socket head cap screws that are accessible under the tape tension sensor photo sensor cover. The entire assembly can be dropped down from its normal position and withdrawn through one of the access ports at the left side of the deck. The MM-1100 tape lifter assembly will have to have the solenoid leads unsoldered for complete removal. The MM-1200 has a connector at this point.

Disassembly and cleaning of the solenoid itself is just about a mandatory ritual at this point. The normal rules apply for determining the need for solenoid replacement. A modest application of Lubriplate to the moving pivot pins is not a bad idea after the old lubricant has been cleaned away with alcohol.

If the solenoid slug travel is set to 0.95" ±0.02 (24.1 mm ±0.5), the lifters will move enough to clear the tape from heads and not impact the lifter clearance slots in the deck plate. Figure 15 shows this adjustment.

The latest MM-1200 has a thumbscrew adjustment for modification of the lifter linkage travel after installation in the deck. It's a good idea

Ampex tape lifter mechanism solenoid travel adjustment.
Figure 15.

to mark the original position of this thumbscrew prior to disassembly as adjustments within the confines of the MM-1100 and MM-1200 chassis are less convenient than doing it in a normal work area.

One problem has plagued both the MM-1100 and MM-1200 lifter mechanism. That is that the lifter posts and their sleeves are assembled using only a press friction fit for retention. The lifter posts have slipped down and the sleeves have slipped either way, on occasion. While the mechanism is out where it can be worked with easily, it might be a good idea to remove the lifter posts and their sleeves and re-install the posts with Loctite bearing or stud retainer compound. The sleeves can be retained with a drop of the non-hardening type of Loctite used earlier to secure the tape tension sensor post sleeve.

Reassemble the tape lifter mechanism after the Loctite has set and re-install it in the deck from whence it came. Energize the deck and verify the proper operation and reliability of the lifters.

The 3M M-79 and M-56 lifters are considerably more simple than those of the Ampex. A solenoid actuation causes rotation of a single shaft that causes the lifter posts to be extended beyond the tape path as it passes over the heads.

Adjustment of the mechanism is substantially a cut-and-try procedure. The plane of the solenoid slug travel must lie within the plane of the lifter mechanism shaft lever. The shaft lever itself must be installed in the proper position to prevent mechanical binding of the lifters in the extended position. Note that the lever can be installed in two different ways that are apparently correct at first glance. The beveled side of the lever must be facing the solenoid coil if binding is to be avoided.

The lifter shaft rotates in two extended inner race, flanged bearings, one located at the top surface of the deck casting and the other below. The shaft is retained by a crown lock nut. This lock nut should not be tightened any more than is necessary to leave about 0.002″ (0.05 mm) vertical end play of the shaft. This precaution prevents axial overloading of the bearings, which are suited more for radial loads. This same clearance is permissable in regard to the pinch roller arm shafts which are retained in the same way.

The reason that freedom of tape lifter movement is of such interest is that a lifter that binds in the extended position even slightly can cause creasing of a master if the deck is placed in the play mode directly from a fast forward or rewind mode. The extra length of tape within the capstan loop upon the appliction of the pinch rollers will take a few seconds to pass by the capstan during which time there will be no tension within the loop.

Many tape operators find it

convenient to manually depress the tape lifters of 3M machines for the purpose of reviewing the tape as it slews at high speed. Less stress is applied to the lifter posts and mechanism if the lifter solenoid slug is not quite able to bottom when the lifters are extended to their limits. This is a cut-and-try adjustment also. It is worth doing, though, as it tends to promote a more kindly attitude of the operator toward the machine and its operating mannerisms.

That brings us to the Studer tape lifter mechanism. Because there aren't any, we can move on to the remainder of our discussion.

Capstan Drives

A capstan ought to be parallel with the other surfaces that contact the tape. The way that the Ampex, 3M, and Studer two-inch transports are constructed, it is hard to change what has been wrought by the manufacturer. Any machine that has been in satisfactory service for some time, and has not been dropped from an airplane or stored in salt water, should still have its capstan in a reasonably good geometry. The difficulties of a perpendicularity measurment in a field situation leave little alternative but to presume that all is well enough to get by with.

Eccentricity is another matter. Motor bearings eventually do wear and motor shafts can be damaged. The easiest way to pass a judgement on the acceptability of any capstan drive system is to determine the eccentricity using a dial indicator and stand.

I have found that this is most readily done with the capstan mounted in its deck. The 3M capstan should have its drive belt installed and adjusted to the proper tension to insure that the measurement is taken under bearing load conditions that are close to those of normal service. Figure 16 shows an M-79 capstan being checked. It's a little easier if this is done with the pinch roller arms and guides removed. The peak-to-peak eccentricities observed in factory-new capstans runs about 50 microinches (0.00127 mm) for Ampex machines, about 25 microinches (0.00635 mm) for 3M and Studer capstans. Rejection of a capstan should be considered when eccentricities of 100 microinches (0.0025 mm) are observed.

3M capstan eccentricity measurement.
Figure 16.

Capstan wear is another factor in the decision to replace a drive assembly or continue it in service. Ampex MM-1100/MM-1200 capstans measure very close to 0.07625" (19.3675 mm). Mincom capstan sleeves measure 1.9085" (48.4759 mm) and 1.9028" (48.3311 mm) on their large and small diameters, respectively. The most critical factor concerning 3M capstan wear is the condition of the edges of the ridges and whether any rounding of the ridge edge corners has occurred. The ultimate test is whether tape squirm can be eliminated within the limits of pinch roller tension adjustment.

The Studer capstan diameters measure 0.3564" (9.05256 mm). The amount of wear on any capstan can be gauged by measuring the diameter of the worn portion and comparing that dimension with the diameter of a part that does not contact the tape.

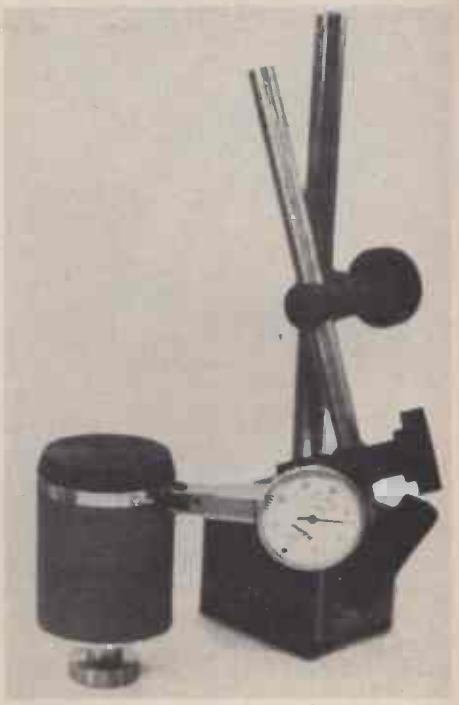
In all cases where eccentricity has grown to excessive values, it's probably easiest to return the entire capstan assembly to the manufacturer for overhaul. The selection and installation of bearings for exacting requirements such as these is a rather specialized matter. Manufacturers seem to be receptive to exchange arrangements at reasonable cost.

Odds and Ends

There are a few remaining items in the tape path that are peculiar to the individual make and model of machine. The Ampex machines have the tape metering and tachometer assembly. The verticality of the rotating drum is less critical than for other components in the tape path because it occurs after rather than before the capstan.

The two bearings in the tape timer tachometer assembly should be replaced if they show any resistance to free rotation of the drum.

The 3M reversing idler assembly is a matter of great importance both in permitting stable tape tracking and in achieving acceptable flutter performance. Eccentricity of the idler drum should be less than 0.0003" (0.00762 mm) peak-to-peak. The measurement is shown in Figure 17.



3M reversing idler eccentricity measurement.
Figure 17.

Removal of the idler drum top cap provides access to the two bearings. The perpendicularity of the assembly shaft can be verified by resting the assembly on its top drum surface, inverted with top cap removed, and measuring the eccentricity of the shaft base. A bent shaft will be indicated by eccentricity in excess of the tolerance given for the drum. The only remedy is replacement. Attempts to slip shim stock under one edge of the base are not likely to be fruitful endeavors. A bent idler shaft will cause the tape to walk up or down within the Isoloop and cannot be corrected for.

Studer rotating idler eccentricities are acceptable at 0.0003" (0.00762 mm) or less. Deviations from perpendicularity can be determined by checking the peak-to-peak vertical deviation of the roller guide with a dial indicator. Anything more than 0.001" (0.025 mm) is cause for corrective measures.

Parting Comments

Tape transport machanisms are delicate entities of a highly precise nature. Their cost certainly warrants the exercise of great care in inspection and repair. Anyone contemplating the extensive overhaul of any tape deck should give himself every possible advantage that could influence the success of the project.

Acquisition of the necessary

measurement tools should not be overlooked as a frivolous luxury. A good quality dial indicator, stand, dial caliper, one or two micrometers of 1 and 2 inch capacity having tenths of thousandths resolution, and a set of feeler gauges can be had for under $200. It is to be emphasized that the job cannot be done without these items. Failure to make an expenditure of this magnitude in the course of restoring a capital asset costing $25,000 to $40,000 is not an economy.

Anticipate the parts needed. Kit those parts prior to starting work. Table 1 is a compilation of the bearings found in the machines discussed here. The common bearing numbers are those that will be adequate to the appliction. Experience has shown that a bearing ordered by the numbers listed will result in a bearing that is manufactured in the real world and will satisfy the appliction noted. Some of the items may be over-specified to quality levels that the manufacturer may not feel is justified. The philosophy supporting this practice is "better safe than sorry." Bearing vendors will be able to cross reference the part numbers given to other manufacturers as availability may dictate. Higher classes of bearings and/or those having special light oil lubricants may have to be back ordered. It is the rare bearing salesperson who appreciates the necessity of the highest quality standards for an audio application. Do not be dissuaded from pursuit of the part needed rather than the part that happens to be available for immediate delivery.

TABLE 1
BEARINGS COMMON TO AMPEX, MINCOM and STUDER TAPE DECKS

Application	Quantity per Assembly	Bearing Number
Ampex MM-1200 Rotating Guides	2	Barden #SFR4SSZZ3B3-1352-2C
Ampex Tape Tachometer Drum	2	MPB #S38RHH7P28L01
Ampex Pinch Roller	2	Ampex #164834-03
3M Pinch Roller 3M Pinch Roller Arm Shaft	2	MPB #S814FRHH7P28L01
3M Tape Lifter Shaft	2	Fafnir #AMF5DD C1
Studer, All Applications*	-	GMN #SS61900-2ZWA7NX12F2

*See Studer mechanical parts listing for quantities for each assembly.

Once again, let us recall that this discussion of tape deck maintenance techniques is intended as a guide to the deck therapist where the manufacturers service manual and/or common sense seem to fail. The information given here is not comprehensive. A complete overhaul manual for each of these machines would be a lot thicker than this issue of *R-e/p*. This data has been born of repetition and experience, both sad and gratifying. It is offered for what value it may have to the individual whose tape machine is not what it used to be.

Remember: keep yourself aware of what you are doing at all times. Take time to think about what you're doing and to observe the way things are. Try not to substitute wishful thinking or preconceptions for reality and you'll probably come out all right.

WHERE, OH WHERE DID MY PRESENCE GO?

by William H. Hall

(What every engineer should know about noise reduction.)

Awhile ago I had the opportunity to hear a *direct-to-disc* recording reproduced on a very good system while visiting a local company here in Dallas. I was very impressed by what I heard. The presence and realism of the program material was mind boggling. These days, about the only time I hear that type of transient audio response is on live, two track recordings, and at the studio on a trial mixdown from the 16 track machine, without signal processing.

During development of the ***Time Warp*** and our other digital wonders to come, we have become quite familiar with most of the advantages and disadvantages of noise reduction systems. Almost every form of transmission system requires some form of dynamic range improvement, and with the continued drive for ever and ever greater dynamic range, now approaching 100 dB, noise reduction systems are a definite requirement.

It is not the purpose of this article to get very technical about the different types of noise reduction systems, and certainly not into the merits of each type. There are, however, several characteristics of most systems which need to be explained, and which can improve the sound quality derived from multi-track recording equipment. First of all, all noise reduction systems utilize some form of compression and expansion to achieve a signal-to-noise improvement in a primary transmission channel. This device can be a multi-band unit or utilize a simple dynamic ratio of compression/expansion. Both designs are capable of extremely good performance . . . provided the dynamics of the storage or transmission system are not exceeded.

The Problem

All of our transmission and recording mediums are non-linear, especially when close to the extreme limits of the dynamic range. Clipping, mushing, splattering, and TIM are all there, as they are so well described in all sorts of literature. The compression system is often used with the idea that it is to be a buffer against these over-modulation problems . . . and, they could be, with the exception of one basic little flaw. Gain reduction machines are *after the fact machines*. It takes a finite amount of time for the compression or expansion system to react.

Figure 1, is a good illustration of the overshoot problem. The compandor is being subjected to a 25 cycle burst of 1 kHz sine wave, and the differentiating action of the compressor could cause bad overmodulation in a recording or transmission channel.

The long negative spike as shown in the photograph is a transient generated by the compressor, and is a characteristic of the design used for this illustration.

Continued overleaf —

William H. Hall is vice-president of engineering for MICMIX Audio Products in Dallas, Texas.

Air Studios–London
selected the Neve/NECAM computer console as the only approach to automation.

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There is no other system even approaching the performance of NECAM. It can store and recall as many mixes as you like, instantly. The "Merge" function lets you combine different sections from each of 24 tracks with different mixes—all without touching the master tape or losing the original "memorized" information. And it does these things instantly, simply and perfectly . . . at the touch of a button on the small NECAM control panel. NECAM even runs your multi-track tape machine for you.

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Secondly, it's the integration of the tape machine controls with the NECAM system. As you go along, NECAM remembers your starting and stopping points on the tape. You give simple instructions to the NECAM control panel and the tape locates to the exact bar or take, automatically!

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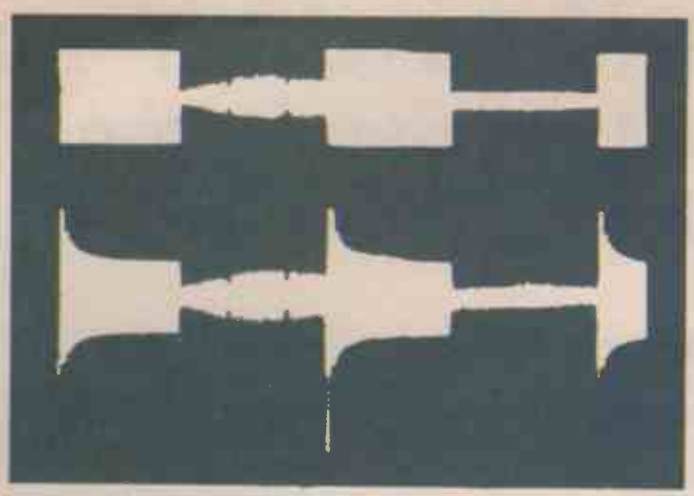
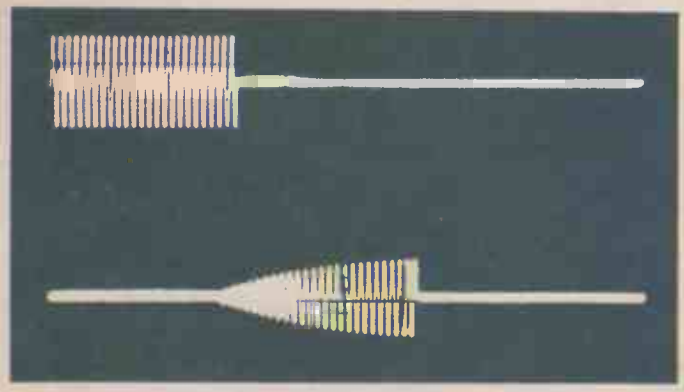
Neve



The integrating action of the expander is shown in Figure 2, and is a typical response of this design, to a 25 cycle burst of 1 kHz sine wave. The compression and expansion curves of the compandor are reciprocals of each other and can complement each other without noticeable distortion when connected by a wide band linear transmission system.



The next photograph (Figure 3) illustrates the action of a fully saturated transmission system which clips off the leading edge of the sharp wavefront. As we explained, in the demonstration system the long spike is definitely a part of the wave train, and is necessary to reconstruct the burst.

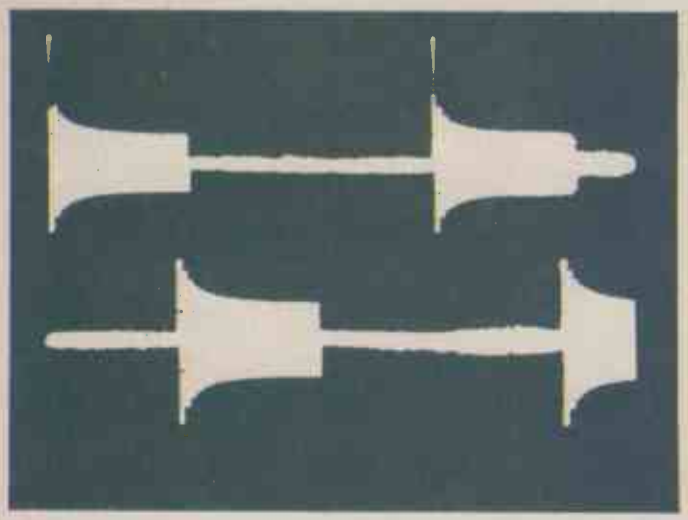
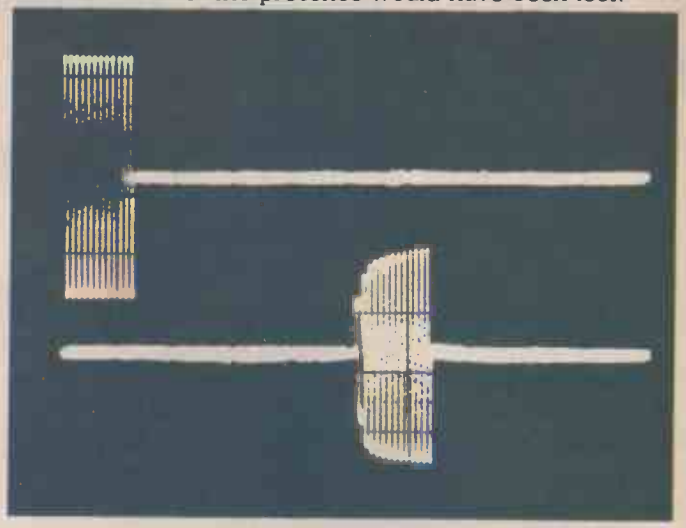
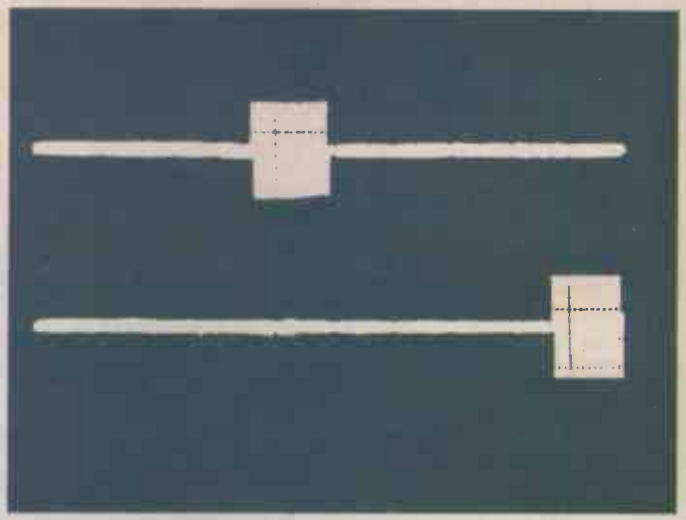


Figure 4 is a close view of the input to the compressor and output after the expander when the leading edge is clipped by the transmission medium. Without the steep wavefront transmitted to the expander there is no way to recreate the original tone burst. If any transient sound such as piano, drums, or cymbals had been transmitted through the channel some of the presence would have been lost.



The Cure

Very simple. Reduce the gain!! Going back to our demonstration system, the next photograph illustrates the same system with the same tone burst, only reduced in volume by 6 dB. This reduction allows headroom for the spike, and reconstruction is close to the original tone burst as shown in Figure 5.



If you question that the sharp edge in your recording system is not quite what you think it should be, it might be worthwile to borrow a function generator and scope and evaluate your noise reduction system. By applying a burst signal into the input of your console, you can easily check the overshoot spikes generated by the noise reduction system. If you check before and after the tape recorder with the scope, it is not difficult to estimate if the leading edge of the pulse has been cut off by either the line amplifiers, or the tape system.

The little discussion presented here is, of course, no cure-all for what ails you, but it might help to restore some of the presence which is easily lost by heavy signal processing which is normal in today's multi-track studios. Direct-to-disc recording, which is the rage at this moment, does have a different sound indeed, but would be difficult for many types of recording which require multi-track facilities. With a little care, and an understanding of the recording process, as well as the equipment involved, the difference between the two techniques can be very small, indeed.

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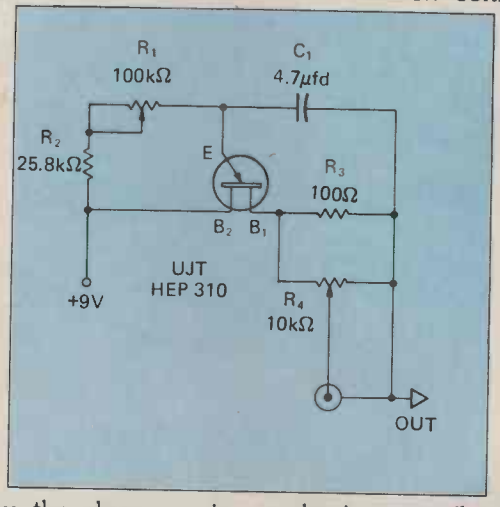
CAN YOU USE A BUDGET CLIC-TRAC?

by Lewis Mark

How many times have you found yourself in a session with a rhythm section that kept time to a dripping water faucet, static electrical discharges in the monitor speakers and every single man marching in the movie "Bridge Over the River Kwai", all at the same time? Keeping the beat isn't all that easy even though some drummers and bassists might disagree with me. What can you do to help them? Or should you just hope for the best and find out during the piano overdubs that the sixteen bar countdown by the drummer is VSO'd 2½ times slower than the rest of the tune. (Believe me, it happens!) Can you stand the suspense? No? Well, then, it's probably easier to build this budget ***Clic-Trac.*** This device will plug directly into your board and provide all the clicks you'll need in perfect metronome time.



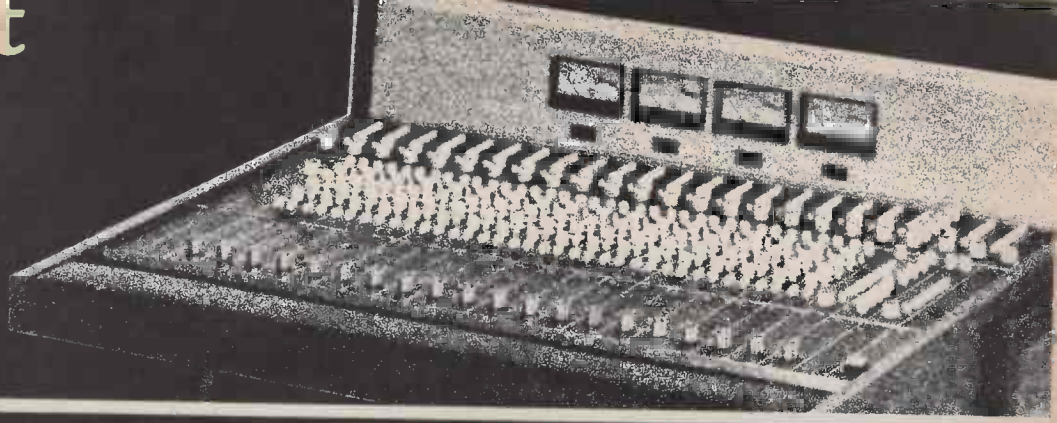
When I built mine, I installed a ¼-inch phone jack for the output so I can plug into a direct box and assign it to a track. More often than not the only way into a board is a microphone input or direct box anyway so this way might be best, especially if you don't want to hardwire it in or you use more than one studio. A male Cannon connector would also work fine, but the ¼-inch jack has some other advantages which I'll describe later.

Construction

The Clic-Trac can be built into any old box you have handy, such as one of those plastic *Radio Shack* boxes for a buck. Also, the parts layout isn't critical so you can make it as small as you can comfortably squeeze it. I built mine on an old terminal strip out of my junk box, Refer to the schematic for wiring detail and don't forget to use spaghetti tubing on wires which are exposed too close to each other. Also, use mylar capacitors when you build this device. UJT's just don't like to see leakage, and any other type of capacitor will have too much. I chose 9 Volts arbitrarily and found it to produce a good, clean output. Since voltage output is directly proportional

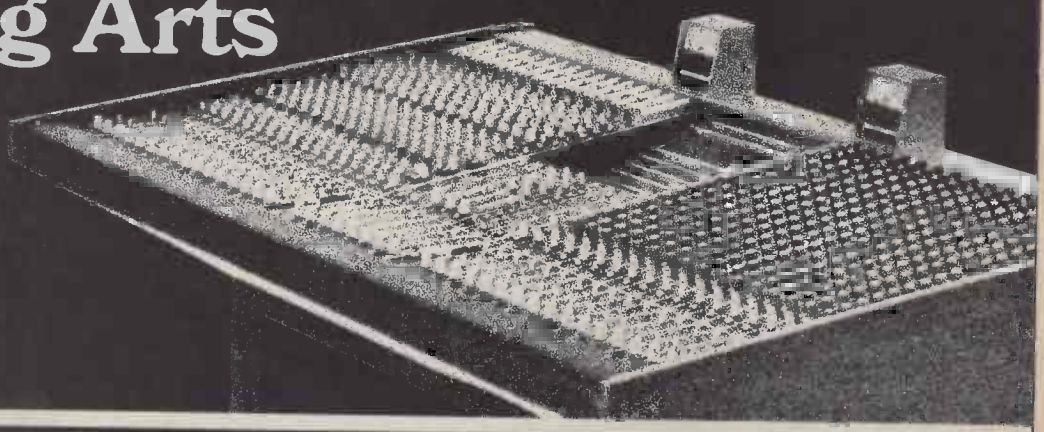
Lewis Mark is an independent engineer/producer working in the Los Angeles area.

Broadcast



Recording

Performing Arts



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to input with the UJT oscillator, using more power supply voltage will yield more output and consequently, more volume. Concerning R2, I arrived at 25.8K ohms by putting a 27K and 560K resistor in parallel. Anything close will work.

Parts List

R1 — 100K ohm ¼-watt potentiometer, linear taper.

R2 — 25.8K ohm ¼-watt resistor.

R3 — 100 ohm ¼-watt resistor.

R4 — 10K ohm ¼-watt potentiometer, audio taper.

UJT — Uni-junction transistor, Hep 310 or equivalent.

C1 — 4.7 mfd. 25 Volt mylar capacitor.

SW1 — SPST toggle or slide switch.

Also needed: Nine Volt transistor battery; box (see text); battery clip; knobs; ¼-inch phone jack or female Cannon connector (see text).

Theory of Operation

Refering to the schematic, we find a simple UJT relaxation oscillator. The UJT (uni-junction transistor) is not really a transistor at all, but a three-terminal device having diode characteristics and containing a single junction. In fact, that's where the name comes from: one junction, multi-terminal = uni-junction. In this circuit, the UJT emitter is reverse biased by C1 which initially acts like a short circuit. As C1 charges through R1, the voltage at their junction rises and when this voltage is high enough (just over half of the voltage across junction B2 B1) the emitter becomes forward-biased and the resistance between E and B1 becomes very low. A large current flow takes place, discharging across R3 and subsequently across potentiometer R4, a simple voltage divider. As soon as this occurs the capacitor voltage falls below the value needed for the forward-bias of the emitter, the UJT becomes reverse-biased, the capacitor begins to charge again and the cycle repeats itself. Note that through the proper selection of R1, R2 and C1 the oscillator range can be varied. Values given here equal or better the tempo of most standard piano metronomes. Waveforms are also noteworthy. The capacitor supplies a sawtooth waveform to the emitter input and the output resembles a cut off square wave, starting vertical and sloping downward.

Comments

The Budget Clic-Trac turns out to be a stable electronic metronome with some very desirable features. Before I began to use this device, nusances such as re-creating a click intro in tempo to the existing tracks involved turning the 2-inch tape over and playing it to the beginning while recording a drum stick hitting a book, in beat with the snare. Well, these days I still turn the tape over, but first I establish the existing beat with the Clic-Trac, wait 'til I feel the snare and simply turn it on. It will click with the snare close enough for a musician to use. (Practice this one a few times since the metronome isn't instant turn-on, i.e.: the capacitor takes a finite amount of time to charge, the first 'click' is emitted.) I say *close* instead of *perfect* only because there are usually very slight tempo changes within say 8 bars of music, except with extremely good drummers.

If you have separate cue sends, this device can be used in real time, or put onto the track of the tape, and sent to the drummer only. Sometimes I've found myself in situations with only one cue send, or even more often, a drummer wanting control of the Clic-Trac's volume and speed. What then? Easy. Borrow someone's small guitar amp and feed into it the cue mix and the Clic-Trac. Most of today's amps have two inputs, if not two completely separate channels. Plug your headphones into the speaker output and hand the drummer the Clic-Trac. Not only can he adjust the speed however he likes it, he also has control of the Clic-Trac volume, cue mix volume, and overall headphone volume! Talk about drummers being appreciative . . . you should see them smile when I explain the little box and how they have total headphone control. They love it — if they like metronomes at all. And what a sales pitch you can give: Mr. Drummer, with this little device you can keep perfect time, supply the bassist with great kick drum, and have everyone love you. Great, huh?

The Clic-Trac is also great for bands who want to practice tempo. Have you ever tried to hear a piano metronome when a band is rehearsing? Plug this little devil in somebody's amp and you can match levels with any hydraulic construction drill. Now you see why I opted for the ¼-inch phone jack.

Don't let tempo be anybody's game. Build yourself a Clic-Trac and be a star.

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IN SEARCH OF THE LOST CORD!

by Chris Roe *of The Ken Schaffer Group*

It's halfway through The Beachboys' Summer Tour, and Brian Wilson sits stage right behind a grand piano running through a complicated solo. Guitarist Al Jardine appears next to Brian, and gives a dervish whirl. Brian cocks his eyes in a cherubic stare, raising his right arm high above the keyboard to point incredulously at Al, who is now dancing all around Brian's piano.

"**Your guitar . . . *Al!* Your guitar** — *its not plugged in!*" Jardine doubles over and spits loose a series of scales for a Brian who is now standing atop his piano bench in an impossible half-frightened pose. It is, Brian thinks, *impossible* . . . Al is not plugged in, yet his guitar is coming through the monitors as though everything were normal!

Later that evening, *Kiss* plays L.A.. Simmons, Frehley and Stanley make impossibe multi-dimensional moves, running across their million dollar concert stage, quickly making evident the fact that they, too, are not *plugged in;* their instuments are cordless.

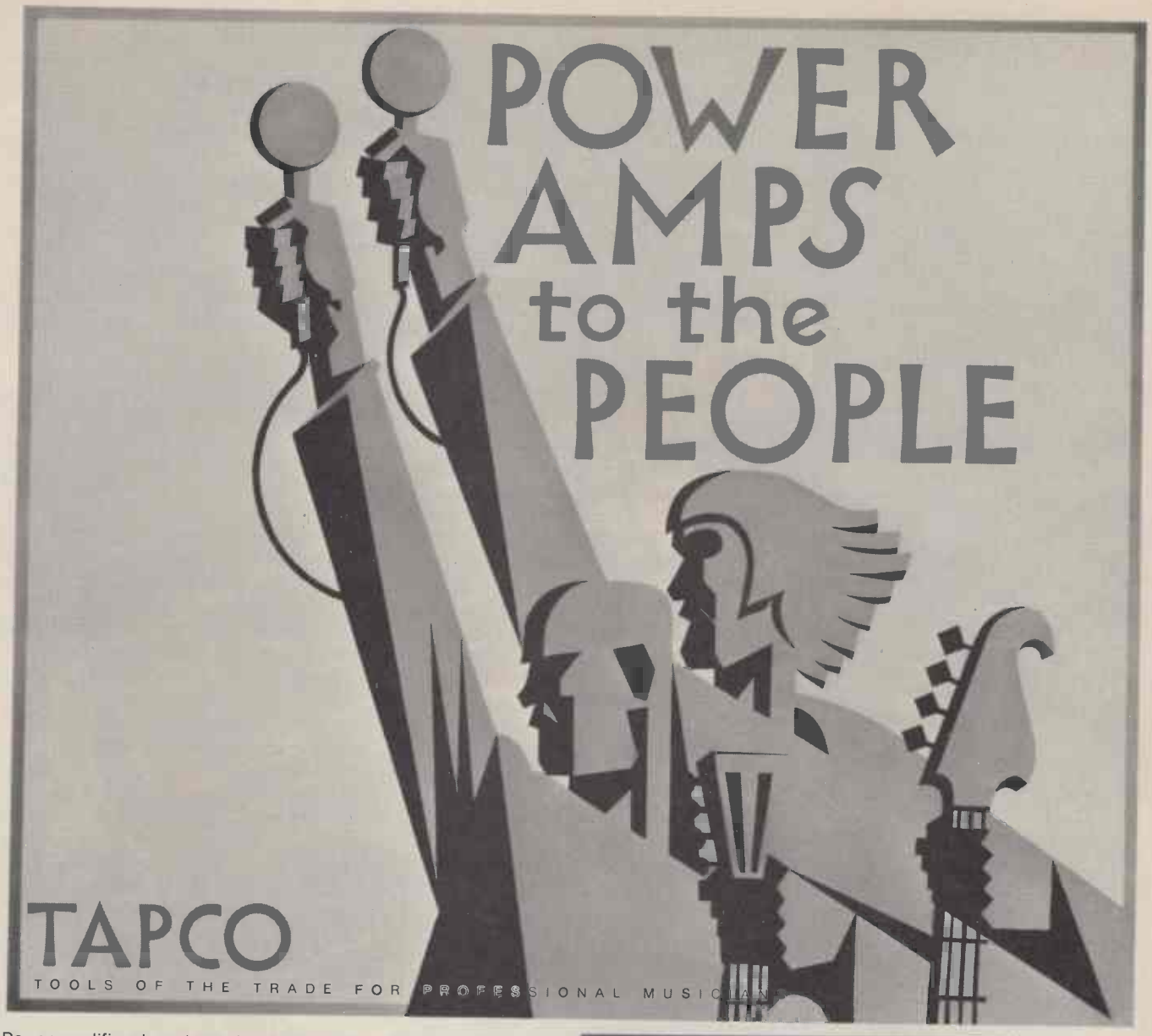
Since June of this year wireless instruments have become a fact for more than forty major bands. The guitar, it seems, has been successfully liberated from the restraints of all cords.

The idea of removing the wire from a microphone is not new. The extension — removing the wire from an electric instrument — may be. But before a system could be developed for instant acceptance onto the professional rock stage, many of the traditional design values of wireless systems had to be stripped and reconstructed: RF (radio frequency) systems of the past had been weak links, and the price for the dual advantages, freedom of movement, and protection against shock provided by these systems resulted in heavily compromised audio, along with qufestionable reliability. Within the rock concert industry, concensus squinted its eyes at the thought of an RF system being anything but exasperating in the distance between its promise and its performance.

Marconi Roll Over!

Early last summer a defiant new wireless system was introduced which established new standards for wireless audio links. It proved that an RF system could deliver all of its advantages without imposing unique problems or sacrifices. Bands, ranging from *Kiss* and *Heart* to *Peter Frampton, Stephen Stills, The Commodores, Foreigner, Ted Nugent, Mahagony Rush, Earth Wind & Fire, Steve Miller, Peter Gabriel, Nektar, AC/DC, America,* and *The Beachboys* puchased the new system known as the ***Schaffer-Vega Diversity System™ (SVDS).*** During this past concert season, during thousands of hours of demanding use the SVDS has shown remarkable reliability, and produced audio quality which most of its users proclaim sounds better than that of a cord.

The SVDS overcomes each of the problems which previously precluded wireless equipment from having a place on the highly demanding professional rock



Power amplifiers have been the stepchildren of the electronic revolution for too long. Many so-called "power amps" are nothing more than redesigned hi-fi amplifiers. Others sacrifice sound quality to attain high volume levels. Still others risk blowing out expensive speakers every time the volume is turned up.

Tapco meets the challenge with two new stereo power amplifiers. Both are designed from the ground up. Both employ Tapco's exclusive Power Sentry® to control clipping distortion and help protect expensive horn drivers. Both are designed to reproduce distortion-free sound at the volume levels demanded by today's professional musicians. And both are engineered and built by the most respected name in sound reproduction.

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CP 120

Rated at 61 watts per channel in stereo, 122 watts mono. Each output is capable of 500 watts total stage dissipation for only 61 watts of rated output power. Sophisticated protection circuitry guards against gross fault conditions without ever affecting sound quality. Power Sentry® protects against clipping distortion, and advanced-design convection cooled heat sinks keep the CP-120 running cool even at full power **CP-120 $339.**

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concert stage. The two traditional RF problems have been eliminated entirely, and the signal handling capability of the system has been expanded to a point where signal-to-noise ratio and dynamic range are high enough to allow SVDS to eliminate the cord for even the most finicky performers.

Previous Bugaboos and Their Solutions

Previous limitations common to all wireless systems include two in the RF section (signal loss, or dropout, and interference possibility) and one in the audio section (extremely limited S/N and dynamic range).

Taking these bugaboos in order:

1. DROP-OUTS: At VHF frequencies (typically 170-216 mHz.) radio signals react with the environment (obstructions, reflections, etc.) in a manner very similar to the way in which audio signals are affected by their own acoustical environment: i.e., RF will bounce off walls and large metal objects. It will be absorbed by various obstructions. With audio wavelengths, bounces arriving at the ear (receiver) may cause phase variations or discrete echoes. At VHF frequencies however, a slightly delayed signal may cause a complete cancellation at the receiving antenna, causing a dropout. This is due to the fact that we are dealing now with such short wavelengths that very small movements between the transmitter and receiver sites can result in a wildly varying cumulative signal strength, moving peak to null within inches.

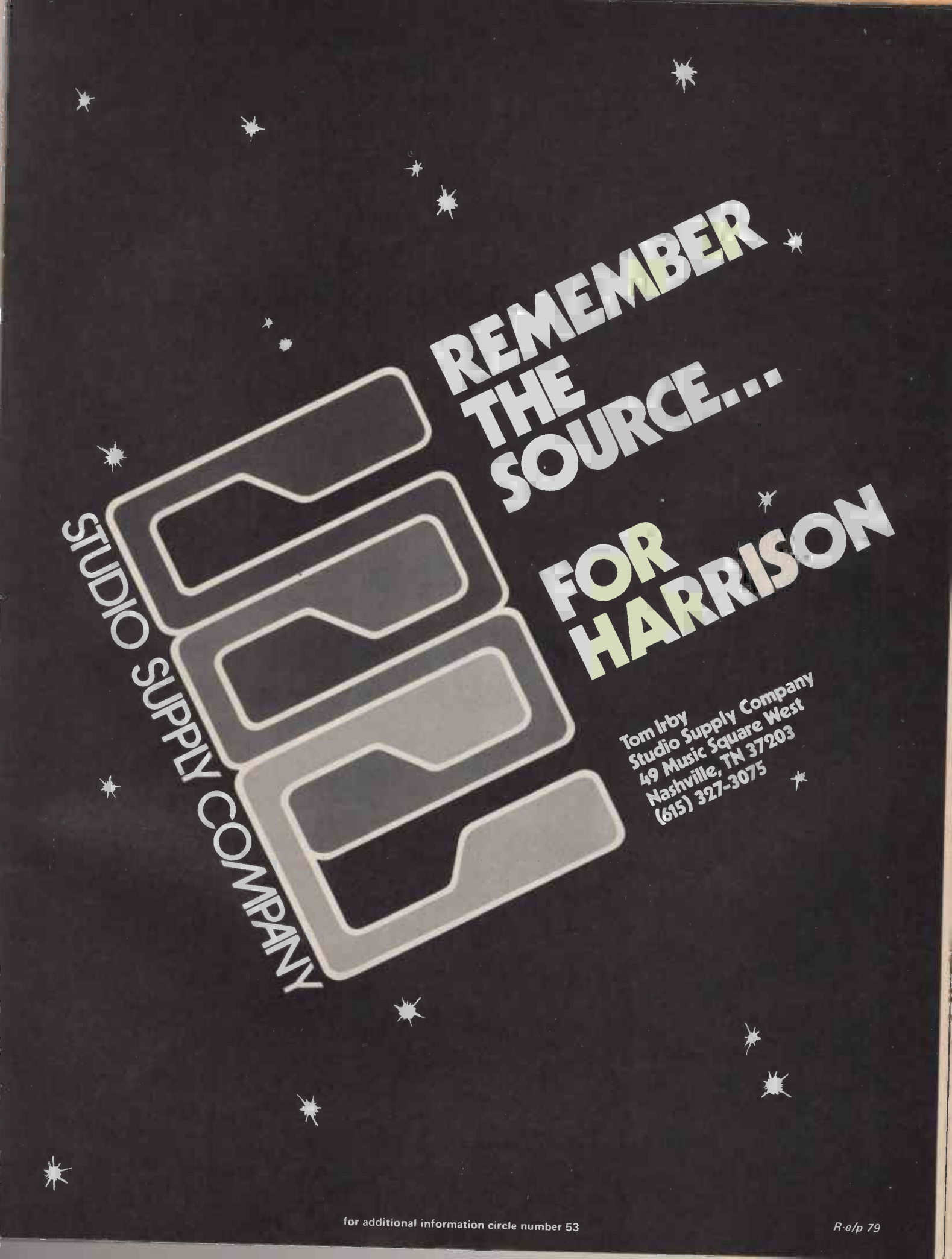
The common wireless receiver is a *single ended* system which receives the transmitted signal at a single point in space. The integrity of the signal may vary widely as to movement; when a null is encountered the resulting drop-out will not only cause loss of audio information, but loss of the constant RF carrier as well. In practice, this may also permit a stray signal to enter the receiver and be delivered through the audio output.

SVDS overcomes the drop-out problem by stealing, in a sense, from the Navy. Back in 1922, when the Armed Forces were marvelling at the possibilities of long-range radio systems, it was realized that the shortwave band offered only limited short-term reliability because of constant random and periodic changes in the altitude of the ionosphere, the atmospheric radio mirror. As the sun moves through its day, the ionosphere moves up or down relative to RF signals striking it at a constant angle from the earth. Since the angle of reflection is identical to the angle of incidence, a *higher mirror* bounces signals a greater distance; a signal bouncing usefully from point 'A' to point 'B' would now be bounced further and possibly *skip* the original receiving point. (Contrariwise, previously undetectible signals might *fade in.*)

In an effort to increase reliability despite an ever changing ionosphere, a very primitive ***Diversity System*** was devised by an imaginitive Navy engineer who reasoned that by placing two antennas in separate radio environments — i.e., as far apart as possible — one of the antennas would be likely to receive a useful signal at a given moment, even if the other one was momentarily in a radio shadow.

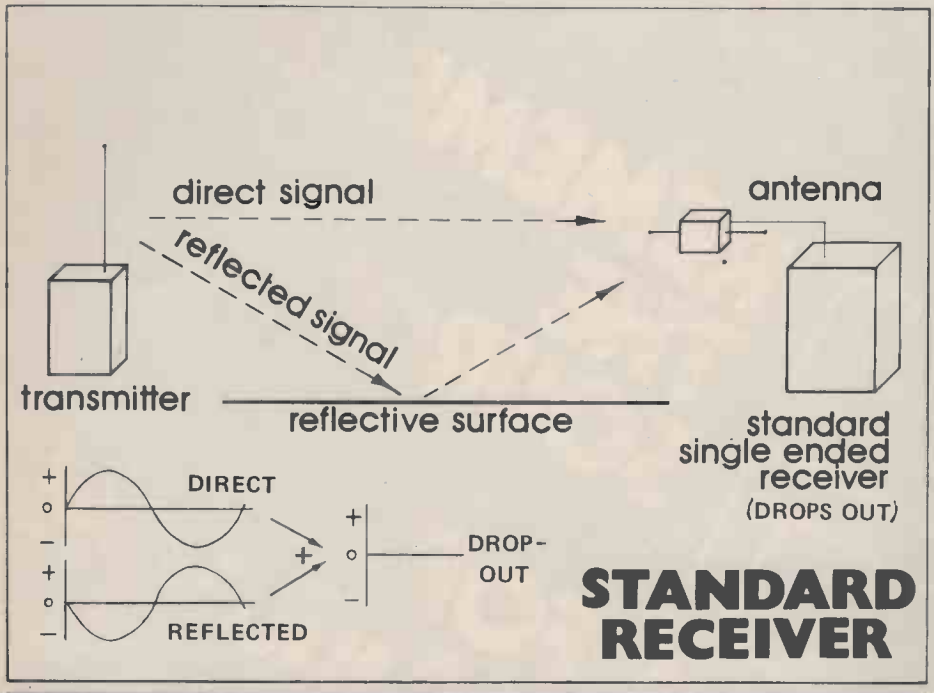
The fellow (a Lt. Bulah Binkin) was onto something. Although early Diversity Systems utilized nothing more than two distant antennas and an antenna selection switch, to be activated manually by the operator at the time of short-term fadeout, it was found that locating two antennas only a few wavelengths apart could offer dramatic improvements in reliability.

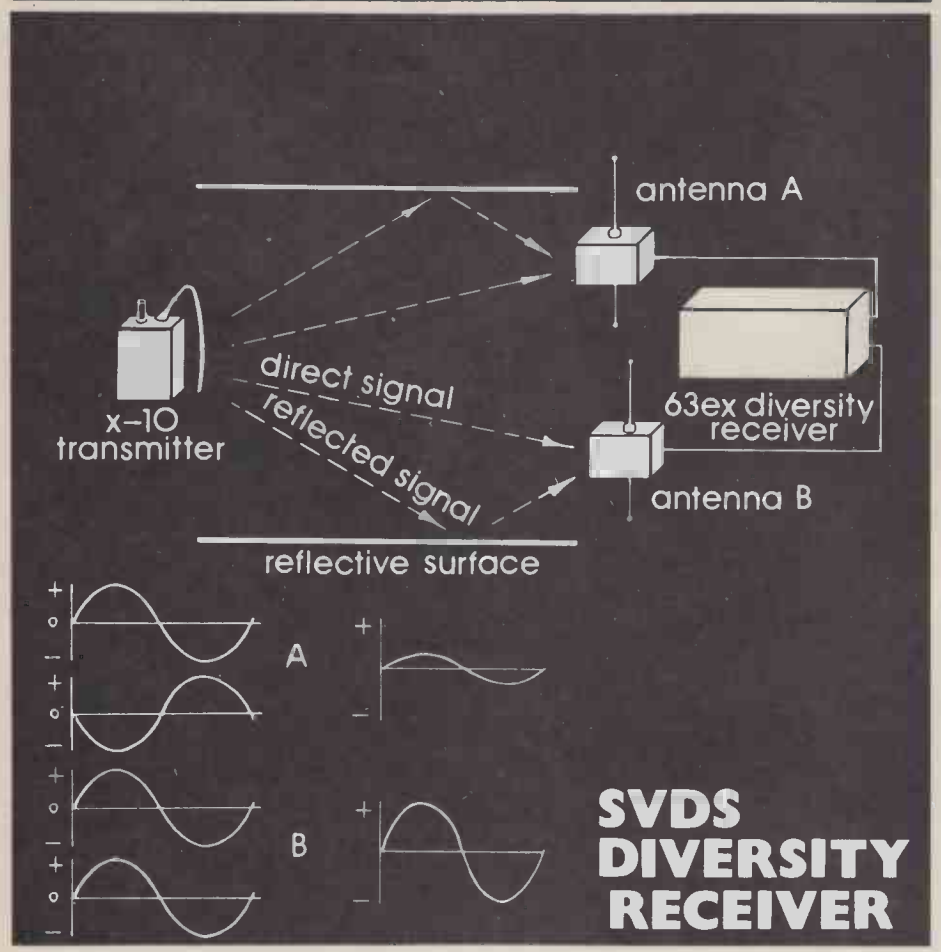
Applying a much more sophisticated Diversity principle to modern VHF wireless systems pays even greater dividends. At our frequencies, where the total signal wavelength is less than two meters, antennas placed only 15 feet apart offer completely separate radio environments; reflections nulling out at one antenna will not be nulled at the other. It is extremely unlikely that drop-out could occur simultaneously at both. Further, offering the transmitted signal two distinct radio paths into the receiving system also increases chances for ideal, unobstructed, line-of-



sight paths to be open.

With the ***Schaffer-Vega Diversity System*** two fully independent receivers are incorporated into a single box. The RF sections of each of the system's two receivers are continuously scanned by a Diversity sensor which determines if one signal is arriving in better shape than the other, and if the currently selected audio feed is, indeed, the best. If the signal arriving at one RF stage is 6 dB better than the other AND if the signal currently selected to feed the audio stages is within a given area of the *weak* threshold, the Diversity receiver will switch to the stronger signal. In SVDS switching, phase and amplitude are precisely maintained — this, of course, being crucial to an invisible, silent switch.





In actual performance usage, this Diversity system guarantees a minimum 100 yard (typically 500 feet) fade-proof range, with the ultimate system audio specs the same anywhere within this area. (The actual distance measurement might be the locus of the two antennas — which are dipole type antennas, normally taped to the top of a guitar amp, either side of the stage.)

The SVDS Diversity system has been put to severely demanding tasks, without apparently reaching its limit, by such groups as *AC/DC* and *Peter Gabriel*, who run their instruments to the back of large halls during their sets. Gabriel, in fact, was one of the first artists equipped with an SVDS system, and remained on wireless the eventful evening his Roxy (L.A.) performance was broadcast live via satellite to 40 cities (though to the consternation of the skeptical remote truck engineer who began quivering when Gabriel's road crew started setting up the wireless — repeated experience of disaster creates miserable expectations!)

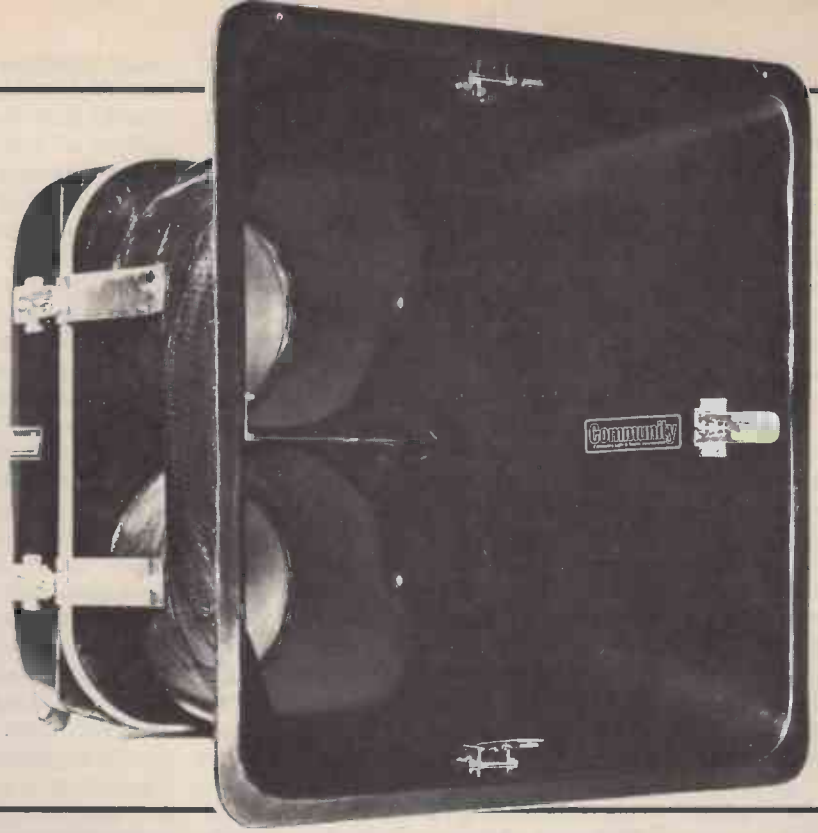
The RF sections of the SVDS are quite similar to the Diversity System introduced in 1976 by Vega (Division of Cetec Corp.), the manufacturer with whom The Ken Schaffer Group has contracted to produce the SVDS equipment.

Caveat Emptor

To further clarify, it is a *true (or coherent)* Diversity System, in that it goes all the way and contains two discrete receivers in a single case, and that, after some complexity, it switches audio, not RF.

Possible misconstructions of the *spirit* of Diversity may appear on the market if wireless grows appreciably in popularity. There are several ways to fudge the public in building such a system. One is to merely switch to the strongest signal at the RF input of a single-ended receiver. This may eliminate drop-outs to some extent, but at the cost of spurious noises and pops each time a switch is made. Also, RF phase may be altered during the switching, resulting in additional audio changes. (It is not uncommon for a Diversity System to switch a dozen times in a few seconds if the performer is moving through three dimensions.)

A second fudge system which would *legally* permit the use of the sexy term 'Diversity' would be a system which parallels two or more antennas leading to the receiver's RF input. With this abbreviation, drop-outs will continue to occur because the signal at an individual antenna is as likely to be a null as a peak; adding two antennas together may merely displace the location of the dropout from one part of the stage to another. *Caveat Emptor* — only a true Diversity System is insurance that a performance will be free of these little spots of nil.

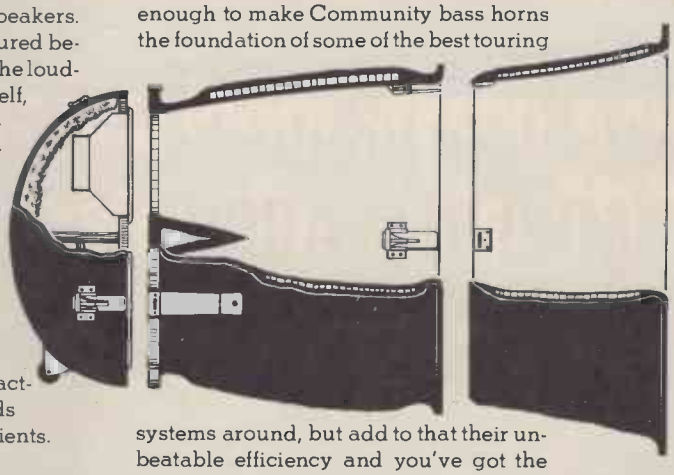


LEVIATHAN BASS HORN

This is the legendary Leviathan, our fiberglass bass horn for two 15" loudspeakers. It comes in three sections as pictured below: the back pod which houses the loudspeakers, the 48 Hz flare horn itself, and the optional extension for increased frequency range, projection and efficiency.

Not shown are our other bass horns: the FRC/B, designed to provide true horn performance in the smallest possible package, and the aptly named BLT, or Bass Long Throw, which does exactly that over several hundred yards with the closest attention to transients.

Like everything else that we make, our Levi, FRC/B and BLT are rock solid, portable, and built to last. That's reason enough to make Community bass horns the foundation of some of the best touring systems around, but add to that their unbeatable efficiency and you've got the bottom line for a full spectrum of professional applications.



What does efficiency mean? Because of our design criteria any Community bass horn's output is typically 4-6 dB above its wooden competitor's. To you, the professional sound person, this means that you need fewer bass horns to fulfill your requirements and, consequently, less drivers and electronics to power them. In addition, our bass horns weigh thirty to forty percent less than the old wooden horns meaning an additional savings in reduced installation and freight charges.

Need a couple of bass horns? See your Community dealer. You might only need one.

SPECIFICATIONS	EXTENDED LEVIATHAN	BLT	FRC/B
Flare Rate	48 Hz	52 Hz	66 Hz
Operating Range	from 50 Hz	from 60 Hz	from 75 Hz
Driver	Two 15"	One 15"	One 15"
Size (HEIGHT/WIDTH/DEPTH)	43¼"/69¼"/64"	44"/44"/56"	30½"/40"/44"
Weight (less drivers)	175 LB	90 LB	65 LB

Community

COMMUNITY LIGHT & SOUND, INCORPORATED ▫ 5701 GRAYS AVENUE, PHILA, PA 19143 ▫ (215) 727-0900

for additional information circle number 54

Diversity allows confidence in the RF continuity of the transmitted signal. This is particularly crucial in rock (and all touring) applications, where the system is to be set up and broken down nearly every night: it must work perfectly as a matter of course.

In fixed-location applications, the cost of Diversity *may* not be necessary. Given a fair amount of time, a traditional (single-ended) receiver can be used satisfactorily if care is excercised in the placement of the single antenna. Wireless microphone systems have been used for years in Las Vegas, for instance; what is required is that the antenna be placed, and the entire stage (and/or additional performing areas) be *walk-tested* for drop-outs. The antenna is moved a few inches at a time, and the walk-test is repeated. Finally, the antenna is installed in a position which results in the fewest (or the most convenient) drop-outs. If necessary, the stage is marked with red tape to indicate to the performer that a particular position is a *dead-spot*, to be avoided. A true Diversity System puts these thoughts and needs to rest.

Interference

The radio spectrum is a very densely populated turf. Unless extreme care is exercised and cost-consciousness is abandoned, the wireless receiver is prey to a number of interference sources, ranging from front-end overload caused by high powered local radiation (even well off frequency) to actual pick-up of coherent signals from both the fundamental (and harmonics) and intermod products of other spectrum inhabitants: CB'ers, police, hams, TV stations, FM stations or even walkie-talkies.

Interference must be dealt with when using any radio system, and there are volumes written on how to increase the ultimate selectivity of a receiver.

The front end of each of the two sides of the SVDS receiver incorporates both electrically tuned circuits and four stages of a type of VHF mechanical filter known as Helical Resonator Cavities. The HRC's are tuned to the exact frequency at which the system will operate by means of their mechanical dimensions; thus acting to block or shunt off-frequency signals to an extremely high (and effective) degree. Other forms of selectivity are built into the Intermediate Frequency (IF) stages of each receiver section, and the end result is an extremely tight selectivity curve, which could only be invaded by monsters.

Working along with these selectivity designs is the nature of the system's modulation itself. A well designed FM system offers *monagamous* modulation — which is to say that only one signal, the strongest, can make its way through to the output. Unlike AM, where several signals can cohabit on warm summer nights, creating all sorts of whistles and bells, FM systems are specified as to *capture ratio*. In essence, it means that FM is normally an all-or-none affair: you have the signal, or you don't; if two signals show up on the same frequency, the strongest will normally capture it completely. Owing to the Inverse Square Law governing signal strength vs. distance from transmitter, it would take both extreme power and down-the-neck closeness for a stray signal to be awarded the frequency. Additional encoding of the transmitted signal may also improve its integrity in battle. Overall, excellent design practice and ignorance of cost considerations can produce a wireless system for which interference is virtually a dead issue.

State-of-the-art design can eliminate the most distinctive problems that have, over the years, driven professional audio people *to the wire*. One set of problems need still to be licked to get a system which transmits the signal invisibly, and these, alas, manifest themselves in the audio section, though they too are derived from *traditional* limits in RF systems which were broken through proprietary circuitry in the SVDS.

Gone With The Noise

RF problems solved, interference and dropout no longer being operating considerations for the tortured user, the final barrier of the RF system remains in view, like the droppings that follow the parade: there is actually a physical, theoretical limit as to how much dynamic range/signal-to-noise ratio can be transmitted through a system.

Actually, it is relatively simple to design a *transmitter* capable of S/N exceeding 90 dB. However, the limit occurs in the discriminator stage of the *receiver*, the section of the decoding chain which separates frequency modulated components of the RF signal from amplitude modulated components. It is to this stage of the receiver that we owe our thanks for static-free reception. But it is also within this stage that the S/N limits occur. And that limit works out to be just better than 60 dB; not near good enough to feed a stack of 10 Marshall heads.

Again, it a question of *application:* as a fixed-location Las Vegas operator can get by reasonably with careful antenna placement and a single-ended receiver, that same man can probably get by with a wireles *microphone* (instruments such as guitars are much more demanding) that offers a 60 dB S/N. — because ultimately the SPL in a club or showroom will never get as high as the normal SPL of, say, a Ted Nugent performance at the Garden. A typical club volume might approach 100 dB SPL; 60 dB below, we find the noise floor of a normal

wireless system. The result is 40 dB of hiss. With a microphone, much of this hiss will be masked by instruments and room noise. Yes, you can mask 40 dB.

But assume we connect the same transmitter to Nugent's guitar. Coming out of his stacks is, let's say, 138 dB at 4 feet. 60 dB below that is 78 dB of hiss. Very unacceptable. Even loud coughing won't hide it.

The objective, then, is to increase the system S/N to over 85 dB under all conditions of interface and operation to remove the system from the *gimmick* category and rival the cord in signal transfer capability. The guitar amp (typically 70 dB S/N) must be fed by a receiver which is silent not only between songs, but between notes. Because of musician demands we cannot cheat and roll off at 12 kHz., because it will change the ambience of the man's $15,000 amp stack. Further, we can't use noise gates of any sort because they will affect the sustain of the instrument.

An exceptionally high dynamic range is offered by the SVDS system. Over 30 dB improvement in S/N ratio is realized through an elaborate combination of transmitter signal encoding and receiver decoding. Both frequency and amplitude pre- and de-emphasis must be employed. Transmitted signal bandwidth, frequency deviation, and audio pre- and de-emphasis must be carefully matched between transmitter and receiver for all audio specifications to be realized.

The final SVDS system, as lauded by current users offers a measured S/N exceeding 85 dB. Compared to a cord feeding the same amp this works out to invisibility; better in some respects, considering that stray cable noises (ground buzzes, RF pick-up) are eliminated entirely.

Further, the signal delivered to the amp will benefit in another sense, which has lately been expounded upon by, and among wireless users: because the long cord is eliminated, so are the capacitive high and mid-frequency losses. The guitar signal, as input to the amplifier, is *sharper, more present and more cutting.* The frequency response of the overall wireless system is flat; because of the elimination of capacitive losses, it is no longer necessary for musicians such as Rick Derringer and Steve Miller to crank up their amp treble boosts all the way up to '10' to cut through. The signal being delivered to the amp is much closer to the actual signal being produced by the instrument in this respect. (Derringer insists Schaffer's marketing effort is mis-directed: "The thing should be sold as a box which makes your guitar sound better . . . and, by the way, *it also makes you wireless!*") Derringer's entire band has been wireless since July; the highlight of his set is when he and rhythm guitarist Mark Cunningham face off at opposite ends of the stage, squat, count down, and toss their screaming guitars in an arc across the stage. Assuming they make the catch they will finish off the set with each other's instruments.

It's A Very Expensive Replacement For A Cord, Isn't It?

English musicians can be predicted to joke about the fact that the system is an expensive way to replace a crackling cord. Why bother?

Obviously, the musician is free to move about, anywhere in the hall. Roger Fisher of *Heart* was so elated the first night he used his system that he nearly broke an ankle as he tripped on Ann Wilson's mike cord . . . *Electric Light Orchestra*'s cello and violin players slide off the stage to catch 5 and forget that *they're still on-stage* even though they are horsing around with their instruments in a dressing room 200 feet away. Freedom of movement does bring a change in posture; ***you're free.***

It might not occur to engineers whose experience is mostly in well designed studios, but the possibility of stage shock hazards are appreciable. More than one musician has been fried by getting his body between, say, a guitar and a microphone. It has been lethal, though it's more often frightening and annoying.

With a fifteen minute sound check and 25,000 people filing into the hall half an hour later, with as many as a dozen AC sources being used to feed everything from amps to mixers to lights, the possibility of a potentially damaging grounding problem is high. Needing to set up and break down five trailers of equipment (about as much as NASA needs for a space launch) every night on a two month tour, time just isn't left for each component to be leveled to a uniform ground potential. Even more so with English musicians, whose bodies must endure 240 volts instead of our 120; and who are more likely to be using tube (valve) amps. Getting zapped can be a terminal note.

Wireless operation guarantees against shock resulting from anything but the most unforgivable carelessness. It is possible to play in the rain on outdoor dates that previously would have had to fold due to safety considerations. Safety, apparently, is no small consideration from the performing end. Shocks of all magnitudes occur much more often than the audience realizes.

For America's largest grossing group, *Kiss*, the safety feature was the first impetus for them to go wireless. Two days after guitarist Ace Frehley survived an almost lethal interface with a stage railing, Kiss was up to New York to check out the first of the SVDS prototypes; they ultimately became, along with ELO, the first bands to go fully wireless, and recently completed three months on the road with a complex multiple SVDS array.

To Kiss, the SVDS system permits elaborate staging and choreography that would not be possible with cords. To quote rhythm guitarist Paul Stanley (before the tour), "The whole stage is designed around what you can do with the thing. If the Schaffers don't work, the stage is a $750,000 scrap heap."

System Configuration

Any wireless system will consist of a transmitter, a receiver and appropriate antennas. With the SVDS system, the transmitter is slightly larger that a pack of cigarettes and can be taped behind the instrument, taped to the instrument strap, built *into* the instrument (for completely invisible operation), or simply worn in the performer's pocket.

The receiver is normally placed atop the instrument amp, with a variable level phone jack output being used to feed the amp itself, or the effects chain which may precede it. Neither the amp nor the effects chain need to know that their signal is being fed not from an instrument, but from a receiver. The amps and effects are kind of dumb. All they know is what kind of signal they *want* to see. The SVDS receiver supplies this. It is connected to the chain *as if it were* the instrument.

A 19" flexible wire serves as the

transmitting antenna; it is run up the strap, across the back of the instrument, or simply left to dangle down the performer's leg. Two dipole antennas are supplied with each receiver, each one supplying a unique signal to the appropriate side of the Diversity System. The antennas must be placed at least one wavelength (6 feet) apart to benefit from the Diversity function. Fifteen feet is recommended. The only cautions necessary are that the antennas be at least 18 inches from large metal objects (to prevent de-tuning), and at least 3 feet off the floor. A 25-foot coaxial cable (RG-58/U) is run from the junction box of each dipole to the receiver's rear panel.

Because the radiation (dispersion) of the transmitted signal normally contains mostly ***vertical*** polarization components, the receiving antennas are also mounted vertically. Though the SVDS manual is extremely thorough in dealing with antenna placement, the point is made that because of the design of the system, nearly all of the antenna instructions are tongue-in-cheek to the extent that they are the theoretical optimums; because of fail-safe circuitry and redundancy, there is little an operator can inadvertently do to degrade the system in normal concert applications. Antennas can be mangled (even forgotten, ask Derringer!) and the set will go normally.

A built-in direct box on the rear of the receiver may be used to supply a direct console feed, 600 ohms balanced, at either mike or line level. The primary audio output to the amp or effects can be set to match the instrument's normal level, or provide considerable boost, including overdrive distortion, if desired. Several SVDS users utilize the receiver's output level pot as a substitute for the amp volume control. This is permissable, although experience with the system usually defines a balance on *when* to vary levels by means of *which* device; some improvement in amplifier S/N can be expected with proper levels.

Once in place on the instrument, the X-10 transmitter is adjusted one time only. A good 9 Volt battery drives the transmitter meter *extreme white;* the instrument's level

contols are opened up full and the musician sets the transmitter level control so that hard peaks will drive the meter just into the red. This setting defines *optimum S/N ratio without modification* of the instrument's signal. Further advancing of the transmitter level control will allow the instrument to generate more sustain through a proprietary compressor system. Users are split, about half-and-half, as to whether the transmitter is best adjusted *technically* or adjusted to activate the compressor for this additional sustain.

Battery life with the X-10 is between 4 and 6 hours, continuous. Unless battery shelf-life is actually known, this translates into two sound checks and two shows. Most bands, however, use *last night's battery* for *tomorrow's sound check* and then put a fresh one in place for the actual performance.

Using More Than One Instrument

If several musicians in a band are wireless, they will each be on a different frequency. This is no problem. Dozens of frequencies are available.

But, if a single musician utilizes several instruments during the set, does he require separate systems for each?

No, and there are several waysin which a musician can use several instruments with an SVDS system. Since most of the cost of the system is in the receiver, an individual musician can obtain several transmitters, one to be used with each instrument. It is only necessary to insure that no two transmitters on a single frequency are activated ('On') at the same time. This ensurance is automatic if the transmitters are installed inside the instruments, owing to a switching circuit installed at the guitar jack: plugging in a cord kills the transmitter and restores the instument to *cord* mode. Removing the cord or dummy plug puts the axe on the air. Special provisions allow for a member of the road crew to tune the instrument with a strobe tuner *without* putting it on the air.

But, the easiest way to deal with multiple instruments is employed by Stephen Stills. He just loads a single transmitter into his pocket and plugs into whichever instrument is next up. This is straightforward and least expensive. Stills uses this method most effectively in dealing with the near dozen instruments he plays during each set.

Recording Wireless

Several SVDS equipped artists have remained wireless for recordings of their live albums. Studio applications will, no doubt, crop up by themselves as the bands who toured wireless last summer begin to file into the studio this fall.

Some of the more tangential applications to which these these systems have been put include interface with a signal actuated switching system for a tape transport, so that the artist could walk around his garden searching for his muse and get it all down on tape *right then*, just as any new lick possessed his fingers. More common, of course, is the sight of the entire band leaving the stage to go out in the hall and harrass the mix engineer during sound check. The drummer gets lonely. Already legend is the story of the night Keith Richards and Ron Wood departed Atlantic Studios in New York at 3 AM to go down on Broadway and play for the hookers, the rest of the crew drank beer and champagne listening through the amps in the studio. Other bizarre occurrences will, no doubt, come to pass.

Who's Wireless

Without a complete recital of names, it can reasonably be expected that systems such as SVDS will (or already have) become accepted as standard stage equipment for most major bands within the near future. In addition to the 40 odd bands already equipped, another score are waiting for delivery.

The **Ken Schaffer Group** is located at 10 East 49th Street, New York, N.Y. 10017. Telephone: (212) 371-2335.

New Products

TELEFUNKEN MULTI—TRACK RECORDERS ANNOUNCED

Identified as the M-15A ***Magnetephon*** multi-track master recorder, the newly introduced units are available in the United States from Gotham Audio Corporation. The machines are available in 8, 16, 24, and 32 track configurations and feature clocked CMOS logic with Hall effect push buttons and solid state switching throughout for reliable, click-free operation coupled with minimum maintenance.

The indirect capstan drive system incorporates a brushless dc motor whose speed is referenced to a quartz crystal oscillator. An easy threading path of outstanding stability is assured by the rugged deck casting which supports precision aligned heads and guides. A unique mechanical servo system provides constant tape tension in all modes of operation, yet affords editing flexibility which is not possible on electronic servo machines. Fast wind speeds are continuously speed variable, while a slip-free LED timer accurately counts in minutes and seconds on both sides of zero.

The machines are available in 7½/15 or

15/30 ips speed configurations and have a tape capacity of 11½", equivalent to 3300 feet of standard tape. Shown is the 16 track version (there is room for up to 32 tracks) with all electronics cards easily accessible in the two file draws beneath. To the right of the top plate are shown capstan speed control and switching for the telcom c4 noise reduction system by TELEFUNKEN which, for up to 24 track configurations, can be accomodated in the electronics drawers.

An auto locator using microprocessor control and having nine position memories, a variable speed capstan controller with LED read-out of speed in percent of nominal, and a mechanical editing scissor arrangement which cuts the tape directly in front of the playback head gap are a few of the accessories offered.

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

for additional information circle number 59

CONSULTRONICS AUDIO ANALYZER

Consultronics has announced that the 300 Audio Analyzer system, an accepted standard for audio measurements in Canada, is now available to U.S. users.

A Tektronix 5111 mainframe houses a series of modular plug-ins including the 301 Generator supplying swept and fixed signals, the 302 Receiver (mono) which digitally displays frequency, level distortion and noise (also controls the storage scope display), and the 306 Stereo Receiver which identifies phase and level differences between two channels.

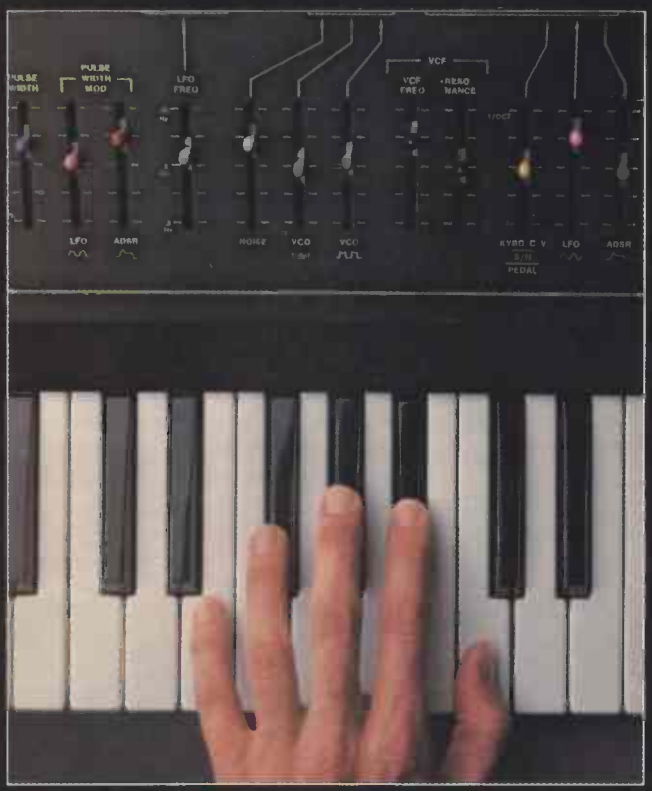
A remote controlled free standing generator has a *dial-up* feature and program interrupt (mono and stereo).

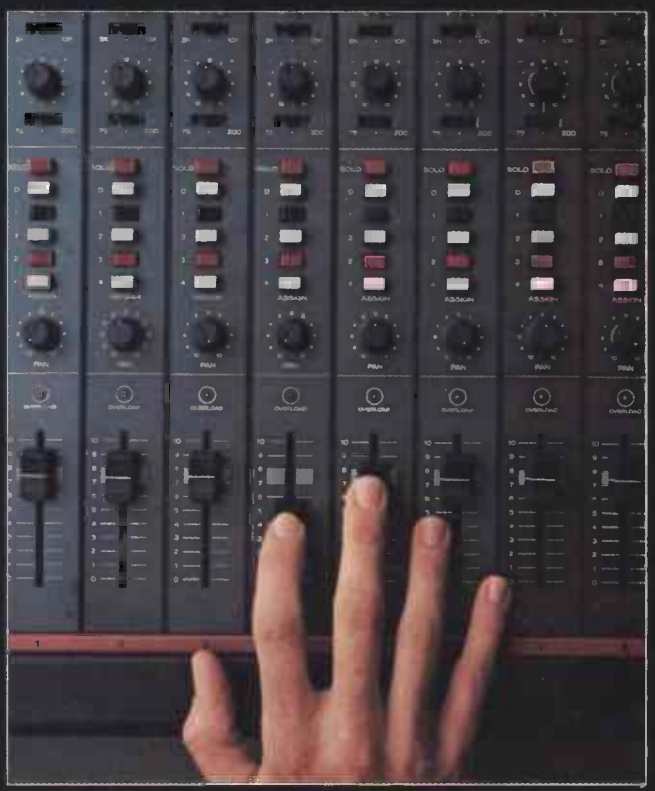
CONSULTRONICS
500 UNION BOULEVARD
TOTOWA, NJ 07512
(201) 278-6456

for additional information circle number 61

SYMETRIX ANNOUNCES NEW SIGNAL GATE

The Signal Gate's controls include independently adjustable attack, release, range, and threshold, an in/out switch, and an external control input jack (mounted on the front panel) which accepts any audio or





THIS IS WHERE TOMORROW'S GREAT MUSIC IS COMING FROM.

We think musical styles change because musical talents change.

There is hardly a musician making money today who doesn't know as much about recording music as he does about playing it. And recordists know as much about playing music as they do about recording it.

Because both know the equipment that captures music can also be used to improve it.

So while musical styles may change, the interdependence of musician, recordist, and the instruments they use will not. And that is the reason for the TASCAM Series by TEAC.

For not very much money TASCAM lets both musician and recordist get their hands on mixers and recorder/reproducers that let both tailor their music their way.

The Model 5-EX shown with four Model 201 input modules. Model 5 shown with Model 204 talk back/slate modules.

For every kind of music, for every kind of need, at home and on the road, by price and application, everything we make has the same goal as everything you make—be the best.

Because it still takes great talent to make great music.

TASCAM SERIES BY TEAC®

A new generation of recording instruments for a new generation of recording artists.

TEAC Corporation of America
7733 Telegraph Road
Montebello, California 90640

In Canada TEAC is distributed by White Electronic Development Corporation (1966) Ltd.

DC control signal. Also mounted on the front panel are two LED's which give a visual indication of the *above or below threshold* status of the program or external control inputs.

According to the manufacturer, the Gate's unique voltage controlled amplifier circuitry offers superior noise and distortion specifications over previous gate design which have used FET's as the gain control elements. RMS signal detection, fast turn-on time, and an IC regulated power supply are some of the additional features.

The Gate is designed to fulfill the need for a program or externally controlled audio gate in music and film recording, as well as sound reinforcement and broadcast applications. It comes in a 19" by 1-¾" rack mount enclosure, and sells for $249.

SYMETRIX, INC.
109 BELL STREET
SEATTLE, WASHINGTON 98121
(206) 682-3076

for additional information circle number 63

TAPE SPEED INDICATOR FROM IMAGE FORMATIONS

Designed for use with 3M Series 79 magnetic recorders the newly introduced unit allows the user to measure in inches per second, Hertz (with 60 Hz. representing nominal speed), and percent of change.

The bright four place LED readout allows the measurement of speed changes down to one, one hundreth of an inch per second change. A crystal controlled time base assures accurate readings.

The Tape Speed Indicator is completely self contained, and draws its power from the tape deck. It can be remoted up to 50 feet from the machine. It can be built into the tape deck on request.

IMAGE FORMATIONS
P. O. BOX 4227
BURBANK, CA. 91503

for additional information circle number 65

dbx ADD-ON NOISE REDUCTION SYSTEM FOR NAGRA IV-S

Custom designed for Nagra IV-S portable stereo recorders the **dbx** 193 requires no power supply of its own, and provides not only two channels of simultaneous noise reduction but a two-channel audio amplifier that can be used to drive small field monitor speakers. It weighs only 5 pounds.

Four separate signal processing circuits, two for record and two for playback, permit the noise reduced normalized signal to be monitored while recording. The system uses a mirror image 2:1/1:2 compression/expansion circuit, linear in decibels over a 100 dB dynamic range. No level matching is required for accurate record/playback tracking. RMS level sensors eliminate compressor/expander tracking errors due to phase changes added by the recorder. The **dbx** 193 tape noise reduction system further reduces the effects of noise modulation without sacrificing high frequency headroom through use of high frequency pre-emphasis in record and de-emphasis in playback.

The 193 provides the Nagra with an additional 10 dB headroom, and in excess of 30 dB noise reduction. A flexible switching system permits comparison of the non-processed input signal with the processed signal appearing at the 193's output section. Tapes recorded with the **dbx** 193 equipped Nagra are fully interchangeable with, and may be played back on any other **dbx** professional noise reduction system.

Price: $850.00

dbx, INCORPORATED
71 CHAPEL STREET
NEWTON, MA 02195
(617) 964-3210

for additional information circle number 66

SIERRA AUDIO MONITOR SYSTEM

Available for the first time as a separate system, the Sierra Audio Monitor is a two-way, four-speaker system employing high quality transducers throughout. Designed to offer the audio professional a high-power, low-distortion, accurate source of reference, the Sierra Monitor has achieved a unique distinction among the world's finest studios.

A successor to a world famous system installed in over two hundred studios, the

Is This Any Way to Build a Studio?

When Dick Cameron, Bob Foster and Troy Shondell of **Starfox Productions** in Fort Wayne, Indiana, asked us to build their new 16 track facility, they didn't ask us for the newest voodoo magic in acoustics theories or the latest whizz-bang gadgetry in gear. Rather, they wanted sublimely comfortable rooms that would demonstrate time and project-proven performance. And they wanted the kind of equipment that had a proud track record in other successful studios.

That's why Starfox called on **El-Tech** and us to execute their new rooms. **Nashville Studio Systems'** history of providing price/performance packages of unexcelled quality, coupled with the kind of after-sale support a mother would be proud of, let these clients know they need look no further than us for their turnkey contractor. When we suggested the El-Tech master record console as their primary gear expenditure, they knew our concern for their future financial success was a prime design parameter.

When your budget tells you it's not a bottomless well, but to get the very best you can afford, you'll want to call on us like so many other studio owners have. We know how to talk to you (and your budget).

That's the Way to Build a Studio!

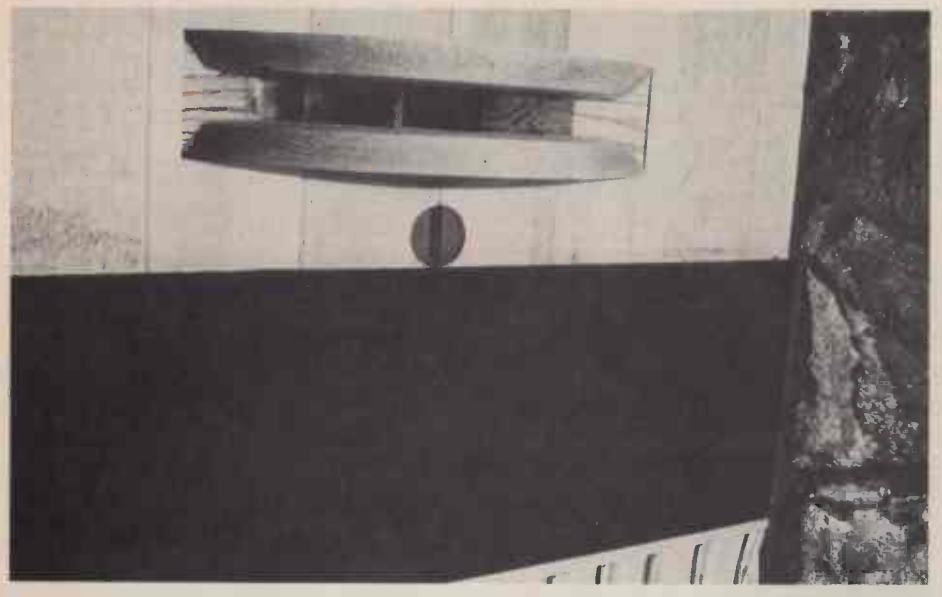
NASHVILLE STUDIO SYSTEMS

16 Music Circle South • Nashville, TN. 37203 • (615) 256-1650

EL-TECH

R-e/p 89

for additional information circle number 67



Sierra Monitor, employing a unique hardwood horn that contributes substantially to its lack of coloration, has a horizontal dispersion of 120° and a vertical dispersion of 45°. The system frequency response in free air is ±2.5 dB from 31 Hz to 16 kHz and will produce 126 dB at four feet Broadband.

The 44" x 30" x 20" enclosure is constructed of 1" stock and weighs approximately 300 pounds. Available unfinished for build-in applications, the Sierra Monitor is priced at $1,650, f.o.b., Burbank. It may also be obtained in several finishes for free-standing applications at prices starting at about $200 higher.

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

for additional information circle number 68

BTX new 4500 SMPTE edit code synchronizer will bring into sync, and hold in sync, any two video or multi-track audio recorders using sensible SMPTE time code.

Use this completely self-contained system to sync your VTR to your audio recorder, or to expand the number of audio tracks with two multi-track recorders in tandem.

For complete information call The BTX Corporation, 438 Boston Post Road, Weston, Massachusetts 02193 (617) 891-1239.

for additional information circle number 69

RTS MODEL 1400 IN-LINE MICROPHONE PREAMPLIFIER/LIMITER

Called a unique and versatile *adapter*, the unit's gain is continuously variable so that it can be used to boost low-output microphones for driving low-gain mixers, to boost mike outputs to line level, or to buffer medium level lines. Also, because of its high quality built in limiter it can be used to prevent overdrive of individual microphone or line inputs, while maintaining high average levels.

The 1400 has a fast rise time with no overshoot, even with 20 dB of limiting applied. It is said to be capable of no oscillation or ring despite highly capacitive loads. Additionally, its low output impedance enables it to drive microphone cables of 1,000 feet or longer with no significant loss of high frequencies, thus effectively improving S/N ratio by keeping the signal well above the noise level. To enhance common-mode rejection and further improve S/N the 1400's input and output transformer are isolated with two-way Faraday shielding.

Because the 1400 is battery operated, it avoids a major source of potential hum and ground loops. One pair of 9V batteries form a bipolar supply with an operating life of approximately 100 hours.

Price: $185.00

RTS SYSTEMS
4167 FAIR AVENUE
NO. HOLLYWOOD, CA 91602
(213) 980-0511

for additional information circle number 70

FURMAN SOUND INTRODUCES STUDIO QUALITY, LOW COST TUNABLE CROSSOVER

Known as the TX-2 the unit is tuneable from 20 to 20,000 Hz., and is switchable for both stereo bi-amp and mono tri-amp systems. Controls on the front panel provide up to 8 dB gain, sufficient, it is said, to drive power amps directly.

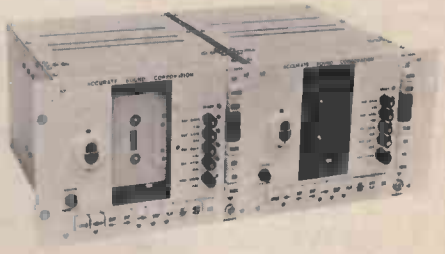
The TX-2's design uses active Butterworth filters with 12 dB per octave roll-offs for smoother frequency handling

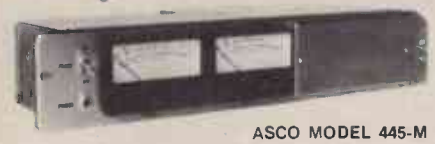
WHATEVER YOUR RECORD PROBLEMS, ACCURATE SOUND HAS THE ANSWERS!

ASCO
INOVONICS

ASCO
MCI 2600

CASSETTE RECORDER

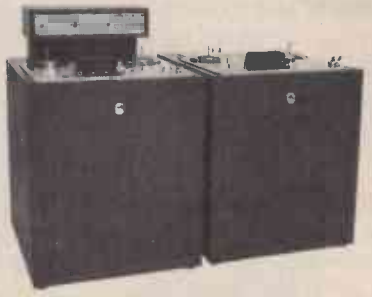


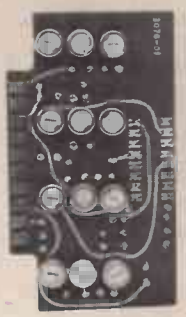


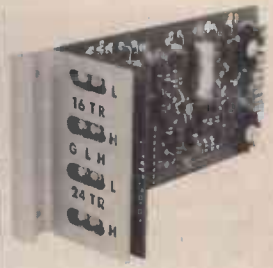
ASCO MODEL 445-M

ASCO 2600
TRANSPORT

ASCO 2400 DUPLICATOR







FOUR CHANNEL EQUAL.

...Whatever your problems: new equipment, rebuilt equipment, reconditioning or updating. ASCO's "Total Systems" capability can solve *your* problem.

RECORDER/REPRODUCE SYSTEMS
The Accurate Sound recorder/reproduce systems provide complete recording using Inovonics, three speed electronics, AG-440, Ampex 351, MCI JH5 or other electronics. The transports feature our new tape motion control box that eliminates the tape handling deficiencies typical of most older tape transports. Contact us about your needs and the system components you would like to use. Price: Systems shown...ASCO Inovonics 2600—$5480.00, ASCO/MCI 2600-2c—$3595.00.

CASSETTE RECORDER
This ASCO CRP-4T cassette recorder is designed primarily as an on-line logging recorder for broadcast use. It is a four channel recorder/reproducer with many transport functions including: skip-forward, skip-back (i.e. automatic fast motion to play mode)—automatic play with either continuous run or BOT/EOT sense—optional bi-directional play—optional capstan engage for search and cue—digital readout tape position indicator—any speed available between .5 and 20 ips with variable speed option—all functions remote controllable.

The system is packaged in a two module bay with provision for module to module dub function. The package size is 7" high x 19" wide x 12" deep.
Model shown is the ASCO AS4000—24RP
Price: $4800.00

ASCO MODEL 445-M
Two channel reproduce only electronics, using standard 440 style cards. Available with or without front panel meters, in a 3½" rack mount chassis. Features a built-in power supply and two speed/ EQ settings. Provision is made for remote EQ selection. Transport power is derived from a rear panel jack. Output level +4 or +8 dBm balanced. Price: $495.00 without meters/ $595.00 with meters.

ASCO 2600 TRANSPORT
The ASCO 2600 Transport features solid state "CMOS" techniques to provide the following: fast motion dynamic braking (i.e. braking is accomplished by reverse motor torque until reel stoppage, then normal brakes are engaged)—tape motion sensing that eliminates tape breakage by locking out the play function until tape has stopped—edit function—constant tension holdback with optional constant tension takeup—optional constant torque holdback and takeup—access is provided for search and cue equipment interface—provision for tape lift function—delayed stop for "pop free" bias turn off—torque boost to accommodate high speed fast start—logic design provides access from any transport mode to any other transport mode—provision is made for logic level remote control of all functions—optional slow start capstan—capable of three speed operation—switch selectable tension settings to accommodate different tape sizes. Available in ¼, ½ and 1" tape widths. Price as shown: $1495.00.

ASCO 2400 DUPLICATOR
Designed especially for quality, high-speed reproduction of programming for automation. The ASCO 2400 now allows 60/120 ips duplicating speeds at comparable quality previously only attainable at real time speeds. Speed and phase accuracy demanded by stereo formats can now be achieved through our new technology. Features include: Automatic cue ... following duplicating run, the master stops the slaves and recues itself for the next duplicating run. During the recue cycle, the operator reloads the slaves in preparation for the next duplicator run—all transports feature plug-in head assemblies to facilitate rapid format changes—reproduce head assemblies include all playback amplifiers with equalization and level adjustments. All record head assemblies include bias and record level adjustments—hot-pressed ferrite heads are used throughout. Write for complete specifications. Price: Four Channel System as shown—$8500.00

FOUR CHANNEL EQUALIZER
By slightly modifying your present 440 play card, this new plug-in equalizer will accommodate four different EQ settings with level adjust. Built-in binary logic allows simple remote selection of desired equalization. Ie. You can now select between two multiband head stacks at two different speeds in one compact package.

Send for our illustrated catalog with new and used equipment listings.

ACCURATE SOUND CORPORATION
114 5th Avenue
Redwood City, California 94063
415/365-2843

and minimal phase displacement. The high and low-pass outputs of each crossover point track each other automatically as the frequency is changed.

Principal uses are as a variable frequency splitter for P.A. and sound reinforcement loudspeaker reinforcement systems, studio monitor systems, component musical instrument amp systems, and as a bandpass filter.

Furman Sound products are distributed exclusively by:

ROTHCHILD MUSICAL INSTRUMENTS
300 WINDSOR ROAD
ENGLEWOOD, NJ 07631
(201) 871-3366

for additional information circle number 72

RAMKO RESEARCH MASS FEED AUDIO DISTRIBUTION AMPLIFIER

The new model DA-X30 Audio Distribution Amplifier will feed up to thirty 600 ohm loads simultaneously with complete isolation. The stereo version will handle up to 60 loads. The main feature of this unit is the ease of installation. Simply run the single balanced output of the DA-X30 around the areas to be served and tap off this line at any place desired.

Frequency response is plus or minus 0.75 dB from 10 Hz. to 20 kHz. The output level is plus 27 dBm. There are three versions to

choose from: a table top or a 3½" rack mount mono unit, and a 3½" rack mount stereo unit. Prices range from $145 to 240.

RAMKO RESEARCH, INC.
11355-A FOLSOM BOULEVARD
RANCHO CORDOVA, CA 95670
(916) 635-3600

for additional information circle number 74

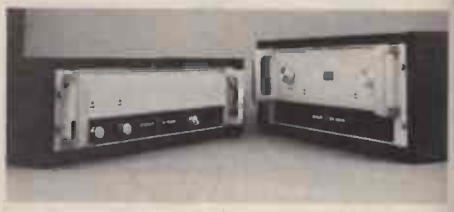
CROWN 'IOC' MUSIC DISTORTION INDICATOR ANNOUNCED

Called IOC (Input-Output-Comparitor) the unique music distortion indication system will be incorporated in Crown DC-300A and D-150A amplifiers.

The IOC acts in conjunction with existing amplifier circuitry to monitor musical waveforms, then analyzing the amplifier's input and output waveforms noting the difference. Whenever rated distortion levels are approached (0.05% THD, IMD), IOC is triggered and the listener is notified through a red LED on the amplifier's front panel.

In keeping with Crown's policy of avoiding continual model changes and planned obsolescence, existing DC-300A's and D-150A's may be updated with IOC for $60.00. Units must be returned to the factory for retrofit, the cost including a laboratory check-out after IOC is installed.

All DC-300A and D-150A amplifiers with IOC will carry a S/N ratio of 115 dB referenced to rated output. This specification improvement in hum and noise



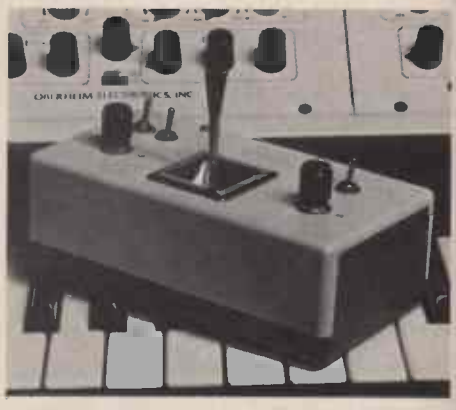
(20 Hz. to 20 kHz.) from 110 to 115 dB is in keeping with Crown's policy of value improvement with minimal technical or model obsolescence.

CROWN INTERNATIONAL
1718 WEST MISHAWAKA ROAD
ELKHART, IN 46514
(219) 294-5571

for additional information circle number 75

MEDIAMIX JOYSTICK MODIFICATION KIT FOR SYNTHESIZERS

Originally developed for use with the Oberheim Two-Voice Synthesizer, the Joystick is offered in kit form as well as on a turnkey modification basis for Oberheims, Arps, and Moogs.



Modification of the sound is realized as the joystick is moved in any direction on a 360 degree horizontal plane. The X axis or left/right of center movement controls *pitch bend*. The 'Y' axis or forward/backward movement is assigned to *filter sweep*. Switches are included to allow the player to

for additional information circle number 73

CONGRATULATIONS "Mack" Emerman

on the expansion of your recording studio!

"Mack" has turned out a lot of gold records using advanced acoustical facilities and equipment. Particularly notable is the obvious appearance of McIntosh amplifiers in the Criteria Recording Studios. According to "Mack," **"McIntosh are the only trouble free amplifiers . . . having tried most others they are the only reliable ones that stand again."**

Shown in optional walnut veneer cabinet

Delivers 200 watts average power output minimum, per channel continuous across 1, 2, 4, or 8 ohms with no more than 0.1% harmonic distortion.

McIntosh

is the LEADER in

- **Long Trouble-Free Equipment LIFE**
- **Listening Quality**
- **Performance**

The McIntosh MC 2205 Power Amplifier always "Sounds Clean". . . .

Conventional amplifiers when driven to clipping are capable of delivering up to twice their rated power with more than 40% harmonic distortion. The extra energy content of the clipped signal will damage most speakers. McIntosh leadership in engineering has developed a new circuit that. . . (1) dynamically prevents power amplifiers from being overdriven into hard clipping. . . (2) which protects speakers by preventing clipping. . . (3) assures that the amplifier will produce its maximum output without increased distortion. That new circuit is "POWER GUARD".

Cool operation is essential to achieve long trouble free life in an amplifier. Cool operation results from the careful design of the output circuit, proper matching of the output circuits to the loudspeakers with an autotransformer and a mechanical design that permits the use of generous sized heat sinks with adequate ventilation without the use of fans. The MC 2205 has 1100 square inches (7.64 square feet) of radiating heat sink surface. In addition, the chassis has been designed to permit the maximum amount of air to flow over the heat sinks to conduct away the life limiting heat.

Bipolar eptaxial output transistors and the McIntosh output circuit allows the amplifier to operate as cool as possible. When there is limited program demand of the amplifier, only the optimum number of output devices operate. Conservative McIntosh engineering keeps operating temperatures low assuring long life.

If you would like more information on McIntosh amplifiers or electronics please write or call us:

McINTOSH LABORATORY INC.
2 CHAMBERS ST., BINGHAMTON, N. Y. 13903
607-723-3512

switch either or both of the modification modes into use. The amount of modification is controlled by rotary pots.

Typical applications have been to more realistically recreate brass, by bending up to a note, then adding some edge or brightness (filter) plus some manual vibrato to the tail of the note. Beautiful violin, harmonica, horn, as well as other very musical sounds can be made, enabling the keyboard player to add the human touch and expression that heretofore only horn and string players could achieve.

MEDIAMIX
4060 STANFORD
DALLAS, TX 75225
(214) 368-6846

for additional information circle number 77

WASATCH MUSIC SYSTEMS ANNOUNCES DELAY DEVICE

Known as the Flanger 900-A the new unit is a professional device capable of producing effects such as positive and negative flanging, doppler, vibrato and chorus, pitch shifting, double tracking, Leslie speaker simulation and cardboard tube echo. Delay times of more than 20 ms will create flanging effects of over 6 octaves.

The unit is claimed to have the lowest noise and distortion of any similar device now available. Special filters are said to eliminate input aliasing and output quantization noise.

The Flanger 900-A is designed for both studio and live performance use, and is powered by a dual IC regulated power supply which is built-in; requires 117 VAC, 60 Hz.

Options include: Balance input/output, foot pedal, road case.

WASATCH MUSIC SYSTEMS
BOX 9175
SALT LAKE CITY, UT 84109
(801) 467-4722

for additional information circle number 78

FOUR NEW MICROPHONES FROM NAKAMICHI

The CM-700 Studio Electret Microphone takes its place in the Nakamichi lineup between the top-of-the-line CM-1000 Studio Condenser and the CM-300 Electret Condenser microphones. It utilizes a highly advanced electret element measuring only 16 mm in diameter. The element's small diameter and low mass are said to ensure extended high frequency response, excellent transient characteristics and extremely low coloration. Built into the housing of the CM-700 is a low noise preamplification circuit which utilizes a hand-selected FET for high sensitivity and wide dynamic range. The microphone is powered by an internal, user-replaceable 6 Volt silver oxide battery. Two interchangeable element capsules provide choice of cardioid or omnidirectional polar patterns. Also provided is a "pad" which attenuates the signal by 15 dB to prevent overload in high sound pressure situations. The power switch provides a special position for "lo-cut" proximity effect attenuation.

CM-700
Studio Electret Microphone

DM-500
Moving Coil Dynamic Microphone

The DM-500 Moving Coil Dynamic Microphone is a reduced-cost version of Nakamichi's premier dynamic model, the DM-1000, which was introduced one year ago. Like the DM-1000, the DM-500 is a studio quality dynamic featuring wide frquency range, fast transient response and wide dynamic range. The built-in windscreen effectively minimizes pop, blast and wind noises, making the microphone ideal for close-up vocal applications. Shock-mounting of the moving coil element plus special casing construction makes the DM-500 virtually impervious to mechanical noise transmitted through the cable or mike stand, or generated by hand-holding. The DM-500 exhibits a superior cardioid polar pattern with high rear sound rejection.

The popularity of Nakamichi's CM-300 interchangeable capsule electret system has prompted the firm to introduce a budget-priced version, the CM-100 Electret Condenser Microphone. The CM-100 is

the better bass driver

from ATC/Forsythe excels its US made competitors in several important respects you'll never find listed in data sheet specs. Our PA-75 series of 12" drivers is a unique blend of American brute force ruggedness with the finesse of British cone technology. The result is an audible quality equal to the finest audiophile speaker combined with power handling capacity and service life unexcelled by either of the other two popular commercial drivers. Before you buy anything new or replace what you've got, try an ATC/Forsythe PA-75 in your application. For an evaluation unit, call or write:

Forsythe Audio Systems, 28 Acton Street,
Watertown, MA 02172 /617-926-2574

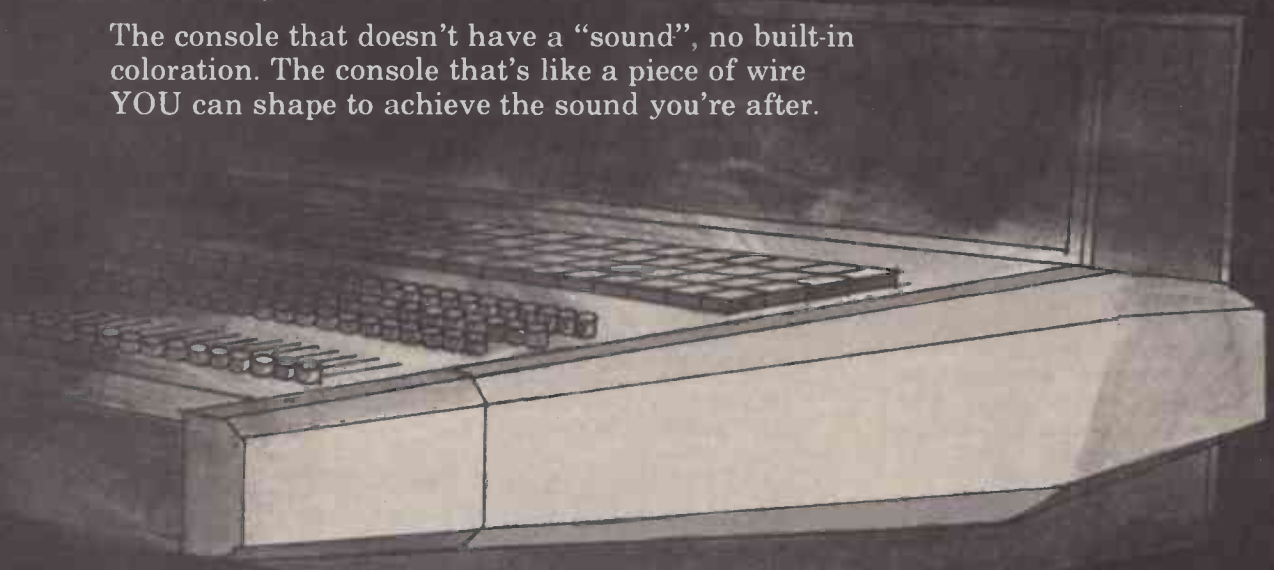
FORSYTHE
AUDIO SYSTEMS

for additional information circle number 79

There is an alternative.

If you're ready to buy a TRULY PROFESSIONAL console,
We're ready to deliver it.

The console that doesn't have a "sound", no built-in coloration. The console that's like a piece of wire YOU can shape to achieve the sound you're after.



BEE JAY RECORDING will soon receive delivery of the first Eclipse C for their new automated 32 track studio in Orlando, Florida.

Studios across the country have taken the alternative and have chosen **SPHERE.** Among them are **BANG RECORDS** in Atlanta and **ALPHA AUDIO** in Richmond, both taking delivery of the all new automated Eclipse type C.

If you're really serious about a truly professional console, you owe it to yourself to call one of our area reps.

Sphere ELECTRONICS, INC.

FACTORY
SPHERE ELECTRONICS, INC.
20201 A Prairie Ave.
Chatsworth, Calif. 91311
(213) 349-4747

MIDWEST and SOUTHEAST
SPHERE AUDIO SALES
478 Devens Drive
Brentwood, Tennessee 37027
(615) 794-0155

NORTHEAST
SPHERE ASSOCIATES
11250-7 Roger Bacon Dr.
Reston, Virginia 22090
(703) 471-7887

physically quite similar to the CM-300; all of the CM-300's optional capsules, in fact, can be used with the CM-100. The cardioid capsule provided on the CM-100, therefore, can be replaced with the optional CP-3, super-omnidirectional or CP-4 "shotgun" element. Instead of a 9 Volt mercury battery, however, the CM-100 is powered by a standard 1.5 Volt penlight cell. Except for a slight loss of dynamic range, the CM-100's performance quite closely resembles that of the popular CM-300 system.

The CM-50 is a Miniature Electret Microphone designed for those applications where conventional microphones would not be practical. It offers a unique combination of superior performance and compact dimensions. The entire head of the CM-50 measures 13 mm (½-inch) in diameter and 34 mm (1-⅜-inch) in length. The head is connected via a thin cable to the connector/battery housing, which can be easily hidden from view. The head weighs a mere 20 grams (0.7 oz.). Design features include a tiny high performance FET pre-amplifier built into the head; and battery powered operation via a user-replacable 6 Volt silver oxide cell housed in the connector section. A "tie-clasp" holder clip is supplied for easy attachment to clothing, and a foam windscreen is provided for outdoor use. The minute dimensions of the CM-50 also make it ideal for binaural "dummy head" recordings.

CM-50
Miniature Electret Microphone

CM-100
Electret Condenser Microphone

Suggested retail prices are as follows: CM-700, $150.00; DM-500, $70.00; CM-100, $70.00, CM-50, $110.00

NAKAMICHI RESEARCH (U.S.A.)
220 WESTBURY AVENUE
CARLE PLACE, NY 11514
(516) 333-5440

for additional information circle number 81

MUSIMATIC C-40 DUAL ELECTRONIC CROSSOVER

The newly introduced C-40 is a dual channel tunable, 2-way electronic crossover designed for use in professional sound reinforcement and stereo and disco systems.

The unit is constructed in an enclosure which is suitable for mounting in a standard 19-inch rack. All controls are located on the front panel.

Price: $276.

MUSIMATIC INC.
4187 GLENWOOD RD.
DECATUR, GA 30032
(404) 289-5159

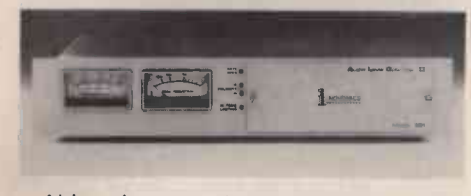
for additional information circle number 82

INOVONICS AUDIO OPTIMIZER INCORPORATES THREE PROCESSING FUNCTIONS

The gated gain-riding AGC amplifier in the Model 221 Audio Level Optimizer II compensates for long-term variations in program input levels over a plus or minus 10 dB range at a correction rate of 0.5 dB per second. Contol over program dynamics is provided by a gated *open-loop* compressor. A fast peak limiter prevents overmodulation with program controlled phase inversion

and adjustable limiting symmetry for AM; a separate 25/75 microsecond high frequency limiter is provided for FM.

The Model 221 is within 1 dB flat from 20 Hz. to 20 kHz. Noise is less than 70 dB below the 100% modulation output level with distortion below 1% THD (10 dB compression and 10 dB limiting of steady state signal).



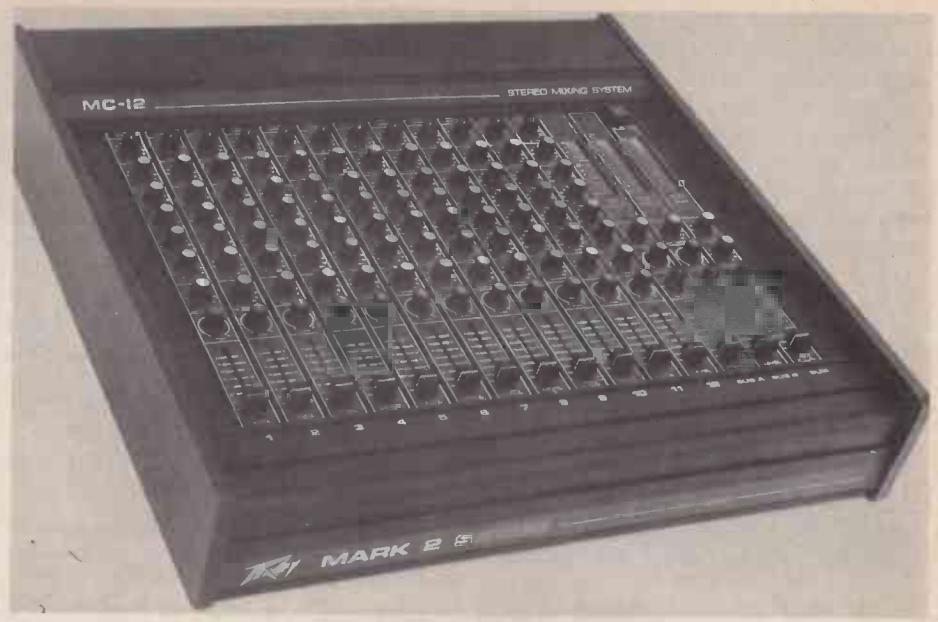
Although primarily designed for radio broadcast applications the Model 221 is applicable to TV audio, and can also be used for dialog recording or sound reinforcement.

INOVONICS, INC.
503-B VANDELL WAY
CAMPBELL, CA 95008
(408) 374-8300

for additional information circle number 84

PEAVEY *MARK 2* MIXING CONSOLES

Designed for portable or fixed installation sound reinforcement and recording applications the ***Mark 2*** series mixers are offered in 8, 12, 16, and 24 channel configurations. The series also includes a special 7 channel 19" rack mount configuration.



The Mark 2 series features include transformer balanced inputs and outputs; LED ladder displays on Main and Sum. Each channel features LED overload indicator, pre-monitor send, 4-band equalization, stereo pan, variable input attenuation, effects send, and level slider.

Master controls include two sub mixes and a master mix which is the sum of sub mixes.

Suggested retail price (for MV-12 pictured): $999.50.

PEAVEY ELECTRONICS
MERIDIAN, MS 39301
(601) 483-5365

for additional information circle number 85

SPECK SP800C MIXING CONSOLES

The newly introduced model is a 16 input 16/8 output, stereo out console which can be easily expanded to 24 track operation with the addition of the 01 or 02 options. the 800C is designed to operate with all models of professional multi-track recorders, and will also work very well with semi-professional multi-track tape machines.

The input modules feature a 4½" conductive plastic slide fader; 6 knob, 3 band parametric equalization; 8/16 track assignment buttons; post echo send; monitor send control; 2 cue sends; solo button which allows stereo panning when engaged; a mic/line switch; and an attenuation switch of -10 or -20 dB.

The output section contains everything needed to do a professional recording session, from the stereo master fader to the 8 submaster level controls. It also includes stereo control room and studio level controls, cue 1 and cue 2 level controls each of which can be soloed, slate and talk buttons with level control, 2 cue prompts, 2 cue returns, 2 two-track playback controls, 2 echo returns, and self contained microphone.

Specifications: Microphone input impedance 150 Ohms balanced, line input impedance 10k Ohms, S/N -72 dB, output level (normal) +4 dBm above 0 VU, maximum output level +20 dBm, headroom +16 dBm, equivalent input noise -127 dBm.

Price: $6,500. fob factory.

SPECK ELECTRONICS
5642 LANKERSHIM BLVD.
NO. HOLLYWOOD, CA 91601 (213) 769-7090

for additional information circle number 87

RACK-IT EQUIPMENT SYSTEMS

Until now it frequently has been necessary to pile and stack expensive audio equipment on shelving units that were designed to fit everything but audio equipment. Rack-It has designed cabinetry specially for audio components.

Both equipment racks being offered are 51" tall x 17" inches deep and come with 2½" ball casters for mobility even on rugs. Style "A" is for 19" rack mountable equipment. Style "B" has four adjustable shelves and will accommodate equipment up to 23½" wide.

The roll around tape console will fit any reel-to-reel tape machine up to 19" wide and 21" long. The console has heavy duty casters and a storage shelf for tape and accessories.

All units are finished with scuff and stain resistant dark walnut formica with black accents.

RACK-IT EQUIPMENT SYSTEMS
MIDWEST SOUND COMPANY
4346 WEST 63RD STREET
CHICAGO, IL 60629
312/767-7272

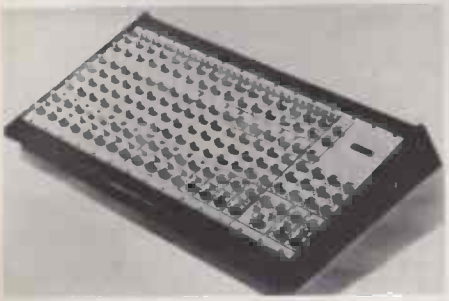
for additional information circle number 88

NEW MMX-1700 MIXING CONSOLE FROM MUSIMATIC

The MMX-1700 is a professional sound reinforcement and recording mixing

for additional information circle number 89

console with 8 to 24 input channels, stereo or quad output channels for 4 channel or stereo submix capability. The standard MMX-1700 is a 16 channel stereo mixer.



A few of the features include transformer balanced inputs, auxiliary inputs, 50 dB of input attenuation, pre-distortion red LED's in each input, 3 band equalization in each input and output. Also, pan-pots, monitor channel which is pre-volume control and pre-input equalization, reverb channel and solo (headphone) channel and mute switches.

Modular construction, solid state circuitry, walnut cabinet, portability and economy are a few other features.

Price: $3,100. — $3,900.

MUSIMATIC INC.
4187 GLENWOOD RD.
DECATUR, GA 30032
(404) 289-5159

for additional information circle number 90

PYRAMID ACTIVE DIRECT BOX

In announcing the new active direct box/microphone substitution device, Pyramid says that the unit accepts direct inputs from guitar, bass, crystal pick up, amplifier speaker output, or other line level signal and translates that signal into two balanced microphone level outputs, and an unbalanced output for consoles, monitor amps, or remote feeds.

The Universal Hot Box features inputs for instrument level outputs, amplifier speaker level outputs, and line on phone or phono

connectors. The unit provides five separate outputs. First, an inverted output for driving auxillary effects units at low impedance; second, a boosted output for headphone monitoring of the processed signal, or for additional gain when plugging into an amplifier; third, an unbalanced output for musical instrument or high impedance monitor system inputs; and two isolated 'Cannon type' balanced line outputs for feeding mixing or monitor consoles.

The unit operates from two nine Volt transistor radio batteries for full output swing. Distortion is guaranteed to be less than 0.05% from 20 to 20,000 Hz with a mike level output of a hot -10 dBm.

PYRAMID ELECTRONICS
P. O. BOX 6171
SAN RAFAEL, CA 94903
415/479-4206

for additional information circle number 94

HARRISON TO INTRODUCE MICROCOMPUTER AUTOMATION

Employing a multiprocessor approach for optimized execution time and an expanded range of available features the new Harrison automation system will be called *864 AUTO-SET*. The unit is a full process control microcomputer designed specifically for the audio industry. Complete data management is included as part of the system, minimizing mixing time and effort.

Under parallel development are many software packages for application to live performances, television production and master control, as well as multi-track recording.

Also about to be shown are Harrison's new second edition automated consoles. These include the 4032B with a new exclusive high resolution (36 segment) VU/PPM meter system, and an "Affordable Model 3624".

HARRISON SYSTEMS
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Call Collect 206/941-2233

EQUIPMENT

FOR SALE: Scully 280-8 recorder/reproducer with Syncmaster. Excellent condition. New Spec SP800C 16x8 mixing console with 240 point Bantam patch bay and producer's desk. 50 reels of 1" Scotch tape. $14,900.00, (U.S.) Telephone:
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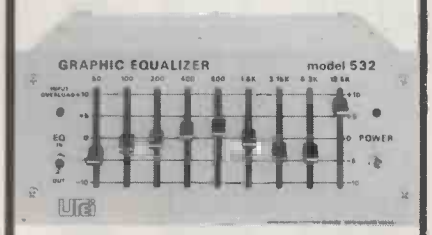

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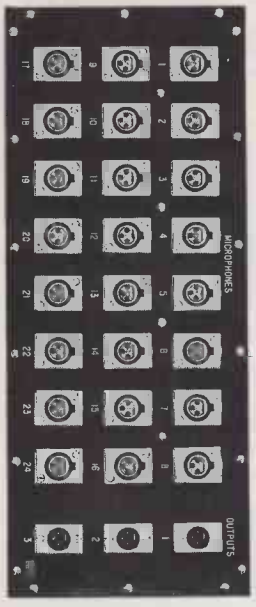

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MCI JH-8, 16-Track, Play only	$3,900.00
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EQUIPMENT

EMPLOYMENT

Continued from Page 15 —

Late News

TAPCO IN NEW HOME

Technical Audio Products Corporation, (TAPCO), a leading manufacturer of sound reinforcement equipment, has moved to a large new plant in Redmond, Washington.

After only three years, TAPCO has evolved from a small-town, two-man operation based in Edmonds, Washington, to an established leader in the sound systems industry, serving markets throughout the U.S.A. and Canada and with plans to enter the European market during 1977.

The move to a larger facility now provides an opportunity for the company to increase its employee force and to expand its successful product line of mixers, reverberation units, and equalizers to new products. New products will be announced at a later date.

RECORD PLANT, N.Y., TO BUILD 'PYRAMID' STUDIOS IN MALIBU

Roy Cicala, President of Record Plant, N.Y., recently announced plans to construct ***Malibu Sound Pyramids*** in the prestigeous California beach city. Construction will begin in early 1978, with completion scheduled later in the year.

According to Cicala, who conceived of the imaginative project, "The innovative design is based upon the premise that in order to achieve the best possible recorded sound, no two opposite walls should be the same."

The Malibu Sound complex will consist of one giant pyramid housing three smaller pyramids inside, each to be a recording studio, with each studio measuring 2,500 square feet. The second pyramid will contain a future studio and mastering facility, and the third pyramid a residence.

The interior wall construction of Malibu Sound will consist of a checkerboard pattern of alternating fiberglass pyramids, 16" square. The pyramid surfaces will diffuse the sound, while the flat surfaces will absorb the undesireable low frequencies, according to Cicala. Each pyramid square will be moveable, enabling the room to be *tuned* and the best possible sound attained.

Additionally, fiberglass draperies that are impregnated with lead will be on motorized tracks, to be operated from the control room, allowing both the producer and the engineer to mechanically change the frequency response of the studio, according to taste, by changing the wall surface while the session is in progress. The special draperies will allow further absorption of higher frequencies.

The architect for Malibu Sound is Charles Moore, head of the Architectural Department of U.C.L.A.

COMMUNITY LIGHT & SOUND CATALOG NOW AVAILABLE

Available from their dealers as well as directly from the company, the comprehensive catalog of professional products also contains exstensive design and application data calculated to be of invaluable assistance to audio system designers, architects and engineers.

Besides complete specifications on ***CL&S*** products there is an extensively illustrated chapter on sound system design and a very informative section titled "Comparitive Measurements". Designed to eliminate the confusion caused by the variables in measurement techniques commonly used in sound reinforcement this chapter details the results of a long period of testing of most of the horns, cabinets and loudspeakers manufactured in the U.S.

Community notes that all equipment was measured under identical repeatable conditions in a true free field. Data published includes response, "Q", "DI", and coverage angles.

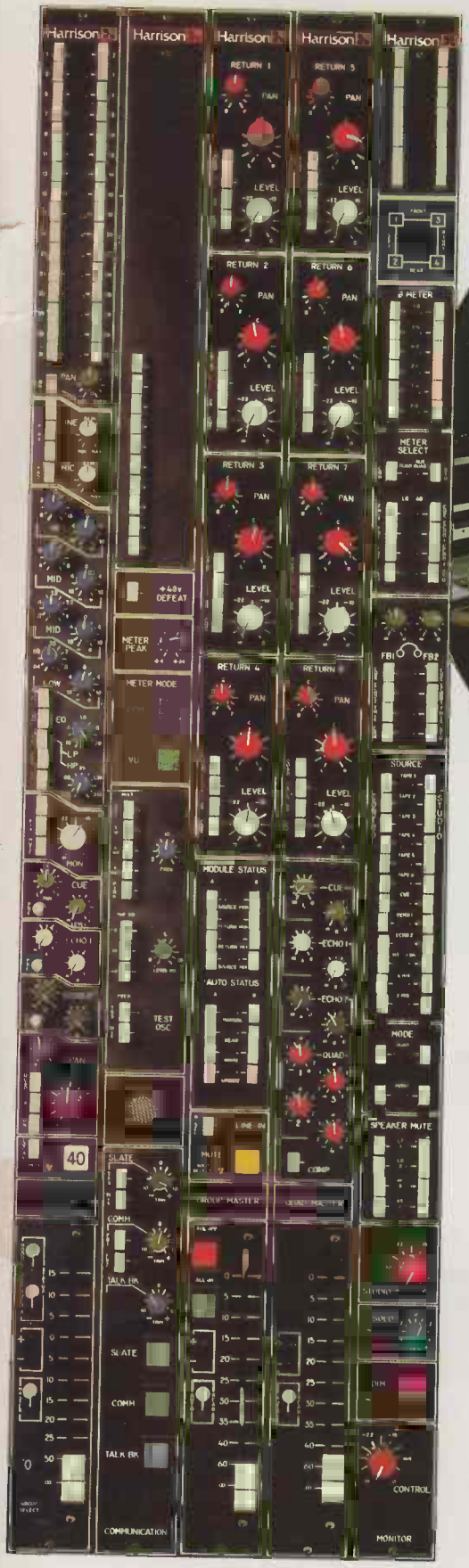
Price of the catalog is $3.00.

COMMUNITY LIGHT & SOUND
5701 GRAYS AVENUE
PHILADELPHIA, PA 19143
(215) 727-0900

for additional information circle number 105

Progress from HARRISON

Second Edition Models 4032 + 3232 Automated Master Recording Consoles



In response to your suggestions, Harrison's Second Edition consoles offer you many new features and functions.

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- Group Muting.
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- Optional High Resolution Phase Meter.
- 2 Phase Meter Source Selection Matrices.
- Pink Noise Generator.
- 48 Volt Phantom Power On/Off Switch.
- Improved Parametric Equalizer Range.
- Optional Step-Type Equalizer.
- Stereo and Quad Meter Source Selection Switches
- Optional 36 Segment, High Resolution Light Meter With Front Panel VU and PPM Characteristic Selection.
- Master VU/PPM Characteristic Selection Switches
- Optional NTP Meter Overbridge.

"Still No Compromise" Harrison

Harrison Systems, Inc.
P.O. Box 22964 • Nashville, Tennessee 37202

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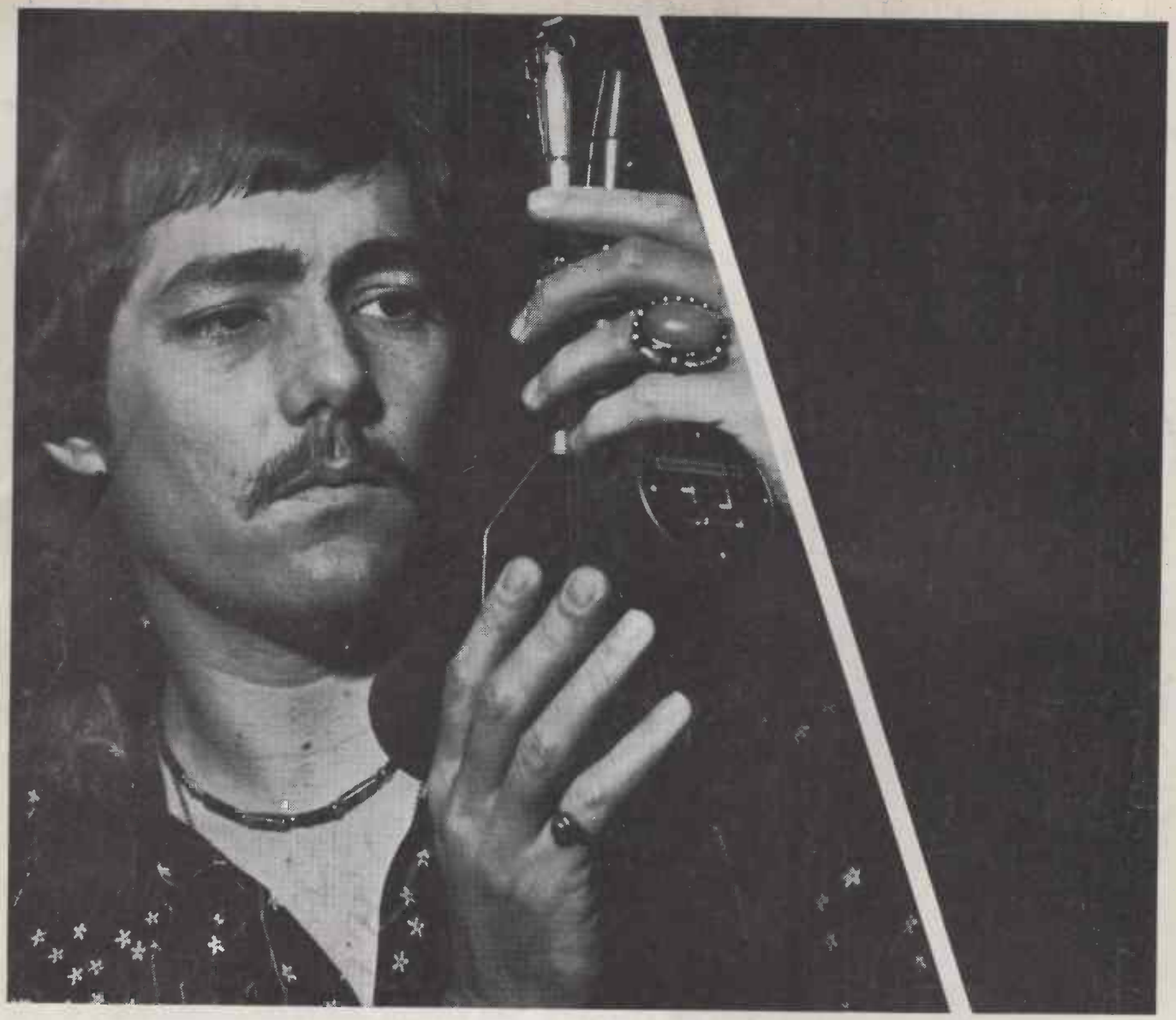
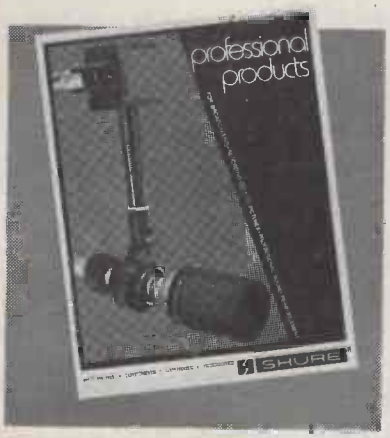
R-e/p 107



Gold prospecting with Chips Davis.



Chips Davis has gold fever as badly as any 49'er. The gold he's looking for is in the recording industry's gold records—and he prospects for it electronically in his Las Vegas recording studio. Because he works with top recording and performing stars like Paul Anka and Wayne Newton, Chips knows the importance of using the right gear for either recording or sound reinforcement work. And he knows that for this kind of prospecting, Shure microphones, audio control components, accessories, and disc reproducers represent the ultimate in quality. Their superb performance characteristics and versatility make them among the most popular and consistent choices of the most demanding professionals. Settling for anything less than the best would be like wasting time on fool's gold. For data on Shure studio equipment, write:

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222 Hartrey Ave., Evanston, IL 60204
In Canada: A. C. Simmonds & Sons Limited

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