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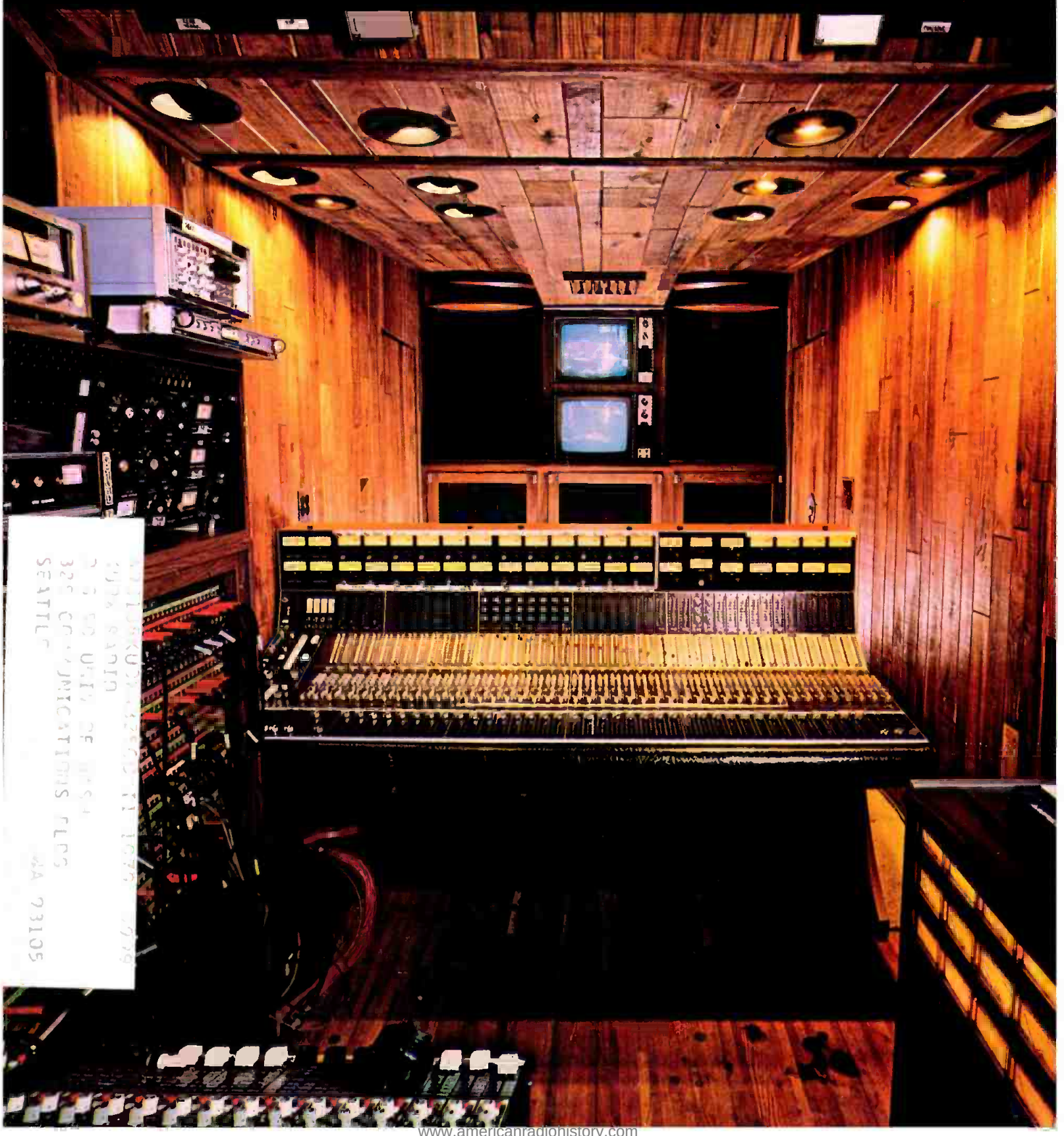
THE SOUND ENGINEERING MAGAZINE

OCTOBER 1979
$1.95

db



Freddie started backup singing in his New Jersey junior high school. He earned a Bachelor of Music Degree from Howard University, and taught in Washington, D.C., while moonlighting as a producer. In 1969, his first Motown production, "I Want You Back" by the Jackson Five, went platinum. Since then, he has collected close to 30 gold or platinum records. Freddie now owns his own studio in L.A. and has recently produced disco hits for Yvonne Elliman, Tavares, David Naughton, Gloria Gaynor, and Peaches and Herb.

ON CREATIVE EXPRESSION

"I'm thinking charts. I'm thinking commercial. And I'm thinking hit, as opposed to creative expression. Because that's usually what I'm hired for. I mean, I hear the standard rap that I would get from a company person or a manager is that 'this group, live, is a knockout. I mean, they're killers. All they need is that hit record. When they get that hit record, man, you're gonna see the baddest group that ever existed in the history of recorded music.' So they want the charts. And that's why I approach it like that."

ON HEARING

"I only go by the ears, and I do hear very well. Musically and technically. I hear stuff all over the place. The guitar player—if he accidentally hits an open A string while he's fingering a chord, we could have thirty pieces on tape and I'll hear that and solo it out and bust him—say, 'Hey, could you keep that string quiet?' He says, 'You mean you actually heard that?' So my ears are really my fortune. That's where everything lies. Right in my ears."

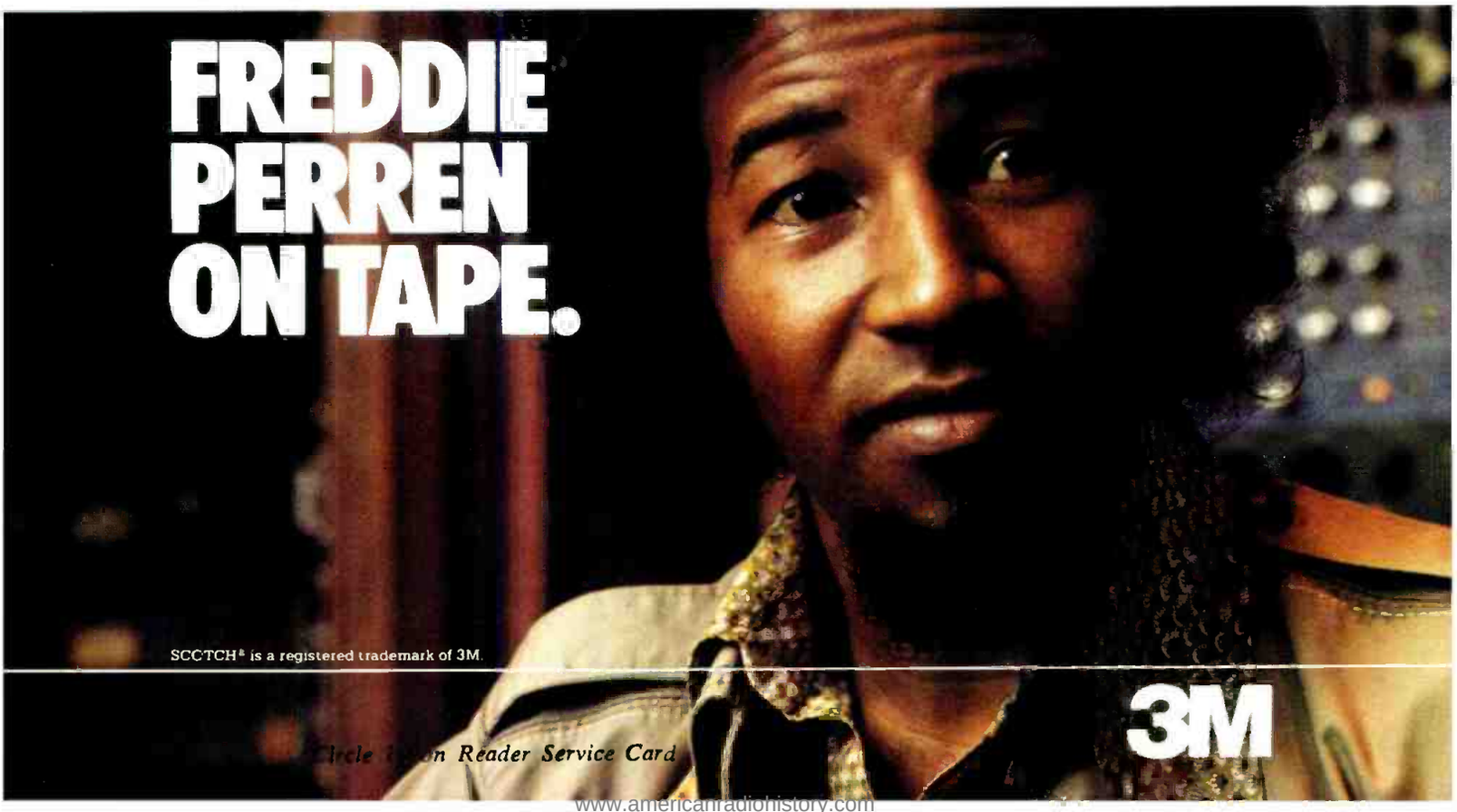
ON RHYTHM SESSIONS

"I do my basic rundown on the rhythm date. The guys are really cookin' and the groove is there and everything. I come in and take a listen to what kinds of sounds I have. But if that sound is not there, then I don't record until the sound is right. There may be some other producers who would just go with the flow. 'If it's groovin', hey, you know, we'll save it in the mix.' But I've attempted to save things in the mix. It doesn't happen. It has to be on tape."

ON TAPE

"I do not know much about the characteristics, physically, of what tape is made of. I'm not too much into that—the chemistry involved. However, after spending six years at Motown—they had many, many rules and regulations. Now, one was that we always use Scotch Tape. When I ventured off into the world of independent producing, out of habit, and not wanting to change a good thing, I went right back to the same tape, which was 250. And I was then approached by other engineers telling me that if you switched, you could increase your performances here—you know, the bottom end, so forth and so on. And I did stray away and I did try cutting other projects on different types of tape. And the bottom line is that I came back to Scotch. I can't say that I noticed the difference of, you know, 3 dB and the low end with Scotch, and the other only gave me a dB-and-a-half. I can't say that. I only go with my ears, which tell me that my home is with Scotch Tape."

SCOTCH 250
WHEN YOU LISTEN FOR A LIVING.



Coming Next Month

- In November, audio education is our featured subject. We'll look in on a few schools to see what's going on in the audio classroom. And, our mini-course on the basics of tape specs will be concluded.
- And, as part of our continuing education in pro audio, we'll examine some basic theories of digital delay systems, and have a look at how to add a spectrum analyzer to your personal computer.
- All this and more, in the November issue of **db—The Sound Engineering Magazine.**

About The Cover

- Inside one of Record Plant's mobile vans. Keeping this control room-on-wheels rolling efficiently is just one more aspect of the business of audio. For a bit more detail about Record Plant's preventative maintenance program, see Irwin Diehl's feature story in this issue of **db.**

THE SOUND ENGINEERING MAGAZINE

OCTOBER 1979 VOLUME 13, NUMBER 10

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

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db Letters

To The Editor:

I read, with interest, Norman Crowhurst's column in the April, 1979 issue of **db** magazine. I'm not sure whether it was to have been intentionally an April fool's article or whether I am less knowledgeable than I thought, but Mr. Crowhurst's description of what happens when a signal at the resonant frequency of the transducer (speaker) is removed from the input of an amplifier containing a negative feedback loop has me totally confused, even though I have re-read his article several times.

I must take exception to Mr. Crowhurst's consideration of possible overload of the amplifier under these circumstances in that he is assuming that the transducer is capable of producing, in the absence of signal at its resonant frequency, the same level of signal into the feedback loop as was produced by the amplifier when the signal was being delivered (i.e. that the back EMF of the transducer would equal 20 volts which would result in 0.99 volts being fed back). This would seem hard to accept as the impedance of a loudspeaker usually rises to several times its nominal impedance at resonance, and for a high impedance winding to develop much voltage across the low impedance presented by the amplifier output, with the feedback connected, would seem a bit difficult. It would seem highly unlikely that a given loudspeaker, even if sustained at resonance in an open circuit condition, could produce 20 volts across its voice coil terminals. I would have to maintain that any voltage produced by a loudspeaker excited to resonance in the above described situation would have to be so small as to be inconsequential from the standpoint of amplifier overload. I can only think that if Mr. Crowhurst's theory was correct, there would be no juke boxes, discos or rock band sound systems!

Bruce L. Mackey
BLM Enterprises
Cortland, NY

Norman Crowhurst replies:

Starting at the end, the fact that there are juke boxes, discos and rock-band

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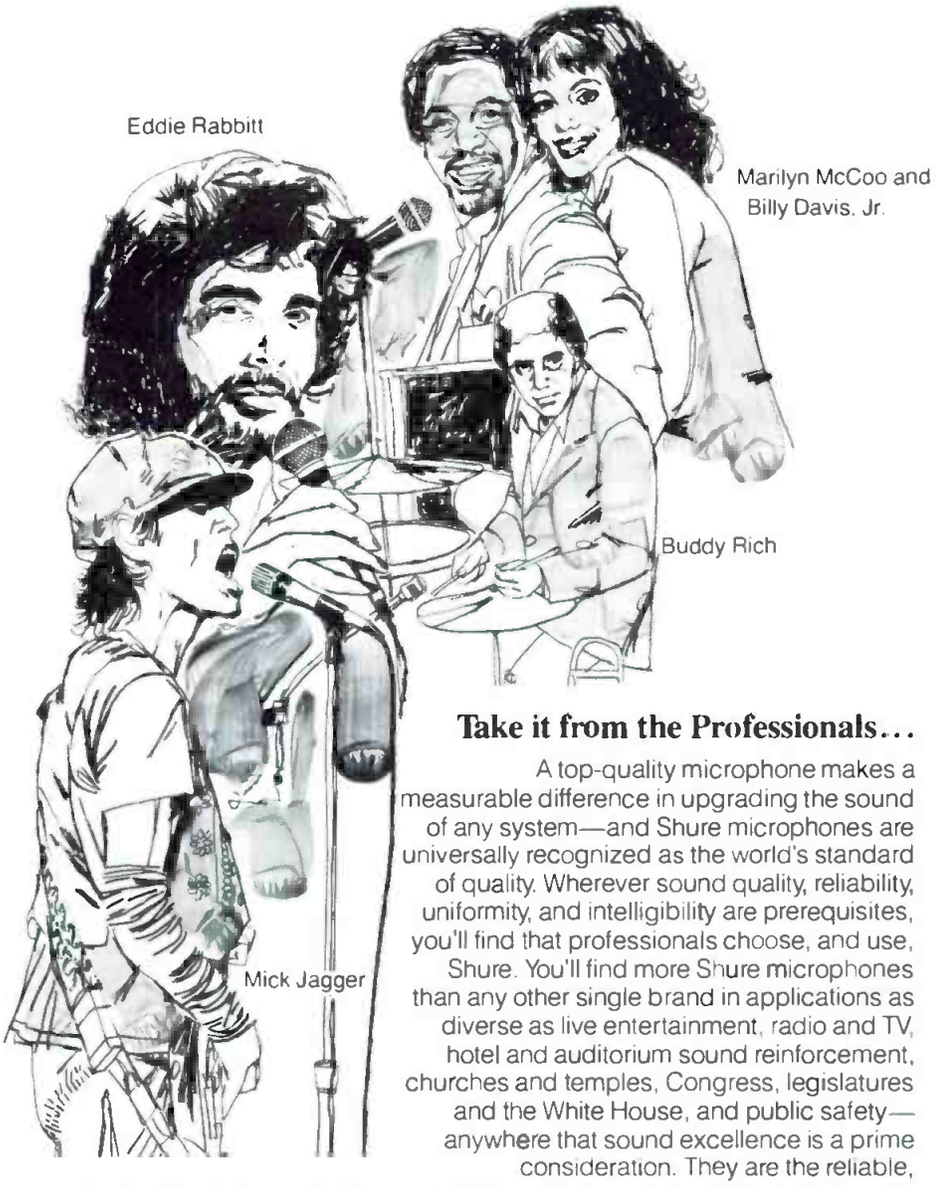

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letters (cont.)

sound systems, merely proves that good engineers *have* solved the problem my April issue discusses, for such systems. There is irony in his objection: the misimpression I wrote the April column to correct—one drawn attention to from my December column—Mr. Mackey seems to think is no misimpression, but fact.

The December column assumption was that an amplifier performs as Mr. Mackey thinks every amplifier must perform, to provide that low output source impedance, "come hell or high water." The reader who caught that statement had himself performed experiments proving this is not (always) true: that some amplifiers produce "interface" intermodulation distortion, due to that internal connection back to the amplifier's input.

My April column conceded that he is right, that in fact I had covered such events myself, both in a book published in 1952, and in a paper presented before the AES in 1957. Now Mr. Mackey disputes all this work as being impossible, and wants me to explain it again. What can I say that has not already been said many times over?

He seems to be analyzing performance on the basis of instantaneous response to individual frequencies. So if the drive at, say 110 Hz suddenly terminates, then suddenly 100 Hz is not *anywhere*, any more. That may happen in an electronic circuit, but in a loudspeaker, the device only works because its various parts move, which means they have velocity, inertia and other momentary properties, which cannot be dispensed with in an instant of time.

The short-circuit that stops resonant movement can achieve that effect, only if it is still there. But if the e.m.f. due to movement, which continuously counters the applied drive voltage, does not stop quickly enough when the drive voltage does, some intermediate stage can be overloaded (unless good amplifier design has taken care of it) before the normally low output source resistance stops the movement causing that back e.m.f. If that happens, the low output source impedance will not still be there to stop the movement.

This whole thing somewhat resembles what happened a few years ago on the East Coast—the big blackout. But in the early '30s, before I got into electronic design, I worked with what Europeans call the "grid" system, which Americans call "interties"—the things whose deficiency in this respect caused the blackout.

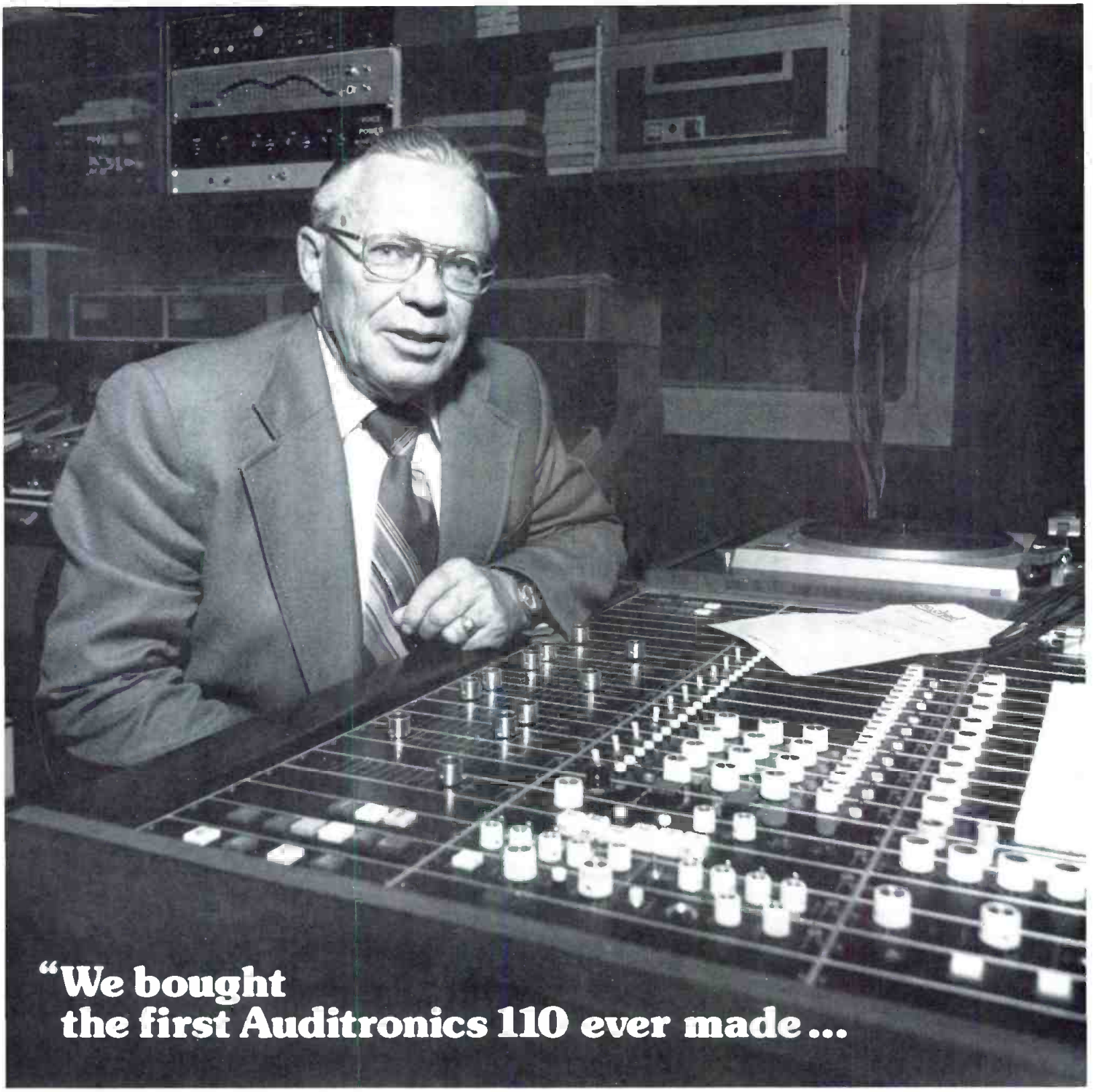
Back in England, I well remember discussions among my fellow engineers, who said such a thing could not happen. But we had detected the kind of surges that could cause it, before any widespread blackout occurred, and came up with a solution.

When I came to this country, and mentioned this to American power distribution engineers, they suggested I go back to the European "boonies." But as everyone now knows, it did happen.

Common to those situations is the time element. The fact that the power distribution frequency is 50 Hz (in Europe) or 60 Hz (here) meant that everything *should* stay in lockstep at that frequency and changes could happen only quite slowly. The surges that cause the trouble had steep wavefronts of equivalently much higher frequency, producing a "trigger" effect. The system goes "wild."

In amplifiers not adequately protected, the fact that every frequency takes a whole cycle to execute a cycle is once again the cause of the problem. If a sudden change allows, in this case the loudspeaker, to inject a signal at the output that momentarily disables some other part of the amplifier in a very small part of a cycle, a very similar trigger effect can happen. And when it happens you know it!

NORMAN H. CROWHURST
Dallas, OR.



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db Calendar

OCTOBER

Synergetic Audio Concepts Sound Engineering Seminars:

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17-19 Boston

30-11/1 Philadelphia

For information on these three-day seminars contact: Synergetic Audio Concepts, P.O. Box 1134, Tustin, CA 92680. (714) 838-2288.

21- **121st Technical Conference Equipment Exhibit of the Society of Motion Picture and Television Engineers (SMPTE).** Century Plaza Hotel, Los Angeles, CA.

27 **1979 Sound Business Show.** Ambassados Hotel, Los Angeles, CA.

NOVEMBER

2-5 **N.Y. AES Convention.** Waldorf-Astoria Hotel, N.Y.C.

Synergetic Audio Concepts Sound Engineering Seminars:

6-8 Nashville

14-16 Orlando

For information on these three-day seminars contact: Synergetic Audio Concepts, P.O. Box 1134, Tustin, CA 92680. (714) 838-2288.

15- **Billboard's First International Video Music Conference.** Sheraton-Universal Hotel, Los Angeles, CA. More information is available from the Billboard International Video Music Conference. 9000 Sunset Blvd., Los Angeles, CA 90069. (213) 273-7040.

DECEMBER

5-7 **Synergetic Audio Concepts Sound Engineering Seminar.** San Antonio, Texas. For more information contact: Synergetic Audio Concepts, P.O. Box 1134, Tustin, CA 92680. (714) 838-2288.

11-14 **International Entertainment Exposition.** Las Vegas Convention Center, Las Vegas, Nevada. For more information contact: American Expositions, Inc., One Lincoln Plaza, New York, NY 10023. (212) 691-5454.

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PATRICK S. FINNEGAN

The Oscilloscope in Audio

• One of the most useful test instruments in the broadcast station is the cathode ray oscilloscope: most generally referred to as the 'scope. These are available today from the most simple to the most sophisticated—and with a price tag to match. The scope allows us to measure and observe the waveform of the signal under test. This instrument can be used in many ways and in a variety of circumstances throughout the station. This month we will touch on a few of the areas it can be useful in audio work at the station.

THE SCOPE

Regardless of whether it is a simple or a very sophisticated instrument, each one is essentially a cathode ray tube with a pair of horizontal and vertical deflection plates. A finely focused beam of electrons is shot from the cathode to the faceplate which glows under the influence of that beam. The electrostatic force across the pairs of deflection plates which is caused by the applied voltages, forces the beam to be deflected accordingly. By moving the beam in accordance with the applied voltages at the deflection plates, the beam traces out the waveform of those voltages on the faceplate of the tube. The force across the horizontal plates moves the beam across the tube face horizontally, and that across the vertical plates moves the beam vertically.

To develop voltages of enough amplitude to create electrostatic forces of sufficient magnitude, internal amplifiers are provided for both sets of plates. The signal which is amplified and applied to the horizontal plates is from an internal oscillator or an external sweep source. The vertical amplifier increases the magnitude of the signal under test and is applied to the vertical plates. The horizontal sweep must be synchronized to the vertical signal for a stationary pattern, and the interaction of these two signals thus "draws" the waveform on the faceplate.

WHAT IT MEASURES

The oscilloscope is a voltage measuring instrument, as well as its ability to display the waveform of the signal for our observation. The scope will measure d.c. voltages but in the majority of instances our concern is for a.c. voltages of whatever type. The scope performs best with those signals which are more repetitive in nature rather than fleeting transients. It will measure transients but the trace will appear and disappear as fleeting as the transients themselves. A different type of scope, the storage scope, is needed for true observation and measurement of transients.

Since the full signal waveform is applied and appears on the CRT trace, voltage is measured in peak-to-peak values. The usual a.c. voltmeters and similar instruments measure in rms values. When actual voltage values are the purpose of the test, observation of the peak-to-peak waveform can mislead the engineer if he is comparing this value against, for example, voltmeter noted markings or indications on a block or schematic diagram. He may believe the measured voltage is far too high for that point in the circuit and thus be led to wrong conclusions: which leads to wasted time in trying to correct the wrong problem. The p-p values of the observed waveform are 2.83 times higher than the rms value as would be measured on a regular a.c. voltmeter.

Since the scope is a voltage measuring instrument it has a high impedance, unbalanced input. The usual value of this impedance is about 1 megohm. For many types of circuits this is adequate isolation. Yet in some critical circuits this amount will cause loading effects, so a 10:1 probe is often used. This probe ordinarily presents about 10 megohms to the circuit under test, but it also reduces the voltage applied to the scope itself to 1/10th of its original value. A 10 volt circuit signal voltage for example, would be reduced to 1 volt applied to the scope input. For voltage measurements the engineer must take this into consideration and multiply the measured value on the scope by 10 to obtain the original signal amplitude.

A.M. MODULATION

Perhaps the most important question to the a.m. broadcast station is whether the audio signal produced in the studio is being properly added to the rf carrier of the station. A correctly calibrated modulation monitor is required by the FCC to

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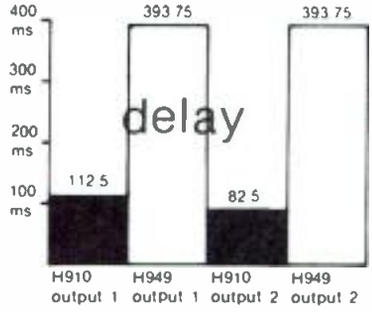

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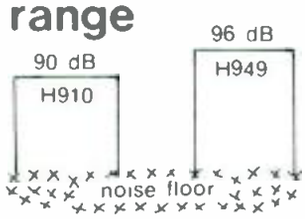
dynamic range



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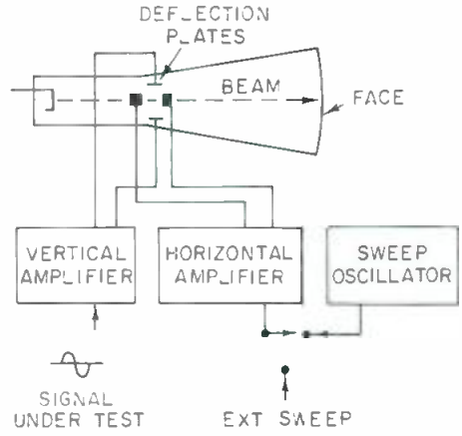


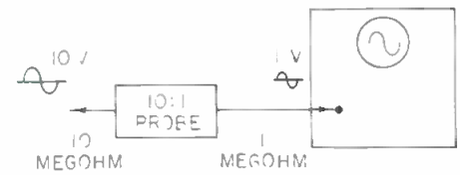
Figure 1. The basic scope.

be in operation all the time, yet no one can guarantee that the monitor will stay in calibration all the time. The oscilloscope can observe the modulated rf carrier directly and thus can be used as an independent modulation indicator as well as a device to calibrate the monitor itself.

Calibration of the modulation monitor can best be done with sine wave signal as the audio modulation on the carrier. Attach the scope probe to the modulated rf input of the modulation monitor and observe the modulated rf waveform directly on the scope. Increase the amount of modulation of the carrier until the two negative peaks of the envelope just touch each other. This is 100 per cent negative modulation (and the most important). With the carrier correctly modulated then check the modulation monitor. Adjust the carrier input control of the monitor so that the carrier level meter reads exactly 100. Make sure the modulation meter peak select switch is set to monitor negative modulation peaks and then observe the modulation meter. It should also read exactly 100 per cent modulation. Rotate the peak flasher control to 100 per cent and the peak light should begin to flash. If these conditions do not occur, then the monitor is out of calibration and must be recalibrated. Perform the adjustments as per the instruction manual for that monitor.

Observation of the modulated carrier on the scope with programming can also reveal some important facts. The wave-

Figure 2. A 10:1 probe gives greater isolation, but also reduces voltage applied to scope.



The logic behind the Revox B77.

The logic is the logic which is built-in.

It's an ingenious and highly sophisticated system—much like the human nervous system—which controls the deck's functions.

You can push any button in any order with no chance of damaging your tapes. Our motion sensing system constantly feeds status reports to the logic circuitry which activates your commands in proper sequence.

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The design and construction of the Revox B77 further guarantee smooth and accurate operation. To get the long-life advantage of ferrite without static build-up or heat degradation, we use Revox's exclusive Revodur heads, made of metal to dispel heat and static, and vacuum-coated with permalloy for durability.

The B77 has a unique capstan motor that's monitored by a tacho head to precisely control speed and limit wow and flutter to professional studio standards.

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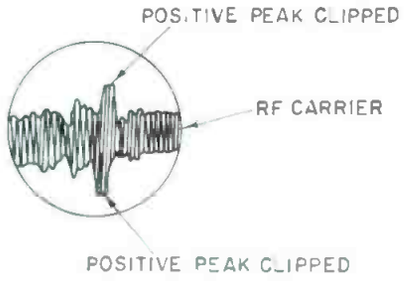


Figure 3. A clipped positive modulation peak can mean incorrect polarity of audio processor or saturation in modulator.

form in this instance will not be as steady as when sine wave is used, so observe both the positive and negative modulation peaks closely. If there is no audio processor which clips audio positive peaks but you observe a flattening of the positive peaks on the modulation envelope, there is a problem in the transmitter modulator: saturation is occurring on the positive peaks. And if the negative peaks are flattening out at the zero carrier baseline, the carrier is overmodulated in the negative direction. If the monitor does not show overmodulation on negative peaks: the monitor is out of calibration and must be recalibrated. Some stations use a processor which selects the highest peak and makes this positive for modulation and clips the negative peak (asymmetrical modulation). In this instance again observe the positive and negative modulation peaks. If the positive peak is clipped this means that the cable leads between the processor and transmitter have reversed polarity and must be corrected. But assuming the polarity has not been reversed and the negative modulation peak is clipped, observe the flat top of the clipped peak for tilt. If tilt is present (that hadn't been observed before), something has changed in the transmitter audio sections or modulator which is now limiting the audio low frequency response.

CART MACHINE PHASING

Stations in stereo often find that cartridge tapes do not always provide the best quality because of phasing errors that result from the cartridge and tape guidance in the machine. With better cartridges today designed specifically for stereo the machine head can be adjusted to provide an optimum phasing. And since the exact number of degrees of phase error is not as important as is the minimum or zero error, the Lizzajous scope pattern can be used for observation and whatever adjustment is needed. To obtain this pattern on the scope the Left audio signal is fed to the scope's vertical amplifier and the Right audio signal is fed to the scope's horizontal amplifier. Either a single or a dual trace scope may be used. In the case of the dual trace scope the Right audio is fed to the 2nd vertical amplifier input, but then this amplifier is switched internally to feed the horizontal amplifier and the results are the same and the same pattern.

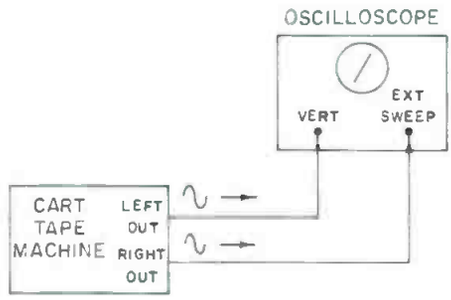
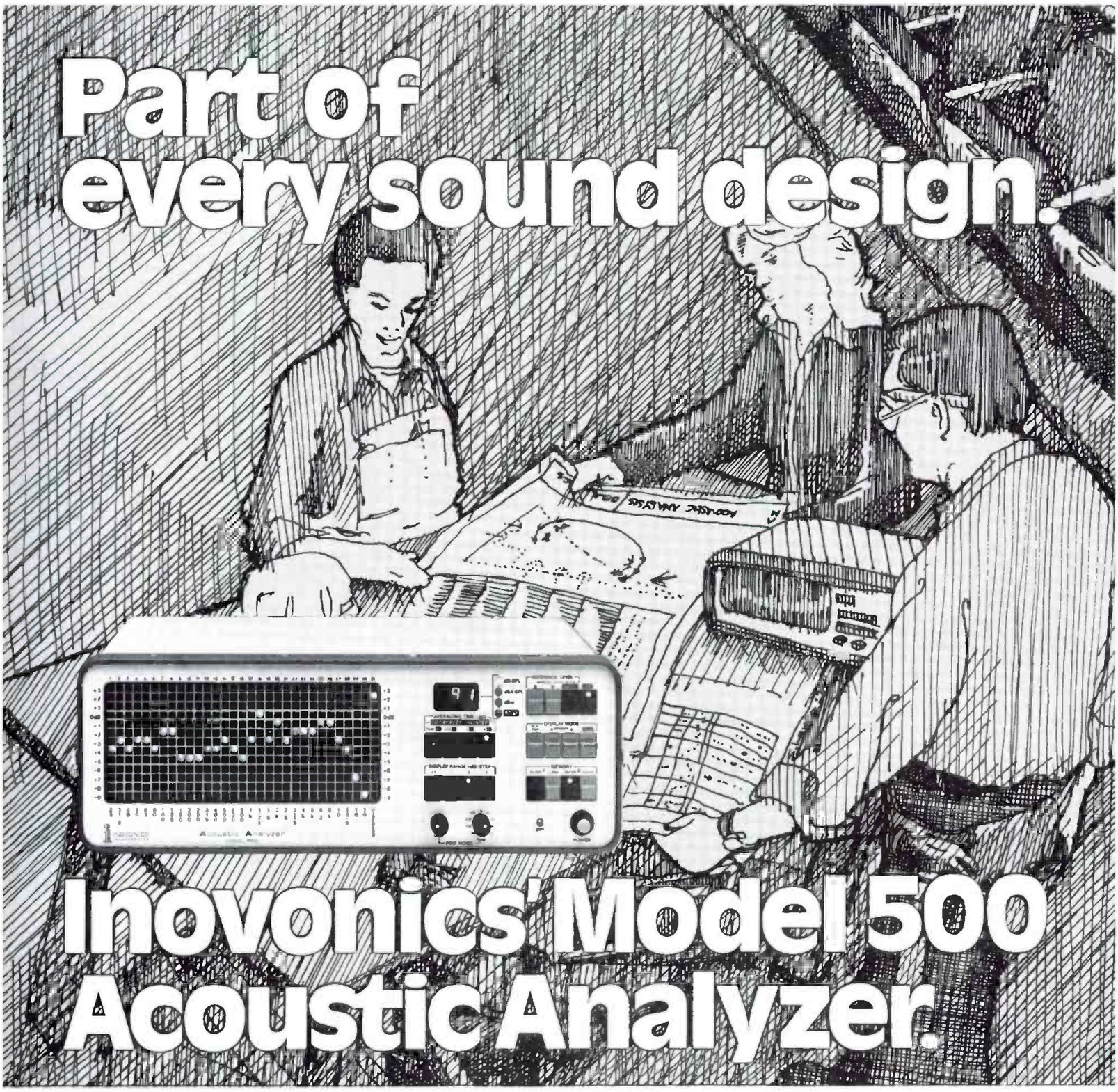


Figure 4. The proper connection of the stereo output of the tape machine to the scope for phase observation.

Before measuring the phase error of the tape machine it is important to measure the internal phase error of the scope. To do this feed both the vertical and the horizontal inputs of the scope with the same signal at the same time. This will produce a straight line from the lower left quadrant to the upper right



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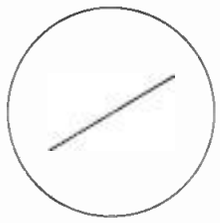
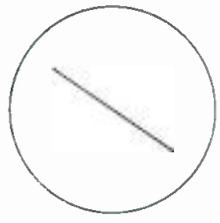
quadrant of the scope face. If there is not a straight line and the trace is opened up somewhat, this is the internal phase error. This can't be changed and is what the tape machine must be adjusted for. Once the scope is checked out, connect the audio outputs of the tape machine. Connect the Left output to the scope's vertical input, the Right audio output to the scope's horizontal input. Play a standard NAB stereo test cartridge used for alignment and response measurements. The first thing to observe is if the lines on the scope are still in the same quadrants of the scope face. If they are straight lines from the lower right to upper left quadrants, there is a polarity reversal of one of the audio channels. Check the scope connections for proper polarity, and if these are correct, check the leads at the playback head. Assuming that polarity is correct, then observe the flatness of the line, that is, if the two lines are closed or there is an opening or small oval shape to them. Be especially watchful at the higher audio frequencies of 10 kHz and above as phase errors are more critical in this region. If there is an opening, gently "tweak" the azimuth alignment of the play head to flatten the lines. Be careful not to overdo it and do not overcorrect for the scope's own phase error.



(A) Correct phase between Left and Right audio.

(B) Small amount of phase error.



(C) One channel with wrong polarity.

Figure 5. Lissajous scope patterns show phasing.

TROUBLESHOOTING

The scope can be very useful in some types of problems as a signal tracer, as well as a device to let us observe and identify that which may be causing the problem. Consider harmonic and intermodulation distortion. These can occur because of the lack of headroom in some units. Use the scope to observe the audio somewhere along the chain. Be observant of the audio peaks and look for intermittent clipping of the stronger peaks. If this is happening, move the scope down the chain and observe some more. If clipping is not now evident, the offending unit has just been passed. Check its gain controls to see if they are set properly. If they are, then some component has changed within the unit and repairs are in order.

Noise can be observed on the scope but when it is low in level it can be below the gain capability of the scope. One way to do this is to use the distortion analyzer and its internal amplifier to bring the noise up to scope level and at the same time maintain proper impedance and isolation of the unit. It isn't necessary to calibrate the analyzer unless you are interested in a specific noise ratio to audio. Leave audio off the channel or preamplifier, increase the analyzer meter gain and observe at the scope output for the noise. Rather than measurement, the scope is serving the purpose of identifying the particular type of noise. This, in itself, is often an important part of troubleshooting problems and can point to the source of trouble. ■

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NORMAN H. CROWHURST

db Theory & Practice

Digital vs. Analog; Linear vs. Switching

• In systems, one encounters the terms "digital" and "analog." In solid state devices, or semiconductors, one encounters the terms "linear" and "switching." After you've studied applications for a bit, you conclude that digital systems use switching-type semiconductors, while analog systems use linear-type semiconductors. In general, that is quite right, but as you have probably gathered by its being selected as a subject for this column, it is not quite as simple as that!

Digital vs. analog can be illustrated quite well by a couple of commonplace examples. To tell time, you can have digital or analog clocks or watches. To calculate, you may use a digital or analog calculator. In case you are not familiar with those terms, even in that context, a digital clock or watch is one that tells you the time with numbers, such as 3:15. After being at 3:15 for precisely 60 seconds, the numbers will change to 3:16.

On the other hand, an analog clock uses hands that move over a circular face, practically continuously. During the 60 seconds between 3:15 and 3:16, the minute hand would slowly move from one position to the other, continuously, if imperceptibly.

DIGITAL CALCULATOR VS. SLIDE RULE

A digital calculator is virtually the only kind in use today. But some of us remember when an engineer was identified by that thing called a sliderule, invariably sticking out of his pocket, as his badge of office. Ask an engineer a question—virtually any question, in those days—and he'd pull out the sliderule, much as anyone else looks at a watch or clock to tell the time.

Like the digital timepiece, the digital calculator gives a readout, in numbers. It can be programmed to a variety of ways of reading out, but they all use discrete numbers. The sliderule, on the other hand, like the old-fashioned timepiece, has numbers on it, but you do not exactly read the numbers; instead you interpolate what the hands tell you, by their position with respect to the numbers. You interpolate a sliderule in much the same way. The sliderule was an analog calculator.

What has that to do with audio? Well, put simply, for years audio had to be analog: an audio waveform was amplified, and processed in other ways, based on either maintaining, or changing, its shape as an analog of the sound it represented. Sound could be synthesized, by putting frequencies together, but what you put together, in those days, were waveforms, so it was still analog.

DIGITAL TECHNIQUES

Nowadays we are getting into digital techniques with audio. This is like running a high-speed computer over the waveform, and having some kind of memory remember, or program, the rate at which the numbers change, and process the waveform, in terms of its numbers, rather than its analog shape. Doesn't that seem awfully more complicated than the simpler linear amplifiers and other audio devices of earlier times?

More complicated, maybe, but look what has happened to calculators and time-keeping. The calculator or the digital watch must contain the equivalent of hundreds, probably thousands of individual transistors which, in earlier times, would have cost the earth. But modern technology has changed all that, by use of integrated circuits—i.c. chips—that really cut cost. The fact that you can get a digital watch, for $19.95 that is a better timekeeper than one of the old analogs costing many times that much, shows what we have gained: precision.

The same with calculators. A precision sliderule was costly—far more costly than a digital calculator that can actually outperform the sliderule by a long way, in every way. That is why engineers don't use sliderules any more. There is much the same to gain in audio, once we learn how to use it.

Of course, there are linear and digital i.c.s, just as there are linear and digital transistors. Only in individual transistors, those used for digital work are usually called "switching" types. This is because they are intended to be used in two-state mode, between which states they switch. Which brings us to the question: What really is the difference between a linear semiconductor and a switching semiconductor?

When you get into i.c.s, of course, the

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theory and practice (cont.)

circuit configuration makes the difference: the transistors and other semiconductors of which it is composed, are arranged in one of two ways. Either so the individual transistors switch from one state to the other, and cannot be held at any intermediate condition, such as a "flip-flop" circuit; or else so that they do operate over a continuous range of variation, like an amplifier.

But the individual transistors and diode that go into such a package, although they are produced by a process that puts hundreds or thousands of them together on a tiny chip, have characteristics that render them more suitable for either linear or switching operation. If you're buying an i.c. chip, you don't have to bother about it, because the chip designer took care of that. But as soon as you get off of integrated circuits, into what is known as discrete components—meaning you are now dealing with individual transistors and other circuit elements, not with complete chips, you need to know what it's all about.

LINEAR OPERATION

Applied to any semiconductor, the word "linear" is really a misnomer. A resistor can be linear, but a semiconductor cannot: it conducts one way, does not the other. But the relationship between "how much" it conducts, and the control, be it voltage or current, that determines that "how much," can be more or less linear, *over a certain range*.

Anything that goes from nonconduction to conduction, does so in non-linear fashion, with a sort of curve: square-law, exponential, or something. But if that conduction is controlled in a way that produces amplification, such as the base current controlling collector current in a grounded emitter stage, there is usually another kind of curvature, coming into the picture: beyond a certain base current, there will be no further increase in collector current.

By properly selecting values in the circuits associated, the relationship between collector current, and the base current that controls it, can be quite close to linear, between certain limits. This means that, between those limits, every microamp change in base current will be accompanied by, say 200 microamps change in collector current.

But at one place a change of 1 microamp base current may produce a change in collector current of 180 microamps, while at another place, it would be 220 microamps. That is non-linearity and must be corrected by use of negative feedback. In theory, a linear transistor has been designed so that, by using the proper circuit values in association with it, it is close to linear, so that feedback will make it close to perfect.

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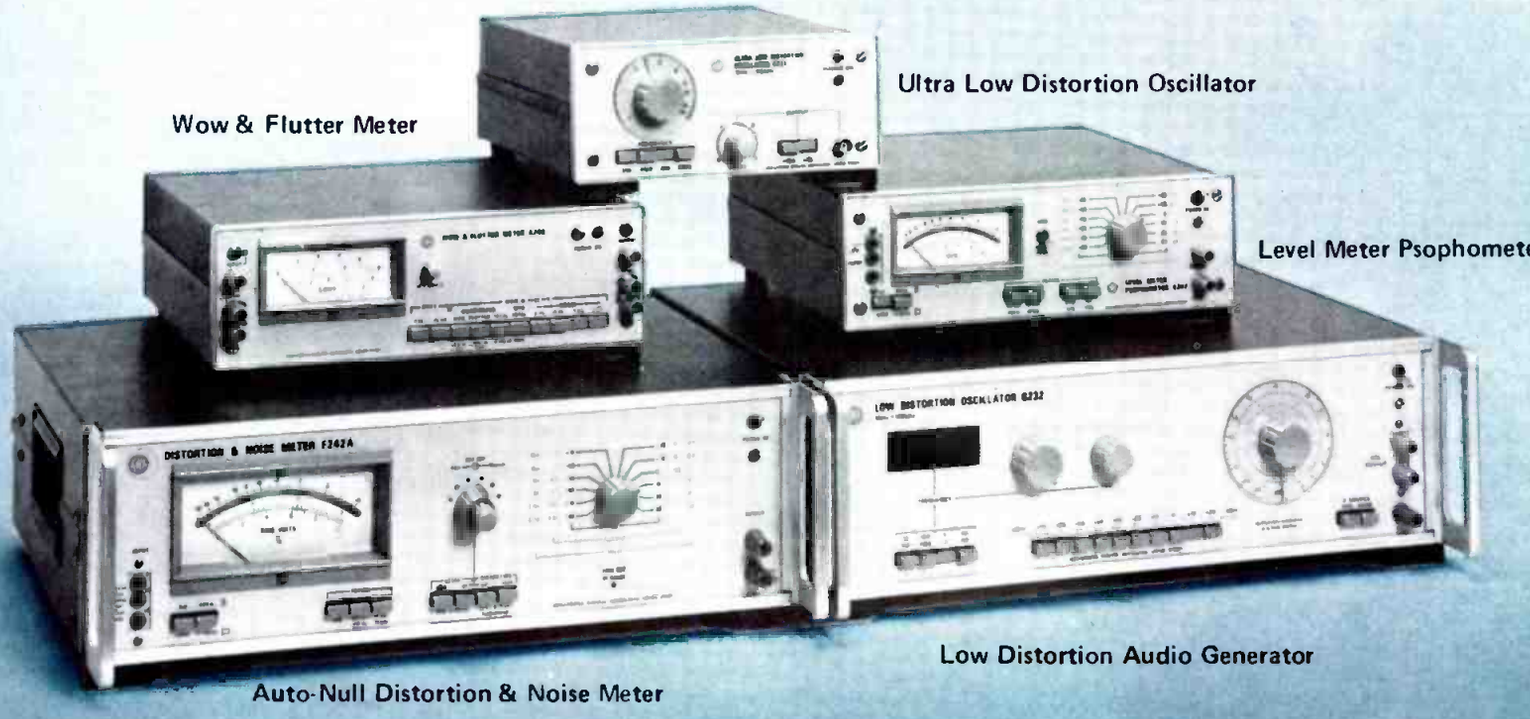

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will tell you how good it is, what values to use, so you can build a circuit round it that makes it as linear as you may want.

SWITCHING OPERATION

A switching transistor, on the other hand, is intended to be operated between two extreme states: fully conducting, or completely non-conducting. This does not mean it does not have in-between states, but that it spends as little time as possible there. If it fully conducts at 1 amp, then when it is switched on, current changes from zero to 1 amp. There is an instant in time when it is half an amp, or any other intermediate value.

But the circuit is arranged to expedite the change, so it spends as little time as possible in between. That is called switching speed. And a switching transistor is designed to give the maximum switching speed, not to switch with great linearity. But there is no magic that makes one transistor work as a switch, and another as a linear amplifier. What makes that difference, is the circuit you build around it. And of course, if the transistor comes as a tiny part of an i.c. chip, that is already built around it, you don't have that option.

Whether a semiconductor works as a linear or switching device, it takes time to change its state: the response of the controlled current, to the controlling current, is not instantaneous. When base current changes, collector current changes a little later, perhaps only a microsecond or less—time measured in nanoseconds perhaps—but it does take time.

In the linear mode, this time relates to the high-frequency roll-off of the system. The faster the changes occur, there comes a point where the semiconductor ceases to follow them completely, because they are too fast. In the switching mode, such time limits the switching capability: how many times a second, or whatever units you use for measuring time, it can perform such a switching action.

And if you are using switching circuits for digital audio, that of course relates to frequency roll-off again, but in a slightly different way. Where the linear mode gradually fails to follow, the switching mode reaches a point, where the behavior becomes erratic.

A LITTLE OF EACH

Now, is a synthesizer, or an electronic organ, digital or analog, linear or switching in the circuitry it uses? Today, few of them are either completely one or the other, but a mix of each. The earliest oscillators, used to generate audio frequencies, used positive feedback that was frequency selective: the frequency selection could use either L-C circuits, or a system of R-C circuits. Either way, just one frequency got fed back, so an oscillation built up at that frequency. They are little used today, because the exact frequency depended on so many factors that tuning became quite involved.

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Waveform fidelity. It should be the objective of any professional component. Because perfect waveform fidelity would mean an output signal that's a mirror image of the input signal.

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ST-9030. THD (stereo, 1 kHz): Wide—0.08%. Narrow—0.3%. S/N (mono): 80 dB. S/N (stereo): 73 dB. FREQUENCY RESPONSE: 20 Hz—18 kHz +0.1, −0.5 dB. SELECTIVITY: Narrow—90 dB. CAPTURE RATIO: Wide—0.8 dB. IF, IMAGE and SPURIOUS RESPONSE REJECTIONS (98 mHz): 135 dB. STEREO SEPARATION (1 kHz): Wide—50 dB.

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A frequency counter is a digital device. In earlier electronic organs, frequency counters, or dividers, produced successive octaves down the scale, for each of 12 master frequencies that produced the top octave of notes. But today, much more sophisticated counters are available. Starting with a few megahertz, as the master frequency, different counters can count off quite high numbers, to produce all the top octave of semitones, properly spaced, by a built-in count programming. That is digital. Then lower octaves can be obtained from that top set, as before.

An advantage of this method is that the whole organ can be tuned by adjusting the frequency of one master oscillator. A control available to the organist enables him to tune his instrument into unison with an orchestra, a piano, or whatever, almost instantaneously. Only the digital technique makes that possible. But from there on, a wide variety of techniques can be brought to play, in producing timbre, waveform variations, and so forth. Some are digital, some are analog, and some a mixture of each.

It's a challenge, this new world of audio. But when wasn't it? How do you think we got to where we are? ■

MARTIN DICKSTEIN

db Sound With Images

Visual Communications Congress

• This being the fall of the year, perhaps a quick look back at a happening before the summer might be of interest to you. The 2nd Annual Visual Communications Congress and Exposition, a 3-day event, took place in N.Y. Sponsored by several magazines of United Business Publications, it included seminars, workshops, and exhibits, as well as concurrent programs. They expected about 10,000 attendees this year, and they weren't wrong, judging from the number of exhibit visitors and the size of the seminar and workshop audiences.

On the opening day, the International Television Association presented a full schedule, with 3 morning workshops and an afternoon seminar. The workshops were entitled "View of The Outside Eye," "The Great American Teaching Machine," and "Advanced Production Techniques." The first of these three had two experts in communications report on what the senior people of companies involved in communications were telling them of their problems. Subjects covered included major concerns of communications corporations and what the solutions might be, how much they were willing to spend to solve these problems, and how internal television specialists might help.

The second workshop covered such subjects as how people learn from broadcast television, how to adapt broadcast techniques to training, how to program for greater training impact, and objectives to set for production of training materials. An expert from the American Society of Training and Development ran this session. The third, gave the visitors a look at new production techniques and technological advances, with special emphasis on the subject of the "real" cost of production. Topics included budgeting techniques for theatrical and corporate films, how to work with unions, techniques for producing special effects for video, and a demonstration and discussion on Steadicam, and its applications.

The afternoon seminar covered corporate video, its power and "politics," and who needs an "angel" and how to get one. The overall title was "Power, Success and Video," and had two experts for corporate management and administration to discuss these topics.

The New York Photographic Conference also ran on the first day. They, also, had a full day. A seminar for professional photographers and photographic management covered such subjects as preservation and storage of photographic materials, photography for publication, the new Copyright Act and how it affects photographers, the photographer's role in AV, and some ideas and gadgets for the professional photographer.

Also offered the first day, was a full-day seminar on Criminal Justice Training and Education (covering all aspects of the use of audio-visuals to improve training results); an 8mm workshop (half-day) giving information on the production of economical science, documentary, and educational films; a Video-Tape Production Association (VPA) seminar on 1" tape; and an introduction

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dbx noise reduction is rapidly becoming the new industry standard because it provides 30 dB noise reduction and 10 dB headroom improvement, from 20 Hz to 20 kHz, without the problems of other systems. The dbx system does not require critical and time-consuming level-match adjustments. Its true RMS detectors are not sensitive to tape recorder phase shift. Its voltage-controlled amplifiers (VCAs) operate over a 100 dB range. Overall the dbx system provides a level of performance and a simplicity of operation that is unsurpassed.

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by Magnavox of its video disc system, Magnavision, to the New York area. There were only 3 showings of Magnavision on-the-hour during the afternoon, but judging by the number of people who asked where the demonstrations were taking place, this was a most popular exhibit.

DAY TWO

On the second day, there was a full-day Marketing Communications Conference. Subjects covered were concepts of imagery in advertising and promotion, audio-visuals at point-of-sale, anatomy of a sales meeting, techniques of dynamic speech making, audio-visuals for effective field selling, and videocassettes and videodiscs.

There was also a full-day workshop on slide production, covering planning and preproduction, writing a slide program, creating the slides, preparing an audio track, programming and equipment, post-production wrap-up, and audio-visual equipment; and a half-day IFPA (Information Film Producers Association) conference with a film festival during the second half of the day. Subjects touched upon included how to solicit government motion picture film and video contracts, giving details on the new federal procurement and contracting policy; and a discussion of telecommunications and new opportunities for the independent producer. The film festival included an analysis of award winning business productions.

Day two also provided a seminar on International video networks, displaying techniques and case histories for corporate management involved in international communications; a Children's Television Conference, a luncheon and forum on children's media for writers, educators, producers and broadcasters (with an update on the state-of-the-art and forecasts for the future); a half-day seminar on medical television covering cable and closed circuit TV; and a repeat showing by Magnavox.

DAY THREE

On Wednesday, the last day, the Association of Multi-Image sponsored a Multi-Media Conference, including such subjects as the "live" multi-media show, the artist's role in multi-image, multi-image production, IBM as a client and in-house producer, National Geographic's production program, and how American Business Press uses multi-media. There was also a seminar (full-day) by the National Academy of TV Arts and Sciences discussing the legal "do's and don'ts" of TV production and Pay-TV as an opportunity for independent producers.

A half-day seminar covering Crime Scene Photography and Surveillance also took place on Wednesday. Intended for criminal investigators, the discussions included photographic coverage of the crime scene, the gathering and presentation of physical evidence, laboratory procedures, basic photographic problems, use of special lenses, and low light situations and light intensifiers.

The last day also offered a half-day discussion of practical photographic optics including interface between camera and other optical devices such as microscopes and telescopes, producing images at fixed scales, understanding light and filters, and making simple optical calculations. This one was sponsored by the Biological Photographic Association. There was also a seminar (half-day) on video tape creativity discussing special effects, electronic titling, and a critique on technique sponsored by the Videotape Production Association (VPA); and a half-day meeting discussing the need for revival in religious visual media coordinated by the Tri-State Media Ministry. The subject here was a study of the re-awakening interest in audio-visuals, broadcast and cable media for religious leaders, educators, and producers.

As you can see, there was something for everybody. There were chapter and council meetings of various organizations associated with the visual field, and a very large exhibit area with about 300 booths. Software, hardware, and services were all represented. There were numerous multi-image exhibits with multi-projectors on large screens. Staging Techniques raised a metal platform to near-ceiling height to put the projectors over the heads of the audience, sitting or standing, to show a performance in slides which came as close to a film-smooth image in motion, as possible. Clear Light, maker of programming devices, also had a multi-image exhibit. They provided a more unique arrangement, however, for their slide projectors. The units were positioned under the large screen and faced the audience. The visitors stood behind a small (waist high) wall to watch the show. On the screen-side of the wall, there was a large mirror, unseen by the viewers in normal watching position. Thus, they could see the screen images and the action of the slide projectors creating them simultaneously. (To see the mirror, the people had to walk around the wall.) An interesting way to demonstrate the action of projectors controlled by their programming devices. Perhaps in a subsequent column we'll discuss the other exhibits.

All this is mentioned to advise you to look out for the next Visual Communications Congress. There will be a lot to see and hear, and, of course, a lot to learn. ■

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db Reviews...

The Incredible Secret Money Machine by Don Lancaster; Published 1978 by Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268. 159 pages, paperback, $5.95

• Don Lancaster is well known for his clear and understandable, no-nonsense technical writing. Indeed, his published contributions to personal computing, when it was but a fledgling technology, make him a kind of founding father of that industry. His articles have appeared in many consumer electronics and personal computing magazines.

Though his work in these magazines has gained him an enviable recognition, probably Lancaster's best-known labors have been his series of technical "cookbooks."

When digital integrated circuitry became a reality in the late 60's and early 1970's a sort of void in understanding prevailed among a large segment of the "old school" electronics practitioners. The applications literature supplied by i.c. manufacturers was filled with new terms, jargon, and references to mysterious new concepts, making it very difficult to apply the old bootstrap technique to one's personal improvement. Don Lancaster did his part in filling this information void with his cookbook series. The *RTL Cookbook*, *TTL Cookbook*, and *CMOS Cookbook* are all aimed at promoting an understanding of techniques and methods employed in the application of digital i.c.'s. Other books published by Lancaster are; *The Active Filter Cookbook*; and the *TV Typewriter Cookbook*.

At first glance, Lancaster's most recent book would appear to be a departure from his earlier work. But, the same style employed in his technical books is used in **The Incredible Secret Money Machine,** to explain clearly and simply the strategies, methods and techniques of operating a small technical business. **The Incredible Secret Money Machine** is a book about making money, or more appropriately, about making a living: "doing the things you just love to do." The book is written with the technical or craft-oriented individual in mind. Anyone who would be self-employed in a technical capacity, full or part-time, or anyone with their own technical business or proprietorship should find Don's book a most useful resource for business information and advice.

A money-machine, by Lancaster's definition, is any small business operation or enterprise that produces income for the individual. Whether it involves the construction of circuit prototypes, refinishing antique furniture, photo retouching services—even a small recording studio—each would classify as a potential "money-machine."

Don't consider this as just another "how to start and run your own business" book: this one is refreshingly different. The author seems to embrace the concept of small business for small's sake. The author opposes conducting business by committee, and in fact, sees employees as an evil—even when necessary.

Though the book presents a clearly-defined approach to conducting business, Lancaster doesn't insist upon a rigid set of rules. On the contrary, within the guidelines given, he suggests that each person set his own goals and modus operandi.

This reviewer found the book pretty much on target, insofar as it offers a general philosophy for running a small business. Of the ideas suggested for business success, one was concerned with being a "doing dogger." Lancaster defines this as "*...someone who makes things happen. Those who act rather than are acted upon.*" Also, under a chapter called Tactics, the author advises; "*Never advertise or accept payment or orders for an undeveloped product, no matter how good it's going to be.*" Elsewhere, he counsels, "*Study the works of chairman Mao, know your enemy. Anticipate what they are going to do and then completely change the rules of the game to something they simply won't understand.*" Another particularly meaningful bit of advice—"*Never assume institutions or people will change with time—they won't. Incompetence and greed are immutable physical constants of the known universe.*" Whether you agree with the author's philosophy or not you will surely appreciate the free-spirit behind it.

The book's ten chapters (numbered 0 to 9) are well balanced with advice, admonitions and well-placed humor. For example, in Chapter 7 titled, Some Unmatters, the author recommends; "*Never confront any government official on any level at any time for any reason. There is nothing more dangerous to your money machine than a hacked-off bureaucrat.... Be nice to the people at the post office. After all, it's a real challenge damaging and slowing up all that mail.*"

Other chapters range in subject from establishing personal goals; to Strategy; Keeping Informed; and there's even one on Investments.

This book reads like a novel and once you start you may not want to put it down. Good reading and good luck to all you doing-doggers and your own Secret Money Machines. ■

Irwin Diehl

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db New Products & Services

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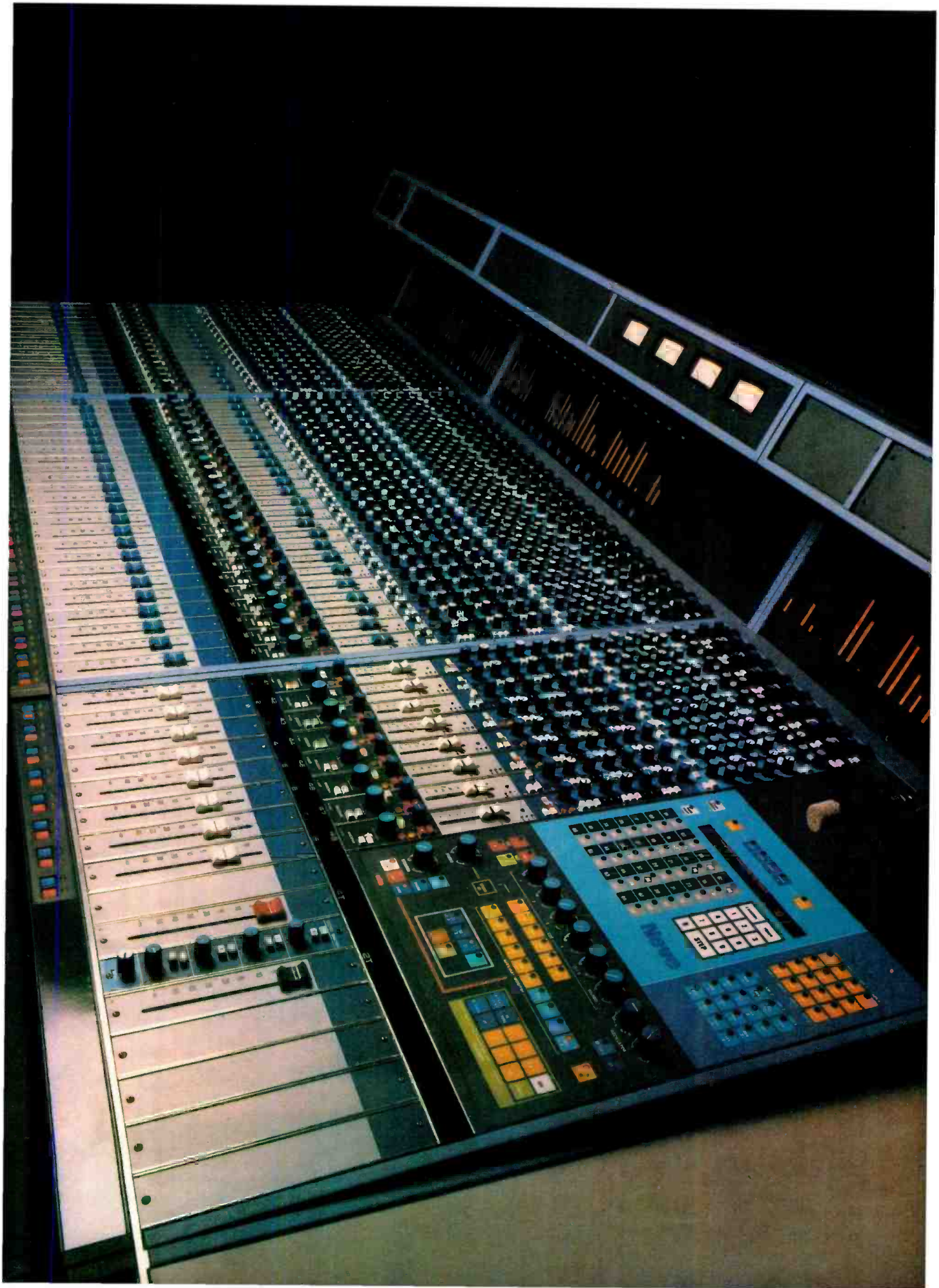

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Just introduced to the world at the AES Exhibition in Los Angeles in May 1979, this thoroughly new console range received much praise for the quantum leap in sound recording technology it represents. Building on their computer/digital experience earned through the successful NECAM Computer Mixing System, Neve engineers have developed the technically superior 8108 range. The console is in production and early deliveries are now being made to several West Coast top name studios. The 8108 Range is available in 56/48, 48/32 or 32/24. Join the Neve world of excellence. Please call or write for our beautiful 8108 brochure.

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All track (bus) assignment is performed at the Central Assignment Panel, allowing up to 56 inputs to be switched to any (or all) of up to 48 tracks. Digitally controlled FET switches provide super reliable routing steered by a powerful micro-processor. Solid state memories can store complete track assignments for up to four different recording sessions, available for recall on moments notice. Days, weeks, months or even years later, input to track switching from memory for a 56/48 console is accomplished in about 2 seconds.

Instant Interrogation.

With the increased number of inputs and tracks being used in studios today, making it difficult to quickly realize track assignment during operation, Neve devised a unique Assignment Interrogation System which enables the engineer to instantly realize assignment, either *from* an input or *to* a track. "Finger close" buttons are mounted below the faders in a recessed area. Assignment indication is cleverly provided both below the faders and on the Central Assignment Panel, simultaneously readying this panel for reassignment of inputs and tracks.

Simultaneous VU/PPM.

The 8108 Range features operator selected mode of metering. Dual column high resolution bargraph meters can provide VU only, PPM only, or VU/PPM simultaneously. Additional bargraph meters may indicate reverberation send or return. Conventional VU meters available on mixdown output.

NECAM or VCA Grouping.

The 8108 Range gives you the widest choice in fader systems. VCA Grouping is standard. NECAM Computer Assisted Mixing may be added to bring the ultimate touch to the 8108 console. Manual faders may also be fitted.

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No other console provides the serviceability and reliability like the 8108 Range consoles. Computer-wiring is used virtually throughout, with solid state switching cards replacing hundreds of mechanical switches. Channel strips are easily removed, in turn with readily removable subassemblies. It is the finest and most advanced console system ever introduced. Please call or write. The Neve 8108 Range is in your future!

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db Editorial

IT WOULD SEEM that our attention this month to the business side of pro audio is well-timed. Almost as we go to press, we've received a few news releases that should be of more-than-routine interest to the business-person in the studio. (See our **db Special Report** in this issue for more details.)

Business? Yes, audio is a business (even if your buddy at the IRS can't cope with your itemized deductions, including 105 LPs, two new turntables, and bi-amped speaker systems in every room at home).

Whether you're about to get started in the basement, or remodelling Studio F for film scoring, don't forget that, just because you're enjoying yourself (we hope), you're still "in business." Keep that in mind, and your basement operation may eventually expand into a multi-media super-studio. Or forget about it, and your super-studio will wind up in the basement.

At either extreme, sooner or later you may need some money. There's lots of it around, but if you don't happen to have your share lying about, you'll want to explore **Recording Studio Equipment Financing.** Author Hamilton Brosious has been engineering sales, leases and equipment rentals for years, and here he offers some counsel on how to get the bank to part with the bucks.

Once you're in business, you'll want to stay there, and minimizing down-time will certainly help. Recently, we've covered test gear extensively, since our expanding audio technology demands even more attention to this side of the audio business. This month, Irwin Diehl offers some thoughts **On the Technical Administration of a Studio.** After all, that fancy test gear won't help much if it doesn't get used efficiently.

Irv also reports on Don Lancaster's **"The Incredible Secret Money Machine."** Not a new piece of studio hardware, this often-irreverant little book describes one man's adventures in his own business.

One of the little tasks of the magazine-editor business is getting to know what the insides of airplanes look like. But it's not *all* that bad. One of those airplanes recently landed in Vienna, and you'll find a report on our business trip to Austria in this issue.

We also get a head-start on next month's subject of education, with **Understanding Magnetic Tape Specifications—Part I.** Our January issue began the year with an in-depth look at magnetic recording tape. And now, author Dave Rubenstein begins his two-parter on magnetic tape specs, and "specsmanship." He'll be back again next month, for the conclusion of this "education" on magnetic tape specification basics. ■

HAMILTON H. BROSIOUS

Recording Studio Equipment Financing

A financial Game Plan to win loan approval.

THINKING about beginning, or perhaps expanding, a recording studio operation? If you are, the money is out there, waiting for you. In fact, there's more capital available for project financing now than at any time in recent history. However, when the expansion-minded recording studio operator, or prospective new owner, sallies forth into the financial arena seeking funds to pay for his venture, the exercise is more-than-likely doomed to failure from the very beginning. The problem lies with the prospective borrowers' considerable lack of understanding of the requirements of various lending institutions.

You'll have a better chance for loan approval if you spend some time developing a financial game plan with these requirements in mind. This financial plan is just as important as the console, monitors and microphones you chose, so devote as much attention to it's preparation as you did to your equipment list. You'll agree it was time well spent, once you've obtained financing approval.

"TWO WAYS OUT"

One of my good friends is "Kemp" the banker—head of the entertainment loan unit at one of the world's largest banks. Recently at lunch in Manhattan (on the bank!), we chatted about what it takes to get a bank to part with some cash. Loans usually have to have "two ways out" for her bank to make a loan. This means you must convince the bank that the loan can be repaid (a goal devoutly desired by all loan officers) in at least two ways.

The customary first way out is for the borrower to have sufficient business strength to permit loan amortization, or putting it another way, to make the payments. The second way out is to put up some sort of collateral equal to the amount of the loan. Then, in the event of business reverses, the bank can recover the outstanding balance. Usually, equipment being purchased should provide half of this second way out. The remaining half may be made up by a personal asset pledge by the borrower or, by a guarantee from a third party (usually Uncle George).

At this point the judgement factor becomes important. According to my banker friend, "Kemp," a loan request that is a little "thin," can be strengthened considerably by a well-done, detailed presentation on the general industry and the specific project. We're going to try, in this article, to explain some of the elements of such a presentation.

Incidentally, the reason for that lunch was part of her bank's

"Ham" Brosious is the president and founder of Audiotechniques, Inc., Stamford, Ct., and is also president of Audiotechniques Rentals, New York City. Mr. Brosious is frequently retained by banks, insurance firms, leasing companies, law firms and recording studios for the purpose of financial consultation and for equipment appraisals.

entertainment financing unit's plan to develop its expertise in the recording business, an area that the bank considers very attractive for new loans.

LOAN REQUIREMENTS...OR, HOW MUCH FOR WHAT?

Number one question from the loan interviewer has to do with how much you want to borrow. This is not the time to tell him that you "aren't quite sure," or, "it's around 40 grand." Or even worse, "how much will you let me have?" Give the exact amount you want to borrow and *support it* with a complete equipment list, including the price of each item and the manufacturer.

The list should also include the name of the proposed equipment supplier. Don't forget to include the appropriate taxes, as well as crating, installation and shipping charges. Most lenders are not happy about lending money on custom-manufactured equipment. They recognize the higher resale value of standard stock equipment and feel similarly about used equipment versus new.

BE AN EDUCATOR

You know your business, but most lenders don't. One of the very first requirements for successful financing is to thoroughly acquaint the prospective lender with accurate, reliable facts about the independent recording studio business and how it relates to the record industry as a whole. With a well-prepared presentation on the dimensions of the recording industry, the odds on your loan officer's approval of your application are considerably enhanced. This type of information should make note of long-term record industry growth, the rapid increase in number of record labels, increased listening exposure, proliferation of recording artists, growing demand for product excellence and...you take it from there. Sources are everywhere...trade magazines, Billboard, Cash Box, Variety, Record World, db—plus the entertainment sections of major newspapers.

Equally impressive is a listing of the dozens of potential types of clients for your services, from demos to record label LP's—from advertising jingles to church choirs. The main point is to demonstrate that the recording industry is a dynamic, growing business.

THE RECORDING STUDIO BUSINESS IS VERY PROFITABLE

Now that you've defined the market, let's see how your independent studio fits into that market and what are your chances for success.

All lenders understand profits. If you can't reasonably forecast profits for your new venture, better rip up your loan application and look for a rich uncle! Fortunately, however, profits in the recording studio business are considerably higher than in most new manufacturing, distribution or retail business. Many recording studios currently operate at forty-to-fifty percent pre-tax earnings, and have the added advantage of relatively few employees and limited inventory. The almost total absence, in recent years, of recording studio equipment bankruptcy auctions is a testimonial to the strength of the industry. There has been a continuous rise in studio gross and profit for nearly ten years, and the continued strength of record sales and advertising studio requirements—plus the advent of new media such as video discs, digital recordings and video cassettes—can only lead to a continuation of this growth pattern.

Research studio rates and profits with friends in the business, and get this story down on paper, in your own words.

OPERATING STATEMENTS

Sandy Schneiderman heads his own leasing company (Terminal Marketing, Suffern, N.Y.) that specializes in recording studio financing. Sandy suggests a minimum of five years successful operation as one of the criteria used in determining the credit-worthiness of a company. Unfortunately, most loan applicants don't have nearly that amount of longevity under their belts. In fact, many are "start ups," or new ventures. However, if you have been in business for awhile, your operating statements will be among the most valuable pages in your loan application. These should be prepared by an accountant and hopefully, will be audited or certified statements. If you've been in business and can't document your results with statements, better forget about borrowing money from conventional sources. Leasing companies and banks don't put much stock in operators who claim that they have purposely held down profits so they would not have taxes to pay. This just doesn't ring true to loan officers, and is a surefire way to end the interview quickly.

PRO FORMA PROJECTIONS

Pro Forma is "bankeese" for estimates and projections, or in other words, guessing. How well you back up your guesses with intelligent assumptions will have a lot to do with the progress of your loan.

First off, you need a *pro forma statement of profit and loss.* This is where you estimate your daily, weekly and monthly bookings, apply an anticipated hourly revenue, add revenue for tape sales, copying and cassette making, and finally come up with your anticipated revenue for the period. On the other half of your sheet, list all expenses for the same period. Include all the standard items commonly referred to as general and administrative...such things as rent, light, heat, office supplies, insurance, salaries and commissions, etc. Don't forget equipment payments (like that loan you're after), tape purchases and other expendable supplies.

With the income and expense figures produced from this exercise, you can rapidly make a fairly accurate prediction of the profit or loss of the venture. Now is the time to use your own creativity in income estimation. Obviously, the studio will not be booked to capacity the day it opens, so it might be wise to assume a small per cent of booking initially, such as 20 per cent the first month, 25 per cent the second and so on, until 50-60 per cent utilization is predicted. By this time, the studio should be operating well in the black according to your predictions. Your accountant should be brought in to assist you with the proper format for presenting these pro forma statements.

The other document required is a *pro forma cash flow.* Simply stated, this lists the amount of cash-on-hand at the beginning of a period, anticipates cash income during the period, and deducts cash expenses for the same. The bottom line is your monthly cash flow, and this is carried forward as your cash-on-hand to start the next period. By referring to the previously-discussed pro forma statement, you can forecast the cash income for each period, and the same statement will also enable you to determine cash expenses. In preparing a pro forma cash flow, remember that cash collections will lag by at least 30 to 45 days from the date billed. (Of course, some clients will pay right away before they get their tapes, but others will drag you out for 60 or 90 days—45 is a pretty-good average.) The pro forma cash flow is an invaluable tool to determine how much cash you'll require for operating capital before the flow turns positive.

PROJECT DESCRIPTION

Now is the time to write, in 300-750 words, a complete description of your new venture, what you hope to accomplish, and why you feel it's a good loan risk. Here is the place to talk about your own background, discuss your related experience, and do the same for the associates who'll be on-board when the doors open. If you happen to have any potential contracts for recording, have close friends in powerful places, or letters

Audiotechniques' "Ham" Brosious on the phone—no doubt solving another financing crisis. Note that Brosious keeps a copy of ***db*** *next to the phone, so he should be able to solve just about any crisis that comes along.*

from friendly clients indicating a willingness to record with you ...they all deserve a few lines. (Also have copies of the letters for inclusion with the complete presentation.)

When you sit down for your first meeting with the loan officer, you'll probably be asked why the bank should loan you money, or something like that. Having already written this out as part of the presentation will make it simple for you to rattle it off to the officer. You can bet that somewhere in the first interview you will be called on to discuss the project.

PERSONAL FINANCIAL STATEMENTS

As sure as the Bee Gee's next album will be Platinum, is the fact that you will be asked for a personal financial statement. So beat 'em to the punch and bring it along on your first interview. The easiest way is to drop in to your own bank, and ask one of the loan officers for a personal statement form. Fill it out in detail, and do it neatly. Include with the statement a resume of the type used for job hunting. Be sure to include employment, personal and credit references.

When the bank officer asks if you'll personally guarantee the loan, it's better to come right out and say o.k. than to try to talk him out of it. In most cases, the loan "won't fly" without it. Lenders feel that a borrower who won't guarantee his own company's loan doesn't have much faith in it...so why should the lender?

ACCOUNTANTS

Ask your accountant to help you with the preparation of all financial documents. If you don't have an accountant, stop whatever you're doing, and go get one! Borrowing money to start a new venture is serious business, and an accountant is one of the most-inexpensive forms of insurance to make sure you get off on the right track. (If you don't believe it, just try to fill out all those federal, state and city tax forms, plus compensation, withholding and corporate forms... you'll get dizzy just trying to keep up with them.) An accountant will also be a source of satisfaction to your investors and lenders.

When you go to the bank or the lender visits your place, try to have your accountant with you. His presence goes a long way to convince the lender that you're in good hands.

THE LOAN INTERVIEW...HOPEFULLY, A ONE-ACT PLAY

Anticipate what the lender is going to want, and have it there the first time. He'll be impressed and pleased with your thoroughness, and it could just be the factor that tips the balance in your favor. And, consider the following suggestions:

1. Although it might hurt your artistic nature, try to look a little business-like when you meet the lender. Even though you may regard the studio as a creative art form above mere commercialism, in the eyes of the lender it's a business, pure and simple. So, the more business-like you appear, the better are your chances for approval.
2. Take your accountant with you. It's just a little psychological edge, but two is better than one. If the accountant can't make it, take a business associate, but try to make it a duo.
3. Bring the whole presentation with you and be prepared to explain it point-by-point. This sales pitch should be done so well that you're proud of it and that you believe it. (Don't forget to keep copies in case you have to repeat the act at another lender's office.)

Just in case you've forgotten, the material you have on hand should include:

a. The loan request and equipment list.
b. Recording Industry economics and market definition.
c. Studio profit analysis.
d. Project description.
e. Current and past operating statements.
f. Pro forma projections.
g. Personal financial statement and resume.

FINANCING SOURCES

Generally, there are three sources for funds for studio loans: banks, leasing companies and private investors or lenders. With the exception of a few large companies, such as Westinghouse Credit and General Electric Credit, most leasing companies are, in fact, leasing brokers who usually turn to banks as a source for their funds. Because of their familiarity with the recording studio business, and since they are not restricted to one source of funds as banks are, the leasing companies frequently can get approval where banks fail. Audiotechniques, like major U.S. recording equipment dealers, usually refers prospective buyers who require financing to leasing companies. However, the dealer may also suggest that the purchaser's local bank be the first financing contact. In some cases, the local bank will not be interested in financing equipment, *until* the purchaser shows the bank that a leasing company is ready to provide the funds. (At that point the bank may decide to do the deal, just to keep outside financial institutions out of town!)

Well-established private lenders or guarantors will certainly help speed-up the financing arrangements. As my friend, "Kemp" says, "If we have a $100,000 loan application collateralized by a $100,000 Treasurey Note, we'll make that loan nearly every day of the year (less 77 bank holidays, of course!). As far as the pros and cons of which type of financing is best, there is no right answer. What's probably right for your company is the kind of financing you can get. If none of these sources will back you, then, most likely, you're not ready for conventional financing. Just for openers, though, I'd try one of the three following leasing companies in the New York City area: (If you're not in the Northeast, then call your favorite dealer for his leasing company recommendations.)

Anthony Rosatto
Leasetek Funding
19 Sylvan Avenue
Englewood Cliffs, NJ 07632
(201) 886-0888

Lincoln Stevenson
North American Leasing
111 West 57th Street
New York, NY 10019
(212) 765-2005

Sandy Schneiderman
Terminal Marketing
15 Carefree Lane
Suffern, NY 10901
(914) 354-0440 ■

IRWIN DIEHL

On The Technical Administration of a Studio

The scheduling of routine inspections, along with prompt, efficient maintenance and repair work, will ultimately determine the quality of work produced in the recording or broadcast studio.

AN IMPORTANT ASPECT of operating a recording or broadcast studio is that of keeping equipment finely tuned for peak performance. The administration of these chores usually falls upon the shoulders of the chief engineer, who must make sure that inspections are routinely scheduled and, that maintenance is carried out promptly and efficiently.

GOALS

Usually, an administrator's commitment to these responsibilities will establish the studio's technical standards, and ultimately determine the quality of the work produced.

In the case of a studio just starting-up, the technical-management duties may have to be carried out by an individual not yet familiar with the administration and planning of equipment maintenance. Whether it's a one-man operation, or a staff of employees that divide the responsibilities, the goal of administering the technical facilities should be *to maximize studio income by minimizing equipment failures and studio downtime.*

Assuring the best performance from the electronic/electromechanical systems means that the studio engineer's success will not be influenced by the behavior of erratic equipment. Instead, the success of the session will depend solely on the talent and creative skills of the operating personnel. This is just a fancy way of saying that equipment should never get in the way of artistic accomplishment.

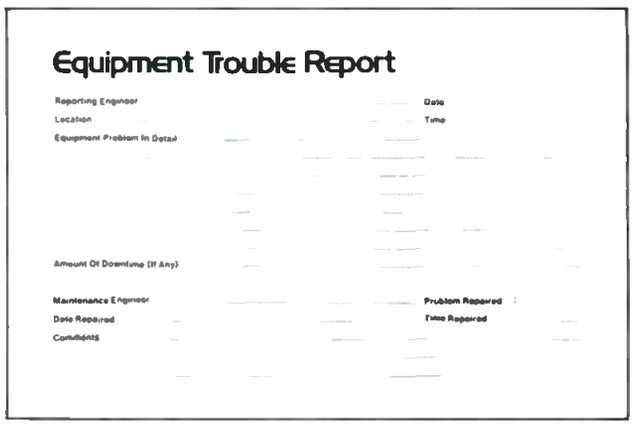
MAINTENANCE SCHEDULES & RECORD KEEPING

A plan is needed. A schedule for routine inspection of each item of studio equipment is important. After considering the amount and type of use a given piece of equipment receives, a more-or-less regular inspection of its performance capabilities should be set up. This is the first principle of *preventive maintenance.* Solve minor problems *before* they become disasters. Devise an inspection schedule and stick to it. The schedule may change as operations fluctuate, but some base plan is a must.

There's a common difficulty with all conscientious inspection/maintenance efforts: The more that the equipment is used, the more frequently it should be checked, and *possibly* adjusted. But here's the dilemma: the more frequently the equipment is used, the less time there is to inspect and adjust. The smart administrator does not get caught-up in this "damned if you do, damned if you don't" routine. The reality is, you're damned if you don't perform routine maintenance inspections. Time *must* be found—off-hours, early mornings, Saturdays, Sundays, or whenever. If necesssary, time must simply be "blocked" for studio maintenance. A success-oriented management will soon regard the maintenance crew as a valuable "client." Each busy studio devises its own method of coping with its maintenance requirements. The important concept here is: *maintenance is vital to a studio's continual success.* Ignore it today, and you won't be so busy tomorrow.

Communicating is not a problem peculiar only to world politics. Recording and broadcast studios may also suffer from a break-down in communications, particularly when it comes to reporting an equipment failure or, describing a problem in clear enough detail to effect repairs. This may not be the fault of operating personnel. The studio engineer is busy enough trying to keep the client, the musicians and the producer happy, without getting bogged down with more paper work. A good technical administrator will recognize the need to facilitate and simplify troubling-reporting.

In broadcasting, a *trouble sheet* is often used to document equipment failures and/or losses of air-time. Operating personnel complete a trouble report at the occurrence of each equipment failure. Often, multiple copies are provided so that others are informed of operating difficulties, in addition to the chief engineer and his maintenance staff. This can sometimes be effective in informing management of problem areas, and perhaps loosening the purse-strings where there might otherwise be a temptation to continue equipment in service beyond its useful life.


Equipment Trouble Report

Reporting Engineer
Date
Location
Time
Equipment Problem In Detail
Amount Of Downtime (If Any)
Maintenance Engineer
Problem Repaired
Date Repaired
Time Repaired
Comments

Irwin Diehl, founder of the Institute of Audio Research, New York, is currently employed as an independent consultant.

Anyone having spent time in both broadcast and recording studios may recognize a common emphasis on equipment reliability. It's true that the recording studio is usually not pressed to produce in "real time" in the manner that broadcasters are. But, the same pressures to minimize equipment breakdowns are ever-present in the recording studio. In fact, the per-minute loss of income due to a failure during a multi-track session can easily equal or surpass the income loss inflicted when the broadcast studio goes down.

The recording studios could do worse than to copy some of the administrative methods of their broadcast "cousins."

MAINTENANCE AT THE RECORD PLANT

One of the larger and more successful recording studio operations on the eastern seaboard is Record Plant, New York. The Record Plant facilities consist of three 24-track recording studios and one 24-track mixdown studio. Each is equipped with an Ampex MM-1200 multi-track recorder, ATR-100 2 & 4-track machines, and a custom-designed Automated Processes console. The Cutting Room (a "sister" disc-mastering operation of Record Plant), and two 24-track remote trucks are also the maintenance responsibility of Michael Guthrie, Record Plant's chief engineer.

Other gear assigned to the care of Guthrie is the usual assortment of electronic musical instruments, amplifiers, and signal processing devices including digital delays, noise-reduction systems, expanders, compressors, etc..

Guthrie defines his general approach to equipment maintenance as: simple and direct. One important element of the Record Plant maintenance program is a *blue-card* system of trouble reporting. And indeed, the beauty of this system is its simplicity. The card, filled out by the recording engineer when a problem arises, serves as both a "flag to trouble" and permanent service record as well. In addition to listing the failure or defect, the corrective action taken will also be recorded. The cards, submitted at night, are reviewed at the start of the next day. This allows laying-out the maintenance work to be scheduled, in addition to the daily alignment of *all* tape recorders.

LEARNING FROM HISTORY

Routine inspections of studio equipment, effective communicating to the maintenance staff of failures, and the organization of an efficient follow-up to correct defects, are important first principles of the technical administration of a studio. Secondary to these, but also important, is keeping an accurate history of each studio component.

There are several reasons for maintaining records of inspections and repairs. In certain instances, warranties with the manufacturer may be involved. If equipment is under warranty and has only "slipped" in its operating characteristics rather than having totally failed, a documentation of original-versus-current specs. can be a much-more-convincing argument than some technician's recollection of "how-it-used-to-work."

Another reason for keeping an equipment history relates again to communications. In a larger operation, the person(s) responsible for keeping the studio up-and-running should be able, at any time, to determine how a device failed and verify how the failure was corrected without taking it out of service and opening up the chassis for a personal inspection.

One more purpose in keeping accurate records is to allow "tracking" the performance of equipment. This can be another very useful instrument of preventive maintenance. For example, the wear of a multi-track reproduce head might be tracked over an extended period and its required replacement anticipated rather than discovered suddenly in the middle of that big string date.

In the same light, a history of each studio component's performance provides a reliable reference for evaluating current performance data.

A specific example would be a detailed chart, or table, that could be used to document the alignment of a multi-track tape recorder. Such a table would provide space for listing initial conditions, as well as final settings. The technician's first objective is to record the existing conditions, and second, to adjust *if* necessary. It should be emphasized that a record of how the technician found a device to be operating is just as important as how he left it operating. The additional data will help pin-point recurring problems, such as a record equalizer that regularly drifts.

AND, AT ATLANTIC...

Atlantic Recording Studios, on NYC's west-side is another of the Big Apple's busier recording operations. Sami Uckan is chief engineer and in charge of the maintenance-administration of Atlantic's two 24-track recording studios and additional 24-track mixdown studio. MCI consoles and multi-track transports comprise the basic studio hardware. The Atlantic facilities also include two disc mastering rooms, tape duplication and a quality control department.

In this 24-hour a day, 7-day a week operation, one "secret" of Sami's success, in terms of staying on top of equipment check-out and repairs, is the studio's own custom-designed, remote trouble-shooting panel.

Again, simplicity is the key. The panel is merely several banks of switches to facilitate interconnecting the bench instruments (in the repair shop) to any of the Atlantic studio facilities. All equipment may be checked remotely from the repair shop. There's no need to remove gear from the studio or to bring test gear into the control room. Also, if equipment begins to act suspiciously during a rehearsal, discreet tests may be conducted from the shop location, without the least imposition on the client.

This system has reduced the time required for routine and emergency maintenance to a fraction of what it once was.

INSTRUMENTATION FOR TESTING & REPAIR

The effectiveness of a maintenance operation can be assured only by provision of adequate facilities to inspect and repair studio components. The most-conscientious effort can be thwarted by an ill-equipped maintenance facility. Remember that a new piece of test gear for the shop is often more valuable than one more whiz-bang box in the control room.

A certain minimum complement of instruments are required for testing and evaluating professional audio equipment. Further, the recent directions of audio design and engineering suggest a second, "optimum" instrument complement, necessary for those studio operations that are planning to keep pace with this new age of audio.

REFERENCES & STANDARDS FOR AUDIO EQUIPMENT CALIBRATION

Equally as important as the accuracy of measurements are the references and standards by which measurements are evaluated. Standard tapes, reference discs, and other reference devices are tools vital to proper maintenance.

Though brief, a general insight into the elements of administering a maintenance operation has been provided. For additional related information, the reader is referred to the bibliography of feature articles, which have appeared in recent issues of **db**. ■

BIBLIOGRAPHY

Jones, W., Audio Tests and Measurements—Part I, April, 1979. Part II, May, 1979. Part III, June, 1979.
Clegg, A., Three-dimensional Analysis: It's About Space. April, 1979.
Maguire, L., Distortion, and How it is Measured. April, 1979.
—. db Test Report—Leader LFR-5600. April, 1979.
—. Directory of Test Equipment Manufacturers. April, 1979.
Morrison, R., Magnetic Tape Reproducer Calibrator, April, 1979.
Plunkett, B., XY Response Plotters for the Studio. May, 1979.
Lerner, R., Test Equipment Without Tears. July, 1979.
Woram, J., A Mini-survey of Graphic Recorders. July, 1979.

db Special Report

JOHN M. WORAM

The AES, SPARS, "Prosound International," and IEE

A roundup of upcoming conventions, and a look at some new organizations and societies for the audio industry.

AES

ONCE AGAIN, the next convention of the Audio Engineering Society falls into the "biggest ever" category. Some 150 exhibitors will be on hand to show convention visitors what's new in pro' audio, with demonstration rooms and exhibit booths now occupying five levels of the Waldorf-Astoria Hotel in fun city.

Special programs will include visits to local recording studios, a workshop on employment opportunities in audio engineering, and a special session on semi-professional equipment and associated techniques.

Technical sessions, include Digital Techniques, Signal Processing and Instrumentation, Magnetic and Disk Recording, and several others. The dates for this 64th convention are 2-5 November, 1979.

And next year, the Society's 65th convention brings the AES back to London, which it last visited in 1975. This time around, the convention will be held at the London Hilton and Park Lane Hotels, on 25-28 February, 1980.

SPARS

"A profound event has occurred in our industry. The Society of Professional Audio Recording Studios (SPARS) has been formed, whose singular purpose it will be to address itself to the perplexities and challenges confronting sound recording studios." So says a recent letter from the newly-formed group, which lists among its goals:

—to establish a forum for professional audio studios as a positive and creative force

—to establish a standard of excellence throughout the professional audio recording industry.

—to establish a Code of Professional Engineering Practices to which the organization members will adhere.

Membership is open to studio owners and operators who meet SPARS qualifications, two of which include:

—the studio must have been established, and in business, for at least two years.

—the applicant must have at least one 24 (or more) track quality recording studio or quality mastering room.

Another qualification may very well be the ability to pay annual dues of $2,000. So far, more than twenty studios are registered as founding members. The list reads like a "who's who of recording studios," from A & R in New York to Wally Heider in California. In between, there's Atlantic, The Automatt, Record Plant, Soundmixers—to name just a few who have recently turned up here in **db** as well. Sigma Sound's Joe Tarsia is acting Chairman of the Board.

SPARS will have a hospitality suite at the Waldorf-Astoria on 3 November, from 3:00 to 8:00 pm (during the AES convention), and invites interested studio owners to drop in for more information.

SPARS is one of several special-interest groups that have recently attracted industry notice. CAMEO is another (see **The New World of Creative Audio** in our July, 1979 issue). And, in England, there's the Association of Professional Recording Studios (See **Convention Report: APRS 1979** in our September, 1979 issue).

Inevitably, group-watchers wag their fingers at the AES and mutter things like, "You see, you didn't do your job, so this new group is going to do it for you."

If the accusation has any merit, still, there are two sides to every story. With three conventions a year, a prestigious Journal, and a distinguished history of more than a quarter-of-a-century, the venerable AES must surely be doing *something* right. Yet critics (who wouldn't dream of rolling up their sleeves and helping out) will sit on the sidelines and complain that

"someone should do something." Not themselves of course, but always, someone else.

On the other hand, the pace of some AES committees rivals that of the continental drift. Sometimes, it seems deliberations shall go on until a quorum reaches terminal senility. So, we shall hope that SPARS never gets to the stage where it does everything by committee. An aggressive organization of studio owners—specifically, *big* studio owners—could become a major force in advancing the entire industry, and a complement to the valuable services of the Audio Engineering Society.

SPARS is thinking about conducting seminars on a variety of subjects, including business management, methods of employee training, client relations, etc. Many of these topics are beyond the scope of the AES, so there's every reason to expeet that SPARS will offer minimal conflict with AES activities. SPARS has set some ambitious goals for itself, and we wish them good luck.

PROSOUND INTERNATIONAL

From England comes word of *"the first independent exhibition to cover all aspects of audio equipment and services...."* The exhibition *"...will provide a meeting place for manufacturers and visitors to interchange ideas and information...."* Equipment will be demonstrated *"...in suitable surroundings to potential buyers all over the world."*

The key words here may be "independent" and "buyers." Again using the AES as our reference, presumably it is "dependent" on its voting membership for direction, while Prosound International is being organized by the independent Batiste Promotions and Exhibitions. As for buyers, the AES conventions are not "selling shows" (in order to protect the Society's non-profit status). That means you can't walk up to an exhibitor, pull out your checkbook and walk off with a new microphone.

To turn the AES convention into a selling show would require a complete turn-around in the Society's structure, and this might be self-defeating to the organization's primary purpose as a professional society.

Prosound International will be held in London, from 2-4 September, 1980. That's about two months before the AES's New York convention, and just six months-plus after the AES's own London show. And, the APRS should be holding its London exhibit in June—just about midway between the other two.

It looks as though 1980 will be a busy year for audio pros in London. And, can the industry support this proliferation of exhibitions? It would be too bad if one show began diluting the strength of another. On the other hand, a little competition can have a stimulating effect at times. And time alone will tell what the results will be. We'll try to keep you informed.

INTERNATIONAL ENTERTAINMENT EXPOSITION

Meanwhile, back in Nevada, USA, the Las Vegas Convention Center will be the site of the first annual exposition to be sponsored by the International Entertainment Association (IEA). Described as the "Cannes Film Festival" of the entertainment industry, the expo will comprise four days (11-14 December, 1979) of seminars, workshops and exhibits.

IEA draws its memberships from manufacturers, distributors and end-users of entertainment equipment. At the expo, production categories will include audio, lighting and disco equipment, and presentation categories range from hotels to discos, theaters, and cruise ships.

IEA has already attracted a favorable response from hotel and restaurant industry executives in search of a "super market" of up-to-date entertainment hardware.

An early news release lists almost 100 exhibitors, with a handful of names familiar to **db** readers (Accurate Sound, Cerwin Vega, Crown, Hammond Industries and others).

From all appearances, it looks as though "IEA #1" could have the potential to provide valuable exposure for the pro audio industry into some previously-neglected corners of the entertainment industry. ■

DAVE RUBENSTEIN

Understanding Magnetic Tape Specifications—Part I

An overview of magnetic tape operation and "spec" terminology

THE TYPICAL STUDIO ENGINEER is a skilled professional who relies on his "golden ear" to transfer one medium to another. Although he is probably well-trained and skilled in the practical operation of recording and reproduction equipment, he may have but a surface knowledge of the true "physics" of the recording process. His skill with the equipment comes through verbal instructions, day-to-day experiences, and the few facts that can be coaxed from equipment manuals. This surface knowledge may be sufficient for the basic operations of the studio, but with a little further insight into the inter-relationship between tape and machine, the engineer can, without too much trouble, no doubt make a much better recording.

COPING WITH "SPECS"

The recording or broadcast engineer may look at the specifications of a certain device, understand perhaps three-out-

Dave Rubenstein is technical manager, Magnetic Tape Department at Agfa-Gevaert, Inc.

of-ten pieces of data, and then make a decision based on a limited grasp of the information presented. All too many times, people choose one product over another for a totally non-technical reason, which in the end may lead to disaster, or at least, a little discomfort.

One of the most blatant trouble spots is tape selection and usage. With this particular software, some of the most horrendous double-talk is found, and the least amount of facts are readily available. The problem seems to lie in testing methods, and the interpretation of data by various manufacturers. Each company has its own standards, references, and methods of determining electro-acoustic and other data.

The first part of this article will deal with the technical terms and definitions found in most specification sheets for audio tape software. It is the intent to help prepare the engineer for the deluge of facts (and fables) he will uncover when trying to decipher a data sheet on magnetic tape.

MAGNETIC TAPE PRODUCTION

Let's begin with a brief discussion of what comprises magnetic tape. First, there is the base material, usually made out of polyester. Polyester is commonly supplied in 26-inch-wide rolls, which are many thousands of feet in length. This base material is then coated with a solution called "slurry"—a suspension of a solid (oxide particles) in a liquid. The slurry contains billions of tiny particles of iron oxide, plus solvents and binder products. It is coated onto the base material extremely smoothly, and with precise tolerances for thickness. Before the slurry dries, a strong magnetic field orients the oxide particles in the same physical direction.

Next, the combination of base material-plus-coating is immediately passed through a dryer, and then proceeds through a calendering process, in which highly-polished rollers polish the tape so that it has a beautifully-smooth surface sheen.

THE PHYSICS OF MAGNETISM

In order to understand the facts, figures, curves and graphs found on a magnetic tape specification sheet, it is necessary to have a fundamental understanding of the physics of magnetism and the recording process.

To produce sound, movement of some kind is required. And, to alter a magnetic field, again one needs movement. The entire science of tape recording is based on alternating magnetic fields. To help visualize these alternating fields, think of a magnet having a north (positive) pole and a south (negative) pole. Then, imagine these poles reversing their polarity at varying speeds. You end up with a series of alternating positives and negatives; some changing quickly—others slowly.

The faster the poles change polarity, the higher the frequency. The slower the changes, the lower the frequency. Visually, a sine wave illustrates the changing polarity over a period of time. The sine wave shows an alternating current, with a positive polarization followed shortly by a negative polarization. As mentioned earlier, the speed at which the polarization changes determines the frequency.

If we wrap a coil of wire around a changing magnetic field, an electric current is induced within the coil. This current can be amplified, so that an audio reproduction of the alternating magnetic field is heard. Or, if an alternating electric current is passed through a coil of wire wrapped around an iron bar, the opposite effect occurs; a magnetic field is produced.

TAPE HEADS AND MAGNETS

In reality, the heads on a tape machine are simply two C-shaped pieces of hard metal, with a coil wrapped around the

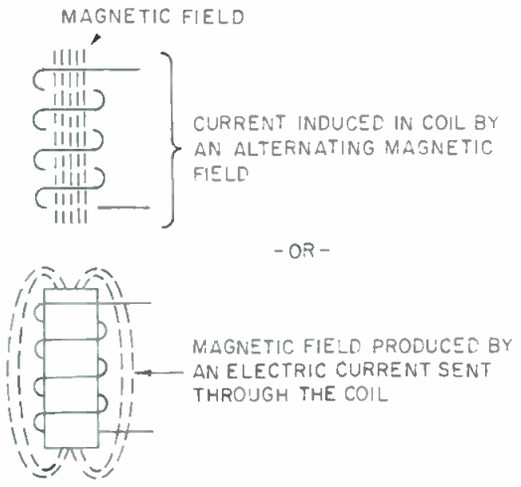


Figure 1. The physics of magnetism.

rear. The front section of the head has a tiny gap between the two C-shaped halves. This is the record, or playback, gap.

Recording heads also have another gap in the rear, approximately ten-times wider than the front gap. The reason for this rear gap is to help prevent the magnetic saturation of the head. However, this rear gap would result in too-low a sensitivity for optimum playback head performance, so these heads have a front gap only.

When the coil is energized with an alternating electric current, a magnetic field is generated within the metal of the head. Magnetic lines of force, or "flux lines" pass through the head, and across the head gap. Without tape, the magnetic flux has its maximum strength between the two poles of the gap. However, if a tape is present at the gap, the field lines will "detour" through the tape, because the oxide coating offers less magnetic resistance than does the air gap of the head.

When the magnetic tape, filled with tiny particles of iron oxide, passes across the head gap, the magnetization of the particles becomes fixed as they leave the magnetic field in front of the gap. But contrary to popular belief, the oxide particles do not actually move, since they have been permanently locked in position by the binder material. They merely receive a magnetic charge from the gap (either plus or minus), depending upon the moment that they leave the head gap area.

Playback is, for the most part, the reverse process, in which the oxide particles on the tape—which are now tiny magnets—pass across the playback gap and induce a magnetic field within the head that generates an electric current in the coil, which is then amplified.

COERCIVITY AND RETENTIVITY

When one speaks of magnetic tape, coercivity and retentivity are two frequently-heard terms. Coercivity, measured in oersteds (Oe) is the amount of magnetism necessary to change the magnetic charge of a given particle. Retentivity, measured in gauss (G), is the amount of magnetic flux that remains on the tape after the magnetic field is removed. Coercivity and retentivity are proportional to the particular oxide material and the size of the particle.

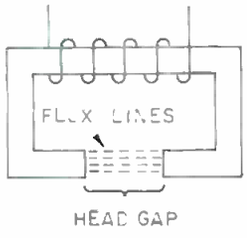
THE HYSTERESIS LOOP

The so-called hysteresis loop may be used to better illustrate the relationship between coercivity and retentivity. In FIGURE 3, an increasing magnetic field has brought the tape to positive saturation. As the field collapses, the tape loses some of its magnetization, but retains the amount shown as B_r, when the field is reduced to zero. This is the tape's retentivity.

Now, as the field strength increases in the opposite direction, the tape is eventually demagnetized. The field strength required is shown by H_c. This is the coercivity of the tape. Further increasing the field strength eventually brings the tape to negative saturation.

The general shape of the hysteresis loop is an indication of the performance of a magnetic tape—the "squarer" the loop, the better the tape.

Figure 2. A record head. The flux lines across the head gap will bend to flow through a tape passing by the gap.



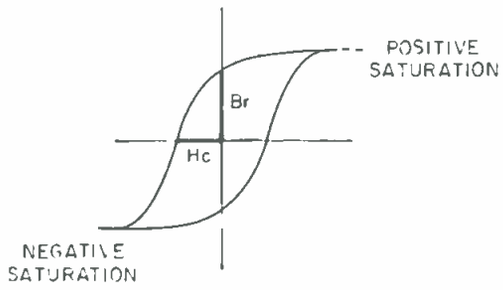


Figure 3. The hysteresis loop.

IMPROVING COERCIVITY AND RETENTIVITY

"Doping" is the insertion of the element cobalt into the iron-oxide crystal structure. The result is a tape with a higher coercivity and, usually, a slightly-higher retentivity. However, there is an important drawback to cobalt-doped tapes. Compared to iron oxide, the cobalt is more-easily affected by temperature variations and mechanical stress. Therefore, if cobalt-doped tape is left in a heated environment, or placed under great physical stress, the results will be a tape with loss of level.

So as usual, "all that glitters is not gold." At this time, the only other known method to increase the coercivity of a tape is to use pure metal particles instead of an oxide. Pure metal powder may have a coercivity of up to 1500 oersteds, yielding approximately 3000 gauss. Tapes made with metal-powder particles have an extremely-high signal-to-noise ratio, and good high frequency characteristics.

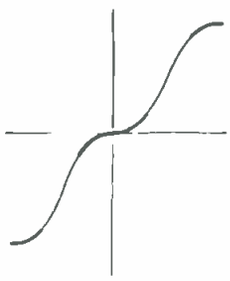
Metal tapes are hard to coat, due to the fact that pure metal powder is pyrophoric (capable of igniting spontaneously in air—Ed.). Therefore, the material is extremely dangerous to work with in its raw state. At the moment, metal-particle tapes are still quite expensive.

Another drawback to metal-particle tapes is that, in order to cope with the extremely-high coercivity, one must use special heads and bias oscillators. (The higher coercivity particles require a greater magnetic field in order to record or erase the tape.) This too becomes very costly, and presents compatibility problems when metal-particle and standard-oxide tapes are to be used interchangeably.

ACHIEVING LINEAR RESPONSE

The closer a particle is to yielding a linear response, the better the particle is for magnetic sound reproduction. But so far, all magnetic substances are still quite non-linear. FIGURE 4 shows the transfer characteristic, or remanence curve, of a magnetic tape. Note the non-linear segments at both extremes, and in the center region. Early recording efforts were hampered by these non-linear segments, which caused distortion at low and high recorded levels.

Figure 4.
The remanence curve shows the transfer characteristic of a magnetic tape. The heavy line segments indicate the non-linear portions of the transfer characteristic.



BIAS

Eventually, it was realized that the addition of a d.c.bias current would shift the applied audio signal into one or the other of the linear portions of the transfer characteristic. The result was somewhat less distortion. This was better, but still not quite the answer. Later, it was determined that by using a high frequency bias current, distortion could be greatly reduced, even at higher levels. This is due to the fact that d.c. magnetization only utilized one-half of the remanence curve, whereas a.c. bias affected both the upper and lower segments. The a.c. bias current is of course many times higher in frequency than the highest audio frequencies, and enables the engineer to record at much higher levels with much lower distortion.

DISTORTION VERSUS BIAS

Distortion is the addition of harmonics of an applied frequency. Because of its prominence, the third harmonic is most disturbing to the ear. Therefore, unless otherwise specified, distortion measurements usually refer to third-harmonic distortion (thd).

Symmetrical curves, like the hysteresis loop of magnetic tape, and the curves of push-pull electronics, produce odd-numbered harmonics. Non-symmetrical curves, such as those of class-A and single-stage amplifiers, produce even-numbered harmonics. Since magnetic tape does have a symmetrical curve (as mentioned previously), odd-harmonics are the ones produced. However, any harmonics above the third are usually insignificant, and therefore not measured.

Bias minimizes distortion, by moving the applied audio signal away from the knee (center section) of the remanence curve, into the more-linear segments of the curve. This is shown

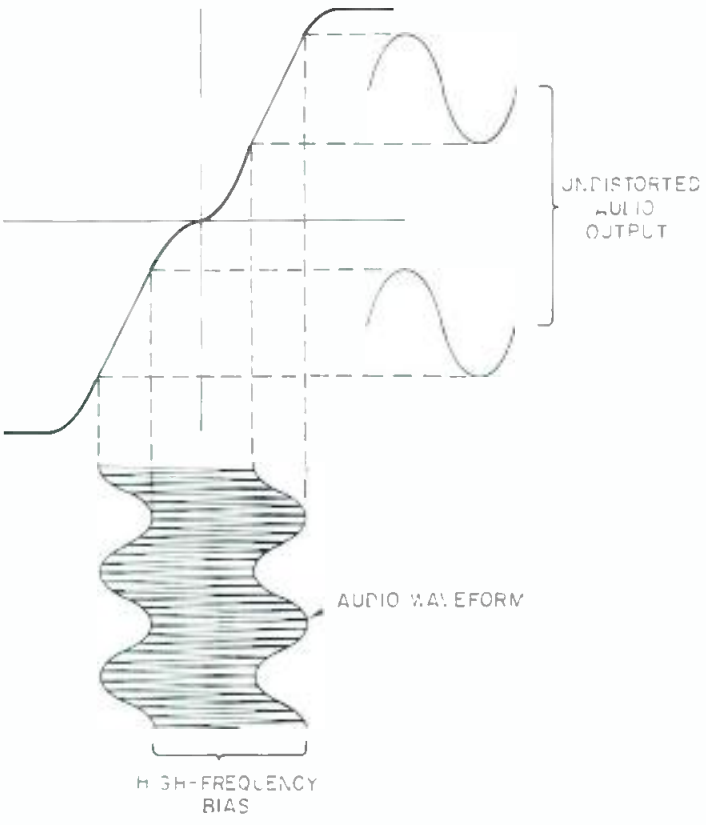


Figure 5.

A.C. bias moves the applied audio signal away from the non-linear portions of the transfer characteristic.

in FIGURE 5, where the bias-plus-audio is shown on the Y axis, and the audio-only is seen on the X axis.

The bias frequency is so high that during playback it is not reproduced, due to the limitations of the playback head.

OPTIMUM BIAS LEVEL

The question may now arise; How much bias current is required? This depends on the chemical makeup of the tape, and is determined by the manufacturer. Two important parameters help decide the best bias setting. These are: frequency response and low-frequency distortion. Another consideration may be compatibility with other tapes, so that the user need not constantly re-adjust his tape recorder for every different tape that he is called upon to use. The amount of bias is also dependent on the coating thickness and coercivity of the tape. The thicker the coating, and higher the coercivity, the greater the magnetic field necessary to penetrate the coating. Therefore, the greater will be the amount of bias current that is required.

It is well-known that, as one increases the amount of bias from zero, the output of the tape increases. Then, if the bias continues to increase, after the peak-output point, the high-end response begins to fall off. At the same time the high end is decreasing, the low-end distortion is also decreasing. And now we have a conflict-of-interest. One wants a beautiful high-end response, *and* low, low-end distortion. Therefore, there must be a compromise as to the amount of bias used, especially at lower tape speeds.

Another factor—coating thickness—also brings with it a conflict-of-interest. A thicker coating will yield a greater low-end response, and a thinner coating (requiring less bias) will yield a better high-end response. The thick coating yields a better low-end response because a low frequency has a longer wavelength. Therefore, the entire coating is used in playback for lower frequencies, whereas only the outer layer of the coating is used for playback of the higher frequencies, due to the shortness of the wavelength. The following formula illustrates the coating-thickness phenomenon;

$$DA = 54 \times \frac{A}{\lambda}$$

DA = Damping factor, in dB
A = Distance between magnetic particle and playback head.
λ = Wavelength.

Example: The lower part of a coating has a ten-micron distance from the reproduce head. The wavelength of an applied audio signal is 38 microns. Compared to the surface of the tape, what is the attenuation of a signal from this area of the tape?

$$DA = 54 \times \frac{10}{38} = 14.2 \text{ dB}$$

To review, we can say that the factors which determine bias setting of a given tape are:

1. coating thickness.
2. coercivity.
3. high-end frequency response.
4. low-end distortion.
5. bias compatibility and record equalization.

MODULATION NOISE

Still another factor is modulation noise. This type of noise occurs from coating inhomogeneity and transversal vibration of the tape as it passes the head gap, causing extraneous noise while the tape is being recorded. It happens as an interaction between head and tape, resulting in mechanical oscillations, especially noticeable on low frequencies.

Agglomerations, as well as shortages, of particles accentuate modulation noise, as these areas pass across the head. The amount of bias also affects modulation noise, or, to put it another way, modulation noise varies with bias setting. Luckily, modulation noise usually follows the curve of low-end distortion. Therefore, if the bias is set properly for low-end distortion, then it is also set properly for modulation noise.

OUTPUT LEVEL VERSUS HEAD GAP

Head gap has been mentioned before, but needs some further comment here, since it too can greatly affect the output level from the playback head. In playback, the narrower the head gap, the better the high frequency response, because the head gap must be less than one-half as wide as the shortest wavelength it is to play back. When the head gap dimension equals a given wavelength, and that wavelength passes before the head, there will be no flux change. If there is no flux change, there is no current induced in the winding—hence, no sound.

Therefore, an extremely-narrow gap is necessary to reproduce those very high frequencies, especially at slower speeds. As far as the record gap is concerned, a wider gap permits a greater penetration of the magnetic field into the tape, and a somewhat lower modulation noise.

Most older studio recorders had a record gap of about 20 microns (0.8 mil) and a playback gap of 5 microns (0.2 mil). Modern multi-track machines, which use the record head simultaneously as a playback head, may have a record gap of 5 to 8 microns, while the regular playback head has a gap width of about 3 microns.

MAXIMUM OUTPUT LEVEL

The maximum output level curves for 3 per cent and for 1 per cent thd reach their maximum at the bias setting where the minimum thd (at some fixed output level) occurs. If the maximum output level at 3 per cent thd reaches a maximum and then drops more than 1 dB without rising again, one can rest assured that the record head is saturated by bias and record current, and what you are in reality measuring is the distortion of the head.

The curve for maximum output level at 1 per cent thd must follow the thd curve at the reference level. In other words, when the thd at reference level is at a minimum, maximum output level at 1 per cent thd is at its maximum.

Part II of this article will be based on the information presented above. So before continuing, the reader should make sure he thoroughly understands what has been covered so far. ■

(To be continued next month)

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FIRST WITH THE PROS.

Circle 39 on Reader Service Card

JOHN M. WORAM

A Visit to AKG

An AKG technological update—research-in-progress, and a preview of some new developments.

SOME PEOPLE THINK that an editor's life is an easy one, free from most of the hassles that beset the rest of the world. (About time you admitted it—Publ.) But let me assure the reader that such is indeed not the case. Sometimes—when answering the call of duty—an editor is summoned to a far-off land, in order to bring the word back to the readers.

For example, earlier this year, **db** responded to a call from a little company with an incredibly-catchy name; *AKG Akustische und Kino-Gerate Gesellschaft mit beschrankter Haftung.* The company is well-known to outsiders (and to insiders as well), simply as AKG Acoustics. It seems they wanted us to send a reporter off to their home office, for a technological update, and that home office just happens to be in Vienna, Austria.

Now Vienna is a very dangerous place. There are pastry shops on almost every corner, as well as sinister cafes that lure the unwary traveller with Sacher tortes and Viennese coffee. But, setting aside all thoughts of personal safety, I dutifully packed my bags and was soon off to the airport. Our publisher was so impressed with my devotion to duty, he quickly packed *his* bags too, and joined me. (A little *too* quickly as I recall, but that's another story.)

Usually, visits such as this one are timed to the release of an important (to the company, anyway) new product. Not this time though. As mentioned already, the purpose of this meeting was merely a technology update, to offer the visitor a glimpse of research-in-progress, and a preview of some new developments that may eventually show up in future products. Some of what we saw was already familiar—some wasn't. For example;

REVERBERATION

Remember when spring-type reverberation systems were "boing boxes"? Some years ago, AKG proved that springs didn't have to sound "springy," when the BX-20E Reverberation Unit was introduced. The BX-20E used a torsional transmission line, in which the spring-wire surfaces were acid-etched, and the spring coil varied through different winding radii, as well as by the use of statistically-distributed partial turns (in the winding).

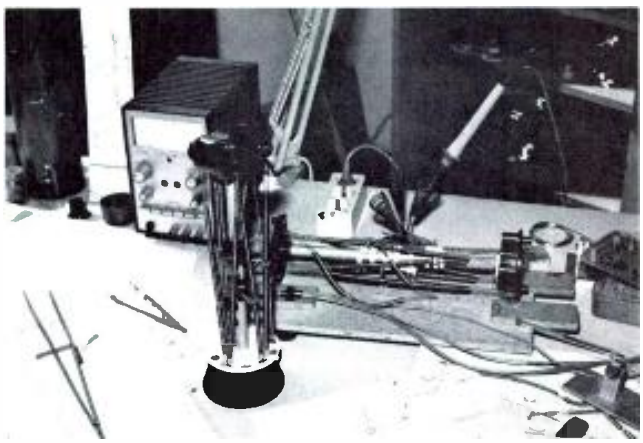
A prototype of the BX-5E reverberation system.

As with everything else in the recording studio, some listeners preferred the sound of the BX-20E, while others didn't. However, the system was an immediate success, and was eventually followed by the still-smaller BX-10E.

While in Vienna, we got a look at the insides of the BX-5E. Unlike its two-channel predecessors, the rack-mountable BX-5E uses a single, common reverberation system, although there are two separate inputs and outputs. Each has its own parametric equalizer (500-5,000 Hz), with variable "Q", and continuously-variable boost-to-cut at the selected center frequency. A fourth potentiometer permits up to 10 dB of bass cut or boost at 100 Hz. Input sensitivity may be set over a 34 dB range, via a six-position switch, and intensity controls permit the mixing of dry and reverb signals. Decay time may be set at 1, 2, or 3 seconds.

TIME DELAY

The TDU-7000 will accommodate up to eight input and output modules in various combinations (4 in/4 out, 1 in/7 out, 2 in/3 out [each input], etc.). Each input module has its own input level control, and an eight-segment led indicates deviation from nominal input level, over a 34 dB range. On each output module, delay time is adjustable in 1 ms. increments, up to a maximum of 399 ms. Toggle switches turn the delay on and off, and reduce the delay to one-tenth the indicated setting. An optional extension module provides an additional 200 or 400 ms. delay.



Meanwhile, back at the drawing board...variations in spring design are tested, and re-tested.

MICROPHONES

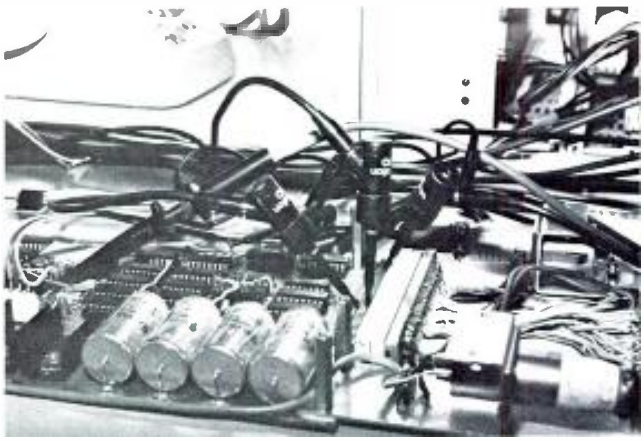
Does anyone remember the old C-12 (tube) condenser microphone? By now, it's almost a memory, and the few left in service here and there are jealously guarded as "studio treasures." Today, AKG uses the CK-12 large-diameter, double-diaphragm capsule in its C-414EB, C-422, C-424 and CK-4 series. Of course, the C-414 needs no introduction here—its been a studio favorite for many years now.

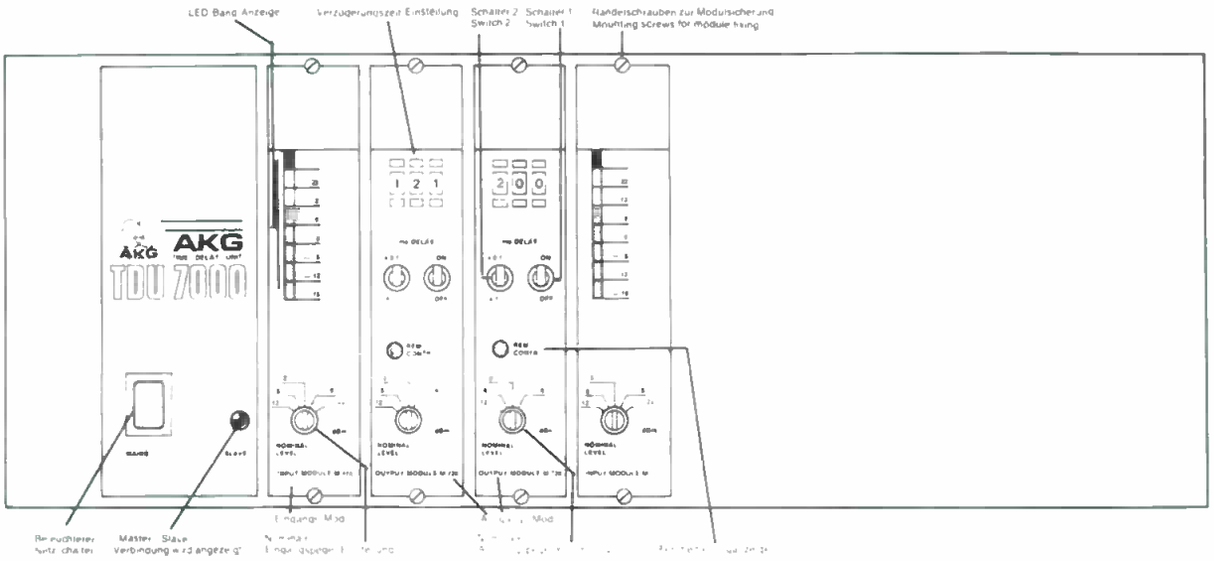
The C-422 is a stereo microphone, whose upper capsule may be rotated through 180 degrees, for MS or XY operation. To aid in critical mic placements, each capsule has its own narrow-beam, high-brightness led built into its casing. This should make life a lot simpler for engineers who use such microphones far above the orchestra, and spend a lot of time wondering whether the capsules are properly oriented. As an added touch, the leds may be turned on or off from the remote power supply/polar pattern selector housing.

The C-424 bears a superficial resemblance to the C-422, although all four diaphragms within the two capsules are electronically separate, giving the engineer four cardioid outputs to muck about with.

A prototype card for the TDU-7000 gets its insides probed for vital signs.

The TDU-7000 time delay unit.





The front panel of the TDU-7000.

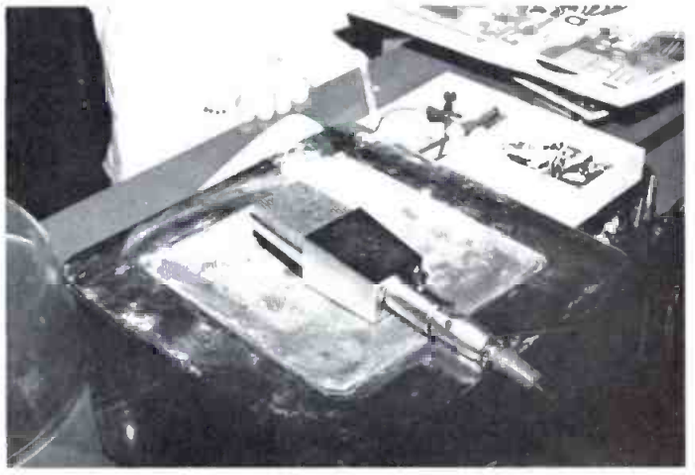
And, for C-451 users, the CK-4 is a screw-on capsule offering (finally!) a bi-directional polar pattern. In many studios, the figure-8 microphone is all but ignored these days—too bad, since it can be a valuable tool in certain applications. It will probably never surpass the popularity of the cardioid, but perhaps the CK-4 capsule will help some of us to re-discover the value of figure-8s in certain applications.

The C-34 is a smaller stereo microphone, which also offers remote control of polar patterns—but no leds on this one. The C-33 offers cardioid outputs only, and a second variation—the C-34MS—offers one cardioid and one bi-directional output, for MS pickups. The C-34MS was specially-developed for the Austrian Broadcasting Corporation, and is not yet part of the standard AKG product line.

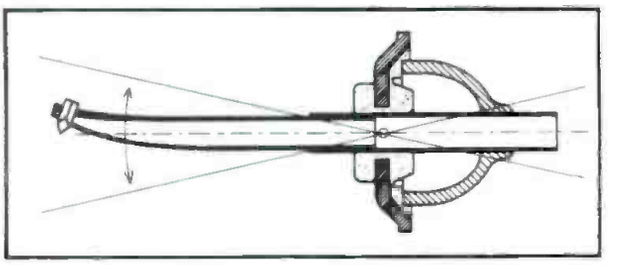
On the remote power supply, the toggle switch turns the C-422's leds on and off. Two nine-position switches control the polar patterns of each capsule independently.

The C-422 stereo condenser microphone.

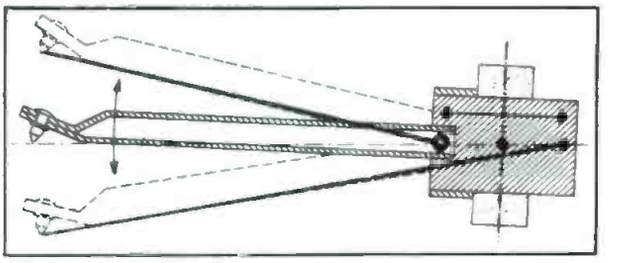
The bi-directional CK-4 capsule for the C-451. The housing encloses AKG's CK-12 large-diameter, double-diaphragm capsule.



A C-414EB is about to undergo some indignities. Once a plastic cover is placed over the microphone, engineers will evaluate performance under typical South American rain forest conditions.



The transversal suspension system uses a single pivot point.



In conventional suspensions, there may be some frequency-dependent shifting of the pivot point.

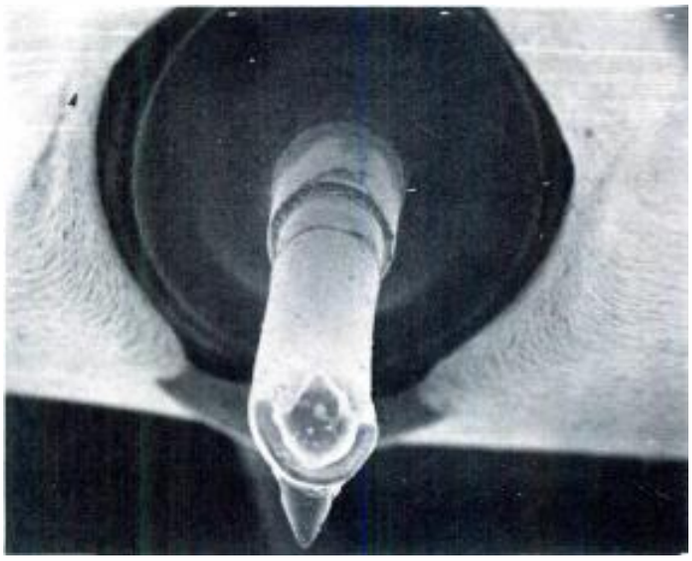
PHONO CARTRIDGES

As most readers know only too well, there's no shortage of phono cartridges on the market. So, when AKG decided to enter this sector of the marketplace, a question naturally came up: "Why?". Well, why not? Chief engineer Werner Fidi had decided that with AKG's experience with other transducers, the company's expansion plans should logically include the development of a phono cartridge.

The performance of phono cartridges is no-doubt best covered in the hi-fi press, although perhaps db readers will be interested in a brief review of AKG's approach to magnetic cartridge design.

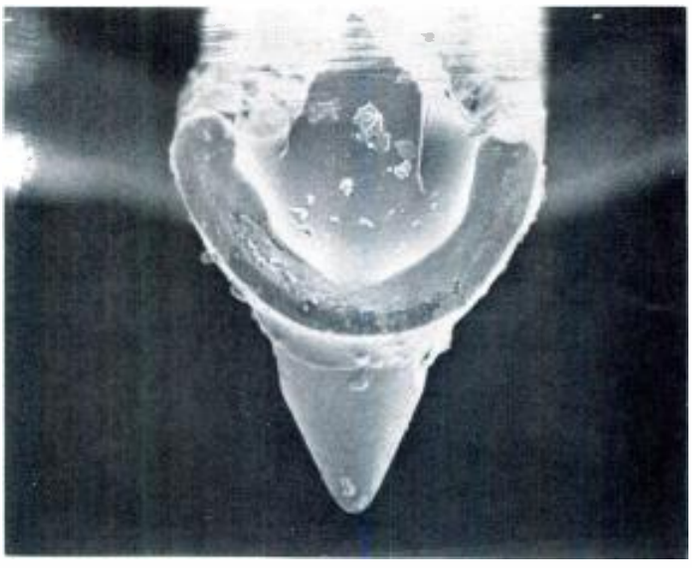
The AKG Transversal Suspension System is a "moving-iron," rather than a moving-magnet cartridge. That is, the stylus shaft terminates in a very-thin-walled, soft-iron tube, armature system, and the magnet is placed with the body of the cartridge itself. According to AKG, this substantially reduces the moving mass of the stylus assembly.

An electron microscope reveals some close-up views of an AKG stylus assembly.



a. 35x magnification

b. 100x magnification



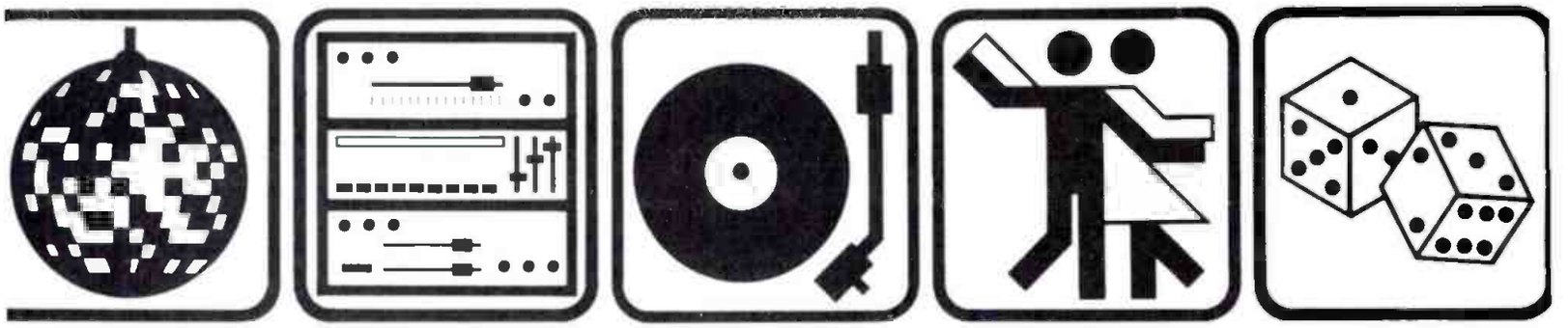
c. 100x magnification

d. 1000x magnification

In moving-magnet designs, AKG points out that the theoretical pivot point of the magnet may shift at high frequencies. By contrast, AKG uses a single-pivot-point suspension, and there should be no spurious frequency-dependent forces exerted on the stylus cantilever.

In a description of the system, AKG notes that the basic idea is fairly simple (as are all good ideas, once someone else has thought of them).

And what a good idea it was to visit Vienna, and AKG! Austria is the birthplace of Haydn, Mozart, Schubert and a host of other famous names in the world of music. Others (Brahms, Mahler, Beethoven, for example), whose parents lived elsewhere, made up for the oversight by spending much of their most-creative periods in Vienna. Music is in the air—chief engineer Fidi is himself an accomplished pianist. I should have asked him what mics he likes on piano. Oh well, maybe next time. ■



INTERNATIONAL ENTERTAINMENT EXPOSITION

DECEMBER 11-14, 1979

LAS VEGAS CONVENTION CENTER

Seminars for Professional Sound and Lighting Personnel

The Sound System:
Tuesday, 9:45-11:15 A.M.
Bob Heil, Bob Heil Sound
Glen Meyer, Electro-Voice
Tom Walter, Community Light and Sound
Cerwin Vega (to be announced)
Michael Pettersen, Shure Brothers
Don Pearson, Ultrasound
Ray Kimber, RKB Industrial Inc.
Others to be announced

Lighting, Engineering the Perfect System:
Wednesday, 9:45-11:15 A.M.
Jim Moody, Sundance Lighting
Bill McManus, McManus Enterprises
Bob See, See Factor
Chip Monck, Moderator
Rich Bay, P&B Lighting
Ted Van Bemmel, Vanco Stage Light
T.J. McHose, FM Productions

The Lighting Worlds—Cross Breeding:
Tuesday, 4:30-6:00 P.M.
Imero Fiorentino, IFA Associates
Lee Watson, Lighting Dimensions Editor
Marty Aronstein
Jim Moody, Sundance Lighting
Tom Folsom, Crews Folsom Assoc.
Brian Edwards, Wavelength

The Special Event—THE KISS SHOW:
Wednesday, 4:30-6:00 P.M.
Bill McManus and Associates

Sound Reinforcement—State of the Art:
Wednesday, 11:30-1:00 P.M.
Steve Neal, FM Productions
Jack Maxum, Showco
Stan Miller, Stanall Sound
Chip Monck, Moderator
Northwest Sound (to be announced)

The Rock Tour:
Thursday, 9:45-11:15 A.M.
Robin McGruder, Showco
Larry Hitchcock, FM Productions
Elliot Krowe, See Factor
Chip Monck, Moderator
Northwest Sound (to be announced)

Lighting Equipment Marketing:
Tuesday, 11:30-1:00 P.M.
Bob Schiller, Strand Century
Joe Bates, Litelab
Dr. Joel Rubin, Kleigl Brothers
Tom Pincu, Berkey Colortran
Marge Roman, Olesen
Larry Cada, Diversitronics
Bob Benson, Skirpan

Running a Successful Stage Equipment/Supply House:
Thursday, 9:45-11:15 A.M.
Jack Ransom, Metro Lites
Grand Stage Lighting (to be announced)
Barbara Brennan, Cinema Services
Jan Musson, Musson Lighting
Marge Roman, Olesen
Lee Watson, Lighting Dimensions, Editor-Moderator

Laser Technology:
Thursday, 11:30-1:00 P.M.
Ivan Dryer, Laser Images
Bart Johnson, Laser Displays
Carl Schulthess, Spectra Physics
Dick Sandhaus, Science Faction
Brian Castelle, Bur. of Radiological Health

Safety Standards:
Thursday, 4:30-6:00 P.M.
Dr. R.W. Davidson, Alexander and Alexander
Others to be announced

Running a Successful Sound Installation and Service Operation:
Thursday, 11:30-1:00 P.M.
James Eliot, Audio Unlimited
Charlie Moore, Dimension Five Sound
Larry Jaffe, DBX-Moderator
Barry Brownell, Brownell Sound
Claire Ford, Ford Audio

Performers Speak Out—Leading Performers Discuss the Live Show:
Friday, 11:30-1:00 P.M.
Chip Monck—Moderator
Speakers to be Announced

Plus more to be announced.

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CETEC-ELECTRODYNE modules and spare parts 711L input modules, active combining networks, line amps, and more: **Modu-Trend Industries, P.O. Box 602. Rockville, Ct. 06066 (203) 872-7750.**

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WANTED: USED RECORDING equipment of any kind. Expanding studio will pay cash. **Dennis Reed, Box 50022, Palo Alto, CA 94303 (415) 494-9344.**

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

SERVICES

CUTTERHEAD REPAIR SERVICE for all models Westrex, HAECO, Grampian. Modifications done on Westrex. Avoid costly down time; 3-day turnaround upon receipt. Send for free brochure: **International Cutterhead Repair, 194 Kings Ct., Teaneck, N.J. 07666. (201) 837-1289.**

JBL AND GAUSS SPEAKER WARRANTY CENTER. Full lines stocked. Instant recone service, compression driver diaphrams for immediate shipment. **Newcome Sound, 4684 Indianola Ave., Columbus, Ohio 43214 (614) 268-5605.**

MULTI-TRACK RECORDING specialists—1-2-4-8-16-24 tracks, authorized dealer for Tascam, Otari, Ampex, Teac, Technics, AKG, AB Systems, Crest, SAE Pro, dbx, Orban, Tapco C12, Audioarts, Loft, Lexicon, Ashly Audio, Altec, PAS, PSL, Shure, and many more. Single items or complete studio packages. Studio design and construction. Phone or write for a prompt written quotation. **Professional Sound Labs, Inc., 42 North Franklin St., Hempstead, NY 11550. (516) 486-5813.**

ACOUSTIC CONSULTATION — Specializing in studios, control rooms, discos. Qualified personnel, reasonable rates. Acoustilog, Bruel & Kjaer, HP, Tektronix, Ivie equipment calibrated on premises. Reverberation timer and RTA rentals. **Acoustilog, 19 Mercer Street, New York, NY 10013. (212) 925-1365.**

BUSINESS OPPORTUNITIES

RECORDING STUDIO AND OFFICE COMPLEX FOR SALE
MCI 24/16 track: Scully 16/8 track; 4-track, two 2-tracks, Mono. Video Tape, 26' x 31' Studio, Conference room, 5 offices, sauna, shower, 3 bathrooms. 9 year lease—Current rent $1500.00/month. Manhattan-Midtown West. Asking $175,000.00. Call **(212) 581-3970.**

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Dept. 102, db Magazine
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Plainview, NY 11803

STUDIO PLUS HOME in Western Washington State. Part or Full-time business. Price includes all major equipment. $95,000. For details write: **Studio, P.O. Box 615, Shelton, Wa 98584.**

EMPLOYMENT

WANTED: FULL TIME maintenance assistant for major Long Island recording studio. Experience a must! Send resume to: **P.O. Box 192, East Norwich, NY 11732.**

AUDIO PRODUCTS ENGINEER—We are seeking an audio equipment engineer who is an aggressive and innovative designer. One who has designed consoles or components for consoles used in recording and broadcasting applications. If you are this creative and product oriented individual looking for a rewarding career we would like to talk to you. Please reply including your accomplishments and salary history to: **Modular Audio Products, Inc., 50 Orville Drive, Bohemia, NY 11716.**

ENGINEERS/TECHNICIANS—Expanding NYC re-recording facility has opportunities for experienced maintenance engineers/technicians and recording engineers. **Dept. 101, db Magazine, 1120 Old Country Road, Plainview, NY 11803.**

SOUND ENGINEER AVAILABLE. Education/experience in recording, reinforcement, radio, theatre and music. Write for resume: **D. L., 3077 Culver Rd., Rochester, New York 14622.**

ACOUSTIC ENGINEER
Must have experience in design & production engineering of loud speaker & speaker systems. Salary commensurate with experience. Send resume to:
Fred Becker
BECKER ELECTRONICS
Route 145
East Durham, NY 12423

Wanted:

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8460 San Fernando Road
Sun Valley, California 91352
Forward resumes to: R. B. Combs

db People/Places/Happenings

• Elected vice president of marketing for **Ampex Corporation, C. Ridley Rhind** will be responsible for overall marketing strategy and for the coordination of new business development. He will also direct the operations of the corporate advertising, public relations and marketing services departments. Mr. Rhind comes to Ampex from **Diablo Systems,** Hayward, CA, where he served as vice president of marketing.

• Nearly doubling their manufacturing, warehousing and office space, **BGW Systems** has expanded its Hawthorne, CA, facilities. Occupying the enlarged office facilities are two new staff members in the sales department: **Marguerite Sweeden,** national sales administrator, formerly with **JBL;** and **Paula Czarnowski,** foreign account specialist.

• Supervising all sales and marketing activities for JBL's professional product lines within the United States, **Ron Means** has been appointed manager of the Professional Division at **James B. Lansing Sound, Inc.,** Northridge, CA. Prior to joining JBL, Mr. Means held sales management posts with **Altec Lansing,** where he most recently served as national sales manager for professional and musical instrument products, and University Sound. In addition, **Jim Phoenix** has been named manager of transducer engineering at JBL, where he will direct the transducer engineering staff in investigating, developing and improving component transducers and system designs.

• **Parasound, Inc.,** San Francisco, CA, has been appointed as the exclusive worldwide distributor (with the exception of Europe) for **Synton Electronics** of Holland. The Syntovox 221 and 222 vocoders will be the first of the Synton product line to be introduced in the United States and other foreign markets.

• **Robert Switzer** and **Thomas S. Butler** have both received managerial promotions in the sales department of **McMartin Industries,** Omaha, Nebraska. Mr. Switzer, formerly Western sales manager, has been appointed director of domestic sales—with national sales responsibility for all McMartin product lines. Mr. Butler, formerly Eastern Sales manager, has been named director of international sales.

• Joining **BASF Systems** in the newly-created post of sales manager of professional products, **Bob Piselli** will assume the responsibility for selling the company's line of duplicator tapes and calibration test cassettes. Mr. Piselli comes to BASF from **Associated Audio Services** of Port Chester, NY, where he was president and a major shareholder. **Jeff Housman** has been named national sales coordinator for audio/video products of BASF, where he will be in charge of government and military sales, trade shows, order processing and field communications. Mr. Housman joins BASF from **Automatic Radio,** where he most recently served as national sales manager for the company's OEM division. And last, but not least, **Michael Cassettari** has been appointed assistant product manager, audio/video, where he will support the division in sales forecasting, promotion planning and budgeting for the company's line of audio and video products.

• **Sid Zimet,** founder of Audio by Zimet, Roslyn, New York, and co-founder of **Sound Workshop,** Hauppauge, New York, has joined the New York offices of **Audiotechniques, Inc.,** headquartered in Stamford, Connecticut. Mr. Zimet's first assignment will be to expand the services of the firm's rental division in New York City. Toward that goal, Mr. Zimet has put into operation laboratory facilities for testing rental equipment before delivery and upon return; and an increased inventory covering a full range of components.

• Named executive director of the **Society of Motion Picture and Television Engineers (SMPTE), Donald F. Breidt** succeeds **Denis A. Courtney** who has retired. Mr. Breidt comes to SMPTE from **Harcourt Brace Jovanovich** where he was general manager of the Trade Book Division.

• The four-month, $1 million modernization of **Electric Lady Studios** in New York City has been completed, with three separate studios now available for booking. Studio A has been totally redesigned by **Westlake,** and is equipped with the new Neve 8078 console. Studio C, conceived by Westlake and John Storyk, boasts the Necam computer. Studio B also utilizes a Neve console, and all three studios are equipped with the Westlake 4-way monitor system and 3M and Studer tape machines.

• Named to the position of general sales manager at **Ferrofluidics Corporation,** Burlington, MA, **Donald S. Sweet** will assume responsibility for all sales and service for the company's domestic and international markets. Mr. Sweet has ten years of industrial sales, marketing and management experience with **Texas Instruments,** where he most recently served as product line manager.

• Appointed vice president-marketing for **UMC Electronics Co.,** North Haven, CT, **Philip Lohman** will assume responsibility for the sales and service of all UMC products produced by the Broadcast Products Division, and the electrical and hydraulic aircraft subsystem test equipment from the United Manufacturing Division. Prior to joining UMC, Mr. Lohman was assistant vice president-international for the U.S. Electrical Motors Division of **Emerson Electric Company.**

• **Victor F. Machin,** executive vice president marketing, manufacturing, and personnel for **Shure Brothers, Inc.,** Evanston, Ill., has retired after 37 years of service with the company in various sales and administrative positions. Mr. Machin will continue his association with Shure as a consultant to the marketing division. **Raymond E. Ward** will assume a portion of Mr. Machin's duties, in his new position of executive vice president of marketing. Mr. Ward, previously vice president of sales/marketing promotion for Shure, has also been named managing director of **Shure Electronics Ltd.,** England. Manufacturing and personnel functions performed by Mr. Machin will be assumed by **J. H. Kogen** in his new position of executive vice president—operations manager. Mr. Kogen will also maintain responsibility for functions of his previous position as executive vice president of finance and engineering.

• In a preliminary step towards setting up a manufacturing base near Seattle, Washington, **Audio & Design Recording** Inc. (the wholly owned subsidiary of **Audio & Design Recording Ltd.** of Great Britain) is moving its U.S. base of operations. **Richard Strang,** ADR's research and development engineer from Great Britain, will be joining **Nigel Branwell** (vice president—marketing) in Seattle to assist in the expansion and to supervise their service program. ADR's new address is: P.O. Box 786, Bremerton, WA 98310. Telephone: (206) 275-5009.

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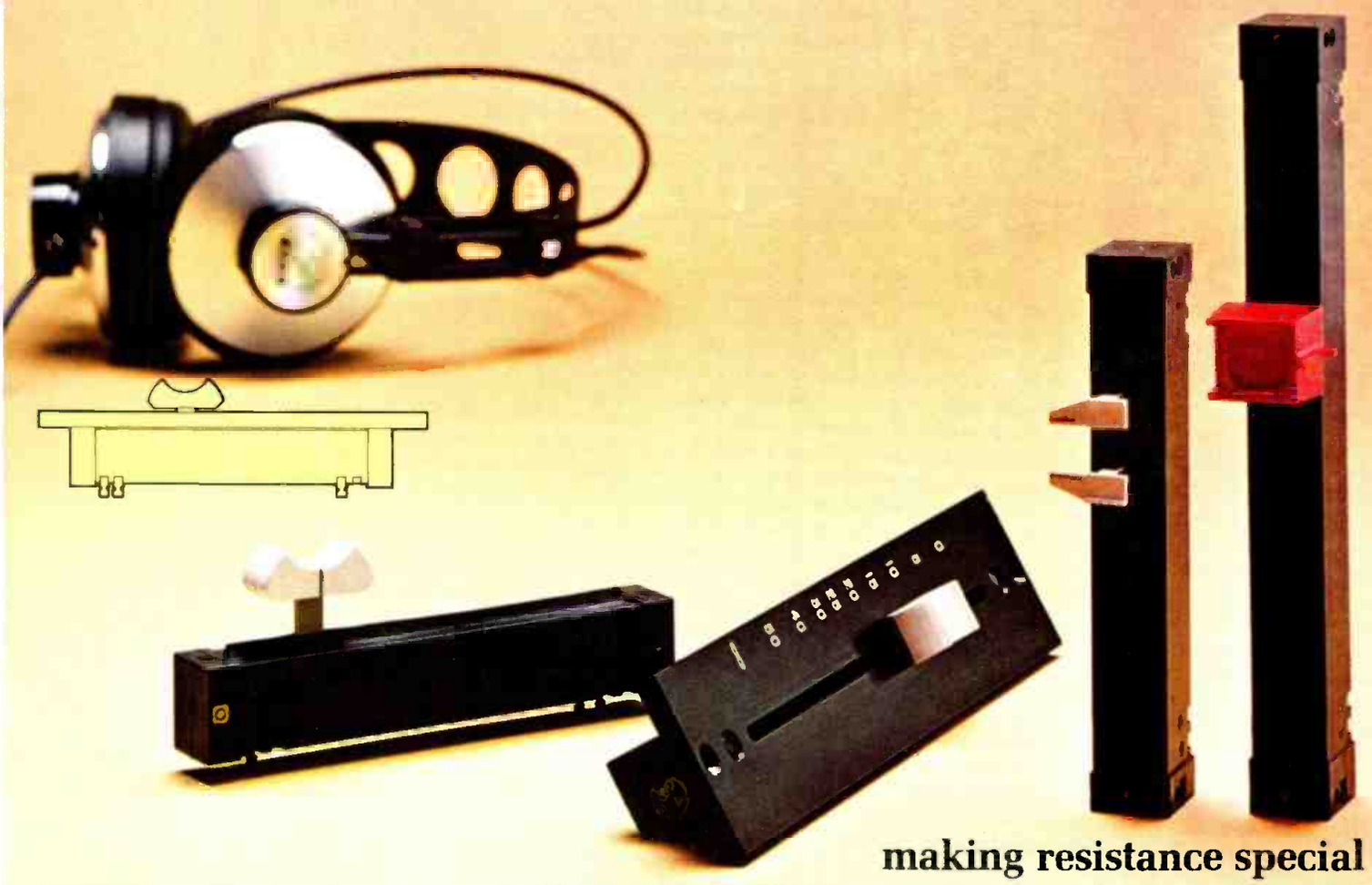

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