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STUDIO DESIGN . . . Page 11  
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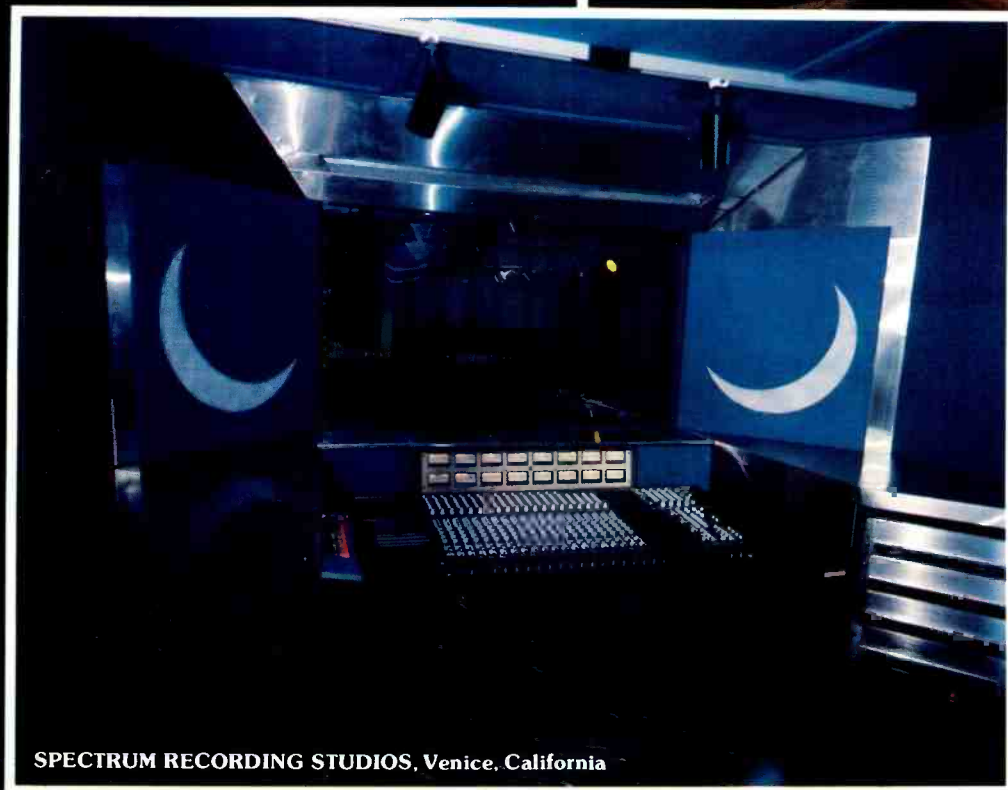
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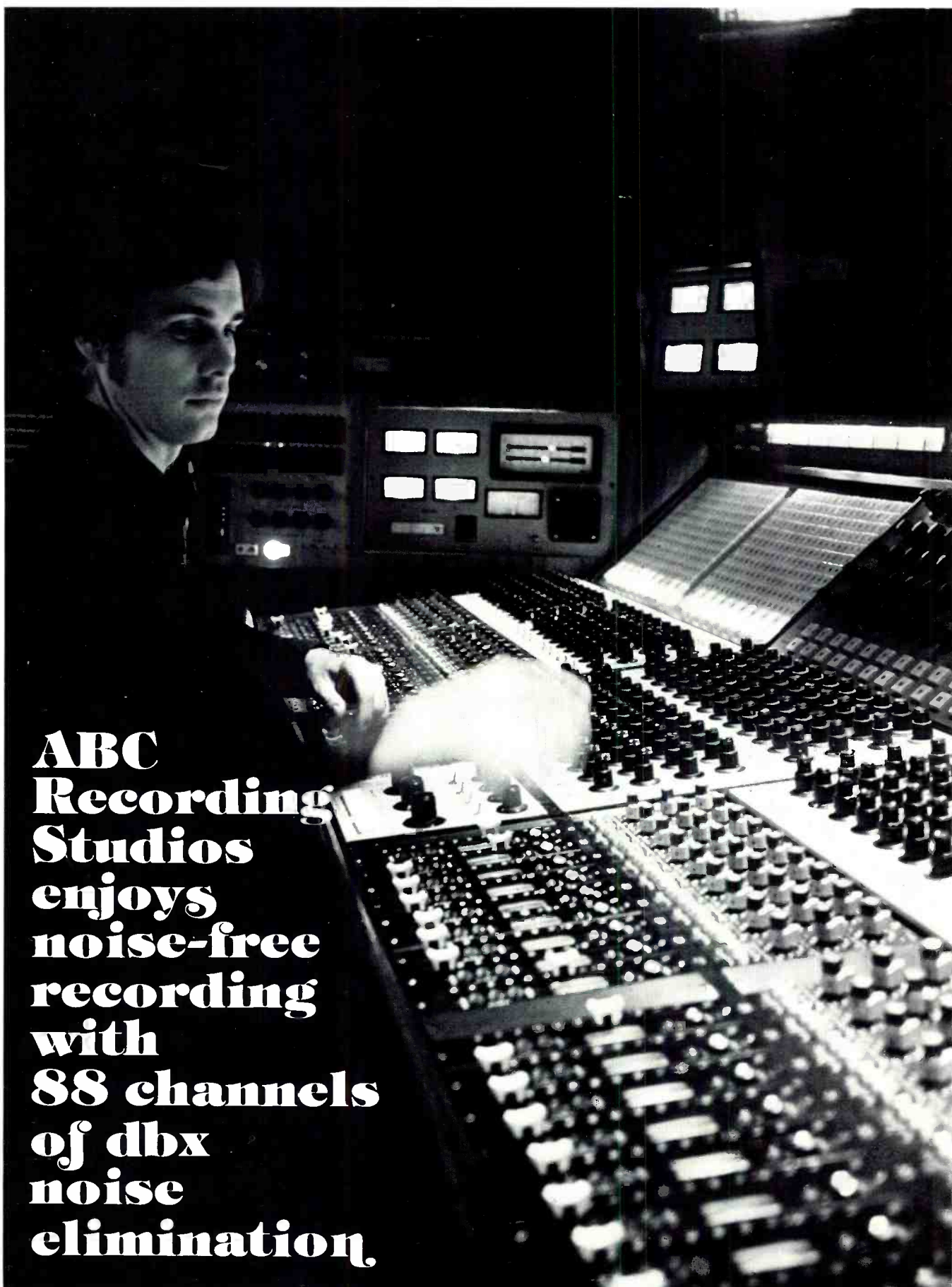
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*Howard Gale at the Studio B console during session for the Three Dog Night album Comin' Down Your Way, ABCD-888.*

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## LETTERS and LATE NEWS

FROM: John M. Eargle  
JME Associates  
Hollywood, CA

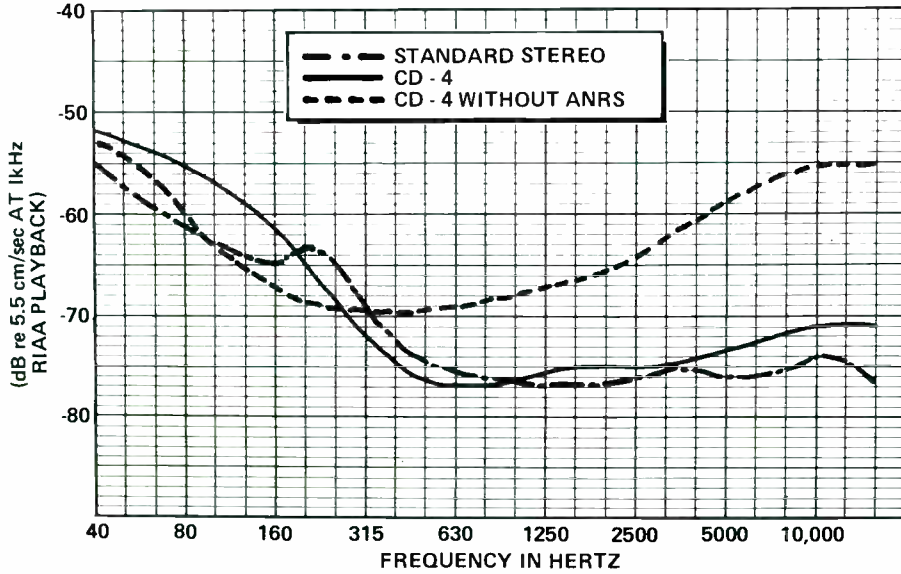
I would like to clarify a statement which appeared in an article in your December 1975 issue, "The Lacquer," by Wayne Yentis. On page 22, Mr. Yentis' relative noise levels for CD-4 and stereo are at variance with practice. The accompanying graph shows relative noise levels for (a) stereo, (b) the CD-4 process, with its integral ANRS (Automatic Noise Reduction System), and (c) the CD-4 process *without* ANRS. The ordinate, or vertical axis, of this graph is clearly designated.

In making these tests, a wave analyzer was placed across one of the four outputs of a laboratory demodulator which had been properly calibrated for the test cartridge at hand. The demodulator provided the three modes of operation shown in the graph; for the standard stereo curve, the carrier recovery system was simply turned off.

Note that with ANRS, which is a single-band noise reduction system similar to the B-type Dolby, the noise spectra of the CD-4 and standard stereo are fairly close out to about 4 kHz. Beyond that point there is a divergence between the two, reaching about 5 dB at 16 kHz.

In the CD-4 system noise comes from two sources. First, there is the component generated by baseband response, the stereo portion of the system, and consists of those noise components generated over the 30 Hz to 15 kHz region. The other component is noise introduced into the FM carrier portion of the system. Since the bandwidth of the carrier portion is from 20 kHz to 45 kHz, noise components may be produced over a 25 kHz wide bandwidth. Roughness observed in the record groove may be noticeable in the carrier region because of the random phase modulation such roughness would superimpose on an otherwise unmodulated carrier even though the FM system is immune to "ticks and pops" *per se* through the use of heavy limiting. This is often observed at inner diameters where the dynamics of the cutting process may be quite different than at the outside of the record. Let us not forget that the cutting action is indeed a complicated one. It is a mixture of shearing, burnishing, and embossing, and the balance between these depends on a number of variables, such as groove velocity, stylus heat, and stylus configuration.

## 1/3 - OCTAVE NOISE SPECTRA



### MIDWEST ACOUSTICS CONFERENCE '76 TO DISCUSS ACOUSTICAL MEASUREMENTS

"The Measurement of Sound Fields and Their Effect on People" is the subject for the Tenth Annual Midwest Acoustics Conference. The one-day meeting will provide comprehensive coverage of modern signal processing and data reduction technology for solving new technical and legal problems in acoustics.

Speakers from government, industry, and universities will participate. The 1976 Conference will be held Saturday, May 1, in the Norris Center of Northwestern University, Evanston, Illinois.

The program features speakers who will review the requirements for good acoustic measurements as well as today's equipment technology. Solutions to problems in the fields of noise control, community noise, architectural acoustics,

sound reproduction, and musical instrument research will be discussed. The speakers will include David Pallett and Curtis Holmer, Nat'l Bur. of Stds.; David Lubman, Lubman Associates; James Beauchamp, U. of Ill.; Howard Schechter, IITRI; and Fred Wightman, Northwestern University.

A number of manufacturers of acoustic instrumentation and audio equipment will exhibit their products.

MAC '76 is an annual Chicago Area Conference sponsored by the Audio Engineering Society, Institute of Electrical & Electronic Engineers, Chicago Regional Chapter of the Acoustical Society of America, and the Chicago Acoustical & Audio Group.

For further information about the conference or exhibits contact H.O. Saunders at Rm. 24A, 225 W. Randolph St., Chicago, IL 60606 or Telephone (312) 727-4331.

### ACOUSTICAL PROPERTIES OF PARTICLEBOARD EXPLORED IN NEW STUDY

An acoustical study on the damping rates of various cabinet materials has showed particleboard scoring significantly higher at almost every sound level. The study, sponsored by the National Particleboard Association, was conducted at the Geiger & Hamme Laboratories under the

... continued on page 58

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The \$595 Dynamic Sibilance Controller contains three independent channels to handle separate vocal mikes or magnetic dummies without interaction. A dual-primary power transformer puts it at home anywhere in the world while levels and impedances permit easy interfacing with any professional audio equipment.

516EC customers often wonder how they ever got along without it. And in today's competitive studio market, the creative freedom offered by really effective de-essing yields a strong competitive edge. For further information on the 516EC Dynamic Sibilance Controller, see your local Orban/Parasound distributor, or contact:

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*ELECTRIC LADY  
Photography : John Veltri*

# SOLUTIONS to 3 COMMONLY ENCOUNTERED ARCHITECTURAL & ACOUSTIC STUDIO DESIGN PROBLEMS

by  
**JOHN STORYK and ROBERT WOLSCH**

#### The Authors

JOHN STORYK and ROBERT WOLSCH are the principals in Sugarloaf View, Inc., a prominent firm specializing in architectural and acoustical design and construction.

Over the past five years some of their better known installations have included: ELECTRIC LADY STUDIOS and ATL-ANTIC RECORDS, N.Y.C.; LEON RUSSELL's STUDIO, Tulsa, OK; BEARSVILLE STUDIOS, Bearsville, NY; and RECORD PLANT 'B' in Los Angeles.

Sugarloaf View is located at: 75 East 55 St., N.Y., NY 10022. (212) 751-5730

In the following design portfolio we have selected three studios which significantly demonstrate, in no particular order, a number of programmatic architectural/acoustic criteria which regularly appear in the designing of recording studio facilities. These criteria are typically those of either an owner who desires a new small facility to be created on an existing piece of real estate, or in an existing structure, which more than likely is ambient environment; an urban area complete with non-compatible neighbors, top bottom and sides, street noise, etc.,

etc., or . . . an owner who already has an eight or sixteen track installation who is interested in upgrading to a sixteen or twentyfour track recording facility . . . while desiring a concurrent improvement of both cosmetic and acoustic factors. This, then, is a demonstration of some of the programmatic solutions to the most often encountered restrictions.

*continued overleaf . . .*

## THE NARROW ROOM

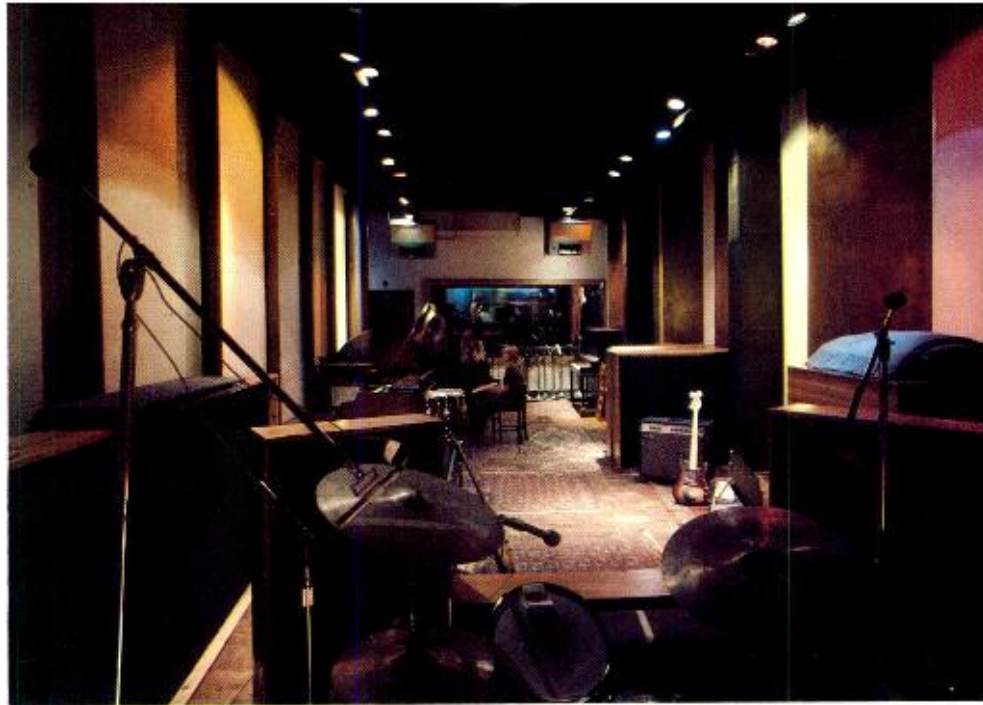
### BLUE ROCK RECORDING STUDIOS New York City 1970

Undoubtedly the single most restrictive and, for that matter, interesting aspect related to the design of this facility was that it had to be constructed in an extremely long and narrow environment. This is the predominant characteristic of the traditional loft type building located in the old downtown are of Manhattan commonly known as 'Soho.'

At the time the project was originated the owners committed themselves, and thus the studio, to attract music and album dates. Consistant with this assigned goal the control room was required to be both acoustically functional and, above all comfortable . . . a studio in which the artist or group of artists could sustain their creativity for long periods of time, typically eight to twelve hours at a stretch.

#### *The control room*

In the control room, with only a trifle more than 12 feet to work within, the illusion of spaciousness and comfort was partly created, as illustrated on the floor plan, by providing a comfortable audience seating area in back of, and elevated 3 feet above the essential control room work zone. In addition to simply providing the audience with a conveniently comfortable listening area, from an acoustic point of view, they were also located within the sound field where acoustic accuracy is able to be maintained to a much greater degree than if the audience were located in seats or the traditional couch in front of the console. The speakers' mountings are rigidly baffled, making use of specially ported cabinets, housing Altec 604-E's. This arrangement provided more level and a broader uniform dispersion at the console.



BLUE ROCK  
Photography : John Veltri

#### *The studio area*

The studio area provides a more interesting example of what can happen in an environment which at first glance does not appear to be conducive to a recording facility. What had to be done was to make the room appear acoustically much wider than it really was and at the same time architecturally create the apparent widening of space.

The solution was a wall system consisting of a repeated series of vertical fins having two surfaces, 2" linear painted fiber-board and rigid plywood. The angles of the smaller plywood fins changed ever so slightly as one went from one end of the room to the other, giving an extremely broad first reflections pattern. A first reflection(s) pattern, here, is a reasonable indication of any mid and high frequency focusing — a situation which would obviously be unsatisfactory, particularly in a narrow room. The 2" linear fiber board provided the necessary absorption on the wall.

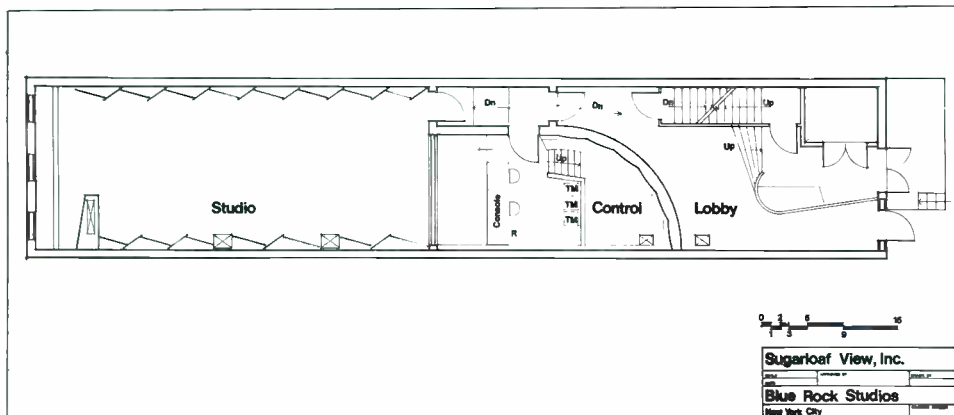
Suspending 1" thick duct liners from the ceiling with clip hangers provided all

the additional absorption needed in the room. The ceiling material when hung as described and detailed with matte black adjustable bullet down-lights becomes quite dimensionless. This allowed us to cover a rather large amount of ceiling surface at a very small cost. This is an excellent example of inexpensive "industrial materials" being used architecturally and coincidentally the beginning of an architectural systems interface.

The air conditioning system was located completely in the basement, a space owned entirely by the recording studio. The air was distributed to the control room, studio and lobby via air handling "columns."

It is hard to completely tell in the photograph but the floor tiles were actually set on the same grid pattern (angle) as the rigid fiberglass "splays" on the wall. This gives the appearance of the space being off axis and consequently wider and less constraining.

Thus, for the first time we actually had used a number of unrelated elements as well as seemingly unrelated program criteria to effect one, hopefully successful, completely interrelated architectural-acoustical design. This is very different from the more traditional and static approach which in this particular instance would probably go as follows: first build the room, then deal with the acoustical problem and then somehow try to put the air conditioning in the ceiling. Granted the effort here was rather primitive yet none the less at this point in time a first step towards some sort of philosophy of interfacing architectural, mechanical and acoustical elements in a recording facility.





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**BROADWAY RECORDING**  
New York City, 1974

This renovation dealt with a number of elements which had not surfaced in the other control rooms. The single most important being symmetry. The existing room had four suspended 604-E's which had simply been placed equi-distant from one end of the window wall to the other without being focused in the vertical or horizontal plane. However, the entrance to the room, which had to remain where it was, forced the console and consequently the acoustical center line of the room to be off-center. This is a very common reality in older control rooms and in many newer ones for that matter — namely that in a traditional sound lock/control room/studio relationship, the control room is entered from the side. Unless the control room is at least 18 feet wide, the chances are that the acoustic and architectural center lines of the room will not coincide, which was clearly the case in this example. Most middle-sized control rooms (200 — 300 sq. ft.) are not 18 feet wide. Consequently, this room required that two different environments be investigated simultaneously; the speaker environment and basically the environment that encompasses everything else (people, machines, etc.) O.D.O. Studios and Bearsville Studios are also examples of this "room within a room" design.

To create a more accurate response from the repositioned monitors, a number of elements were employed. The speakers were infinitely baffled; the im-

mediate environment to the sides of the total speaker enclosure was made reflective as well as convex for scattering purposes — enhancing first reflective energy; new ported cabinets were introduced in the monitor system. The speaker system was focused slightly behind the mixer's ear to give the maximum horizontal dispersion across the board. The wall systems, however, are slightly more complicated than the photograph and floor plan indicate. The apparent curved striped wall elements are actually two different wall systems. From the bottom of the speaker enclosure up to the ceiling, the surfaces are hard and reflective (the fabric covering being only decorative). However, the left hand wall (from this height down to the floor) has a system of alternately spaced wood planks and fabric covered perforated metal screens which provides a broad band absorptive element to equal the extra space (which appears at this height) to the right of the console board due to the off-centering of the entrance steps. In architectural terms this is effected with a fascia/soffit type of construction. This design element provides the means to economically integrate the signal and power conduits, peripheral lighting and air conditioning requirements.

The panels on the ceiling are adjustable slat resonators which were designed as an experiment to see if it were possible to acoustically equalize the mid and high-range response from the 604-E's. Although in theory the calculations appeared reasonable, in practice it turned out to not be as effective as had been expected and ultimately the resonators were

fixed in one optimum position. However, acoustically focusing our attention to the ceiling both in the front and rear of the control room forced us to turn our attention to an entirely new area in control room design, namely that of lighting. Again, an instance where one particular aspect of architectural-acoustical criteria forced us to interface with an apparently different piece of design criteria, usually left to last (or never).

It was decided that the front portion of the ceiling and the speakers were to become a point of visual focus within the room. There was only one location for a lighting unit that could simultaneously light the face of the speakers and ceiling. This was in front of the console. This problem again led back to intergrating architectural (this time furniture) with other requirements. And as can be seen from figure 1, the lighting became part of the furniture.

Lighting the control board proved to be another problem because of the geometry and placement of the adjustable slat resonators which forced the down-lights to be spaced too far apart to provide equal illumination on the console. The problem was solved by using an adjustable dark cone down-light as shown in figure 2. This type of fixture also enables the user to aim the beam of light so that reflected glare or lamp image on the console is eliminated. The complete control room lighting system now becomes a balance of illuminated surfaces.

All lighting within the control room was controlled by auto-transformer dimmers to prevent the occurrence of R-F energy within the environment.



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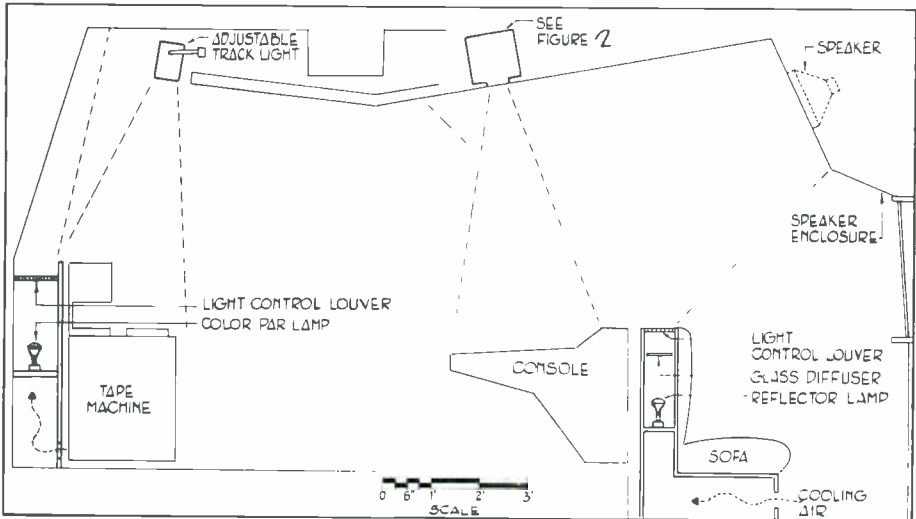
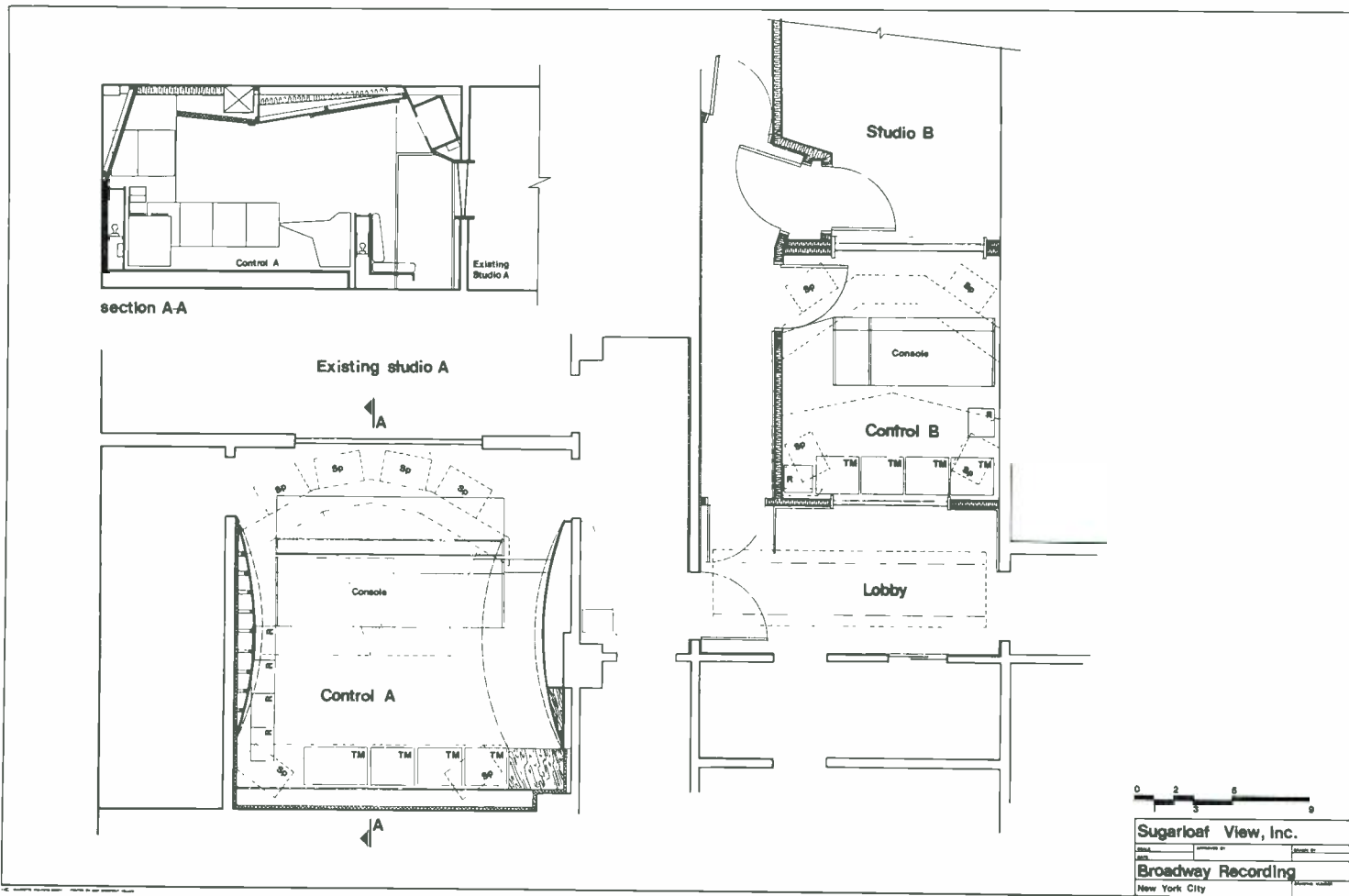
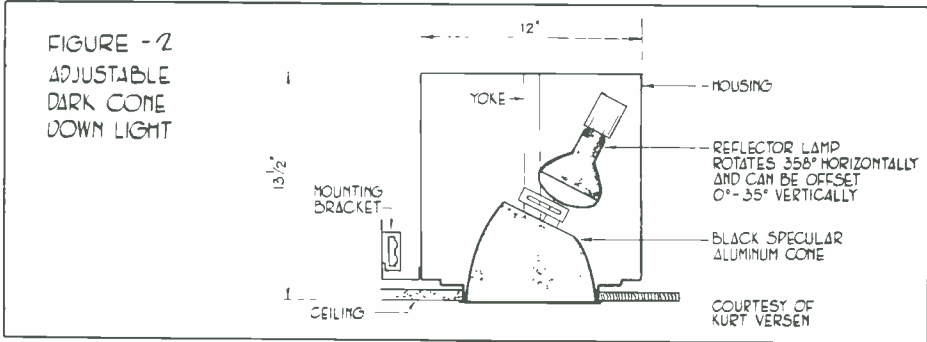


FIGURE 1  
CONTROL ROOM  
SECTION



BROADWAY RECORDING  
Photography: Robert Wolsch



## THE LOW CEILING ENVIRONMENT

### QUAD 5 STUDIOS Merrick, N.Y., 1975

The site was an existing building an hour east of New York City in Nassau County, and hardly an acoustician's dream — very low ceilings, a light wood frame structure and a site with a fair amount of traffic and other ambient noise problems. Due to the limited amount of real estate an attempt was made to unify the control room — studio environment and at the same time make each room appear to be more spacious. We therefore installed an extremely low control room/studio window wall (see photo). This creates a degree of transparency between the two rooms. However, there are a number of problems which accompany this type of architectural solution. For example, one has to be very careful of low frequency modes in the front of the console. This is solved by angling the glass and installing a modified sort of trap as shown below the speakers, mounting the speakers (Altec 604E's with Master Lab crossovers) at ear level and having the speaker separation, versus distance to listener's ear ration fall

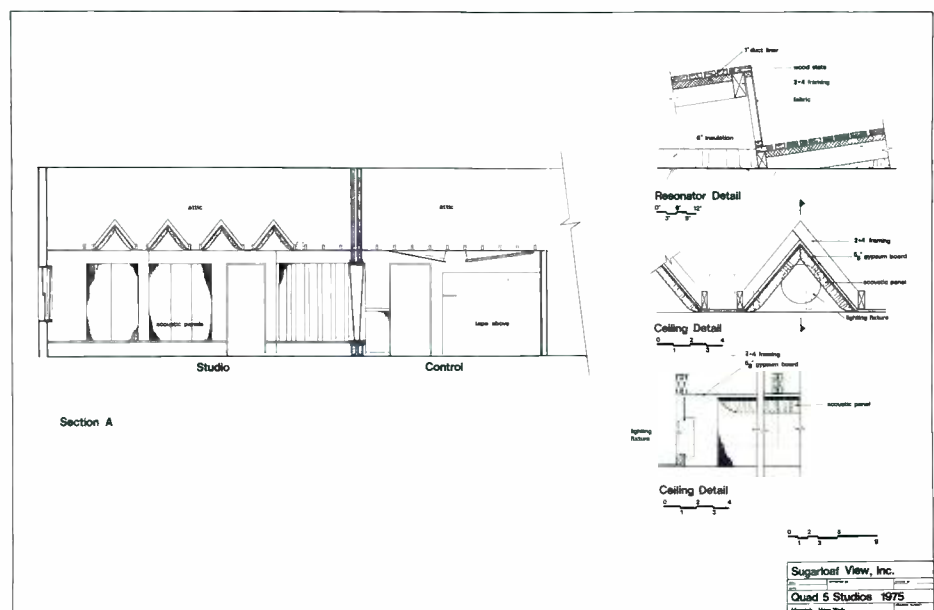
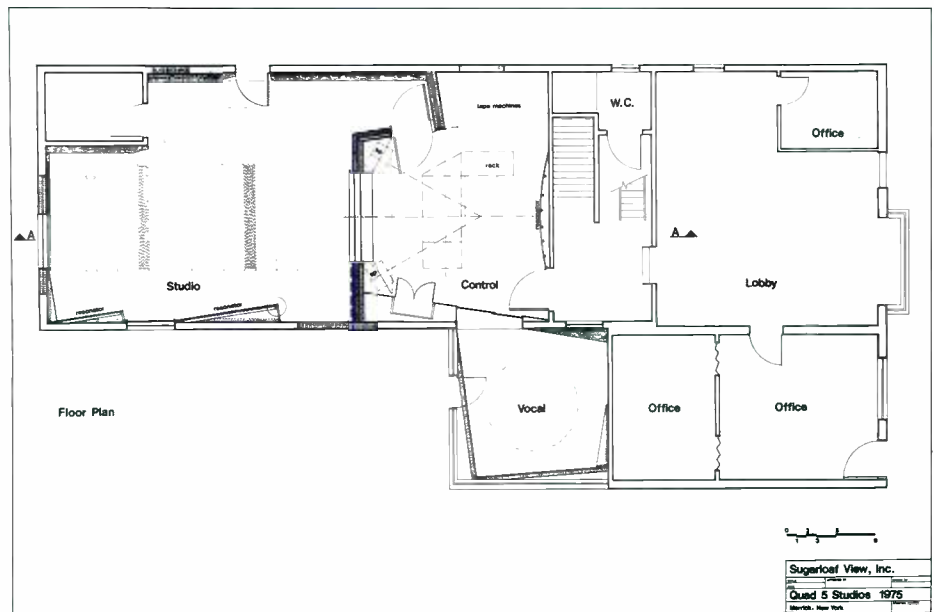
within a certain subjective range. Observing this criteria, one can actually use this type of window installation and at the same time obtain an accurate frequency response curve for a middle-sized control room. In fact, the response curve for this room was slightly better than we predicted and no electronic equalization was installed (see figure 3).

A tape machine alcove in conjunction with fascia/soffit type construction permitted us to effectively maintain an acoustic center line without coinciding with the architectural center line. Prefabricated ceiling clouds and real wall surface mounted resonator provided the additional internal acoustic treatment for this room. Prefabricating these elements resulted in an unusual cost saving.

The most interesting single element in the complex is the integrated ceiling

system in the studio area (not really shown) in the photograph but clearly described in the plans and sections). The existing ceiling was only 7'10" high, hardly gracious from anyone's point of view for a recording studio. We did, however, have the ability to puncture this surface and project it slightly into the attic. Again, what we ended up with was an example of interfacing, no less than 4 separate types of architectural and acoustical systems into one integrated ceiling package. The "cathedral type construction" provided us with 1) a way of making the space appear considerably higher, 2) a place for us to put the necessary ceiling absorption needed to provide minimum separation in the space, 3) a way of successfully integrating linear diffusers being particularly noticeable or obtrusive, 4) a method for providing

QUAD 5 STUDIOS  
Photography : Robert Wolsch





# How to Engineer A Second Generation Programmable Audio System

First, you take some experience. Say you had created the only commercially successful system to date. One that has mixed literally hundreds of hit records, around the world. One whose owners praise, not swear at. Then you use that experience to guide you in the creation of a real blockbuster second generation system.

Let's see, you say, where can we improve on the original? Well, the access time gets kind of long when you use too many functions and, actually, 256 analog functions isn't really quite enough to do total automation of highly complex consoles. So you conjure up a whole new method of programming data. One which maintains a lickety-split 3.2 millisecond access time, regardless of the number of functions encoded. You call it Allison Priority Encoding.

Now that you've got the capacity vs. speed problem whipped you pick a code capacity you know darn well is ample for *all* applications. Say 65,536 binary bits (the equivalent of 8192 analog functions). While you're at it, you build in self testing circuitry and error detection circuits capable of coping with the worst possible junk that a tape machine can produce. As far as storing the data, you set up the system so that either the master tape itself or a synchronized slave machine or cassette may be employed.

O.K., now we've got enough capacity to automate Manhattan, shall we run 65,000 wires to the console? Gracious no, Belden Automation can have that one! We'll use the only logical method we know of for distributing large amounts of data through a system. . . . The data buss approach. Besides reducing the sheer number (and consequent reliability factor) of wires and connectors by around 50 to 1, the data buss approach creates a straight forward and cost effective system which is capable of doing things that simply weren't possible with discrete wire systems.

Now we're ready to start building console components. We've got speed, reliability, unlimited capacity and a superior distribution system. The sky's the limit. We can even automate the ash trays! Let's start at the bottom with the level control section. First, we'll automate input assignments, from one of four sources, with master control to allow simultaneous switching of all channels. That will take 6 switches per channel, with 6 LEDs to let you know what you've programmed. Now, as long as we're going to have grouping masters, we really need to program their assignments so we don't have to go back to writing things on the box. I guess 15 groups should be enough. Let's see, that will take another 15 switches and 15 LEDs per channel. Whew! This thing's going to get expensive. We've still got to do Mutes, Solos, Group Mutes and Group Solos. They each have to use momen-

tary switches, LED indicators and Read/Write switches. Wow, this thing's going to have so many lights and buttons you won't even be able to find the faders.

Hey, wait a minute, the faders! We've got to do something with that update index point and those confusing null lights. Besides that, if we're going to have a really viable automation system, all controls must be electrically set-able and visually monitorable. The only way we know of electrically setting a conventional fader is with little motors. No thanks, might we suggest the Belden/Westinghouse Foundry and Audio Works?

Obviously this total automation thing just isn't going to work if we simply sit back and adapt conventional control technology for programmable operation. If we build a machine so crammed full of lights and buttons as to become a mental and physical obstacle to the operator, then we have defeated the whole purpose of automation.

While some manufacturers, in an apparent effort to jump on the bandwagon, seem content to propose additional complexity (and cost) as going hand in hand with the advancement of the mixing art, we at Allison Research acutely disagree. While our experience has shown us that the industry does, indeed, want automated ashtrays, our own common sense tells us that these giant steps forward must be paralleled with equal strides in the direction of achieving harmony between man and his machine. To that end, we have ignored the bonds of convention in creating our new machines. We have included many radical concepts in our designs. Concepts created to allow the fullest utilization of the automation technique, while reducing the complexity of the man/machine interface to levels far below that of today's conventional non-automated systems. We think you will be in total agreement with our thinking. As a matter of fact, we're betting our company on it.

Sincerely,

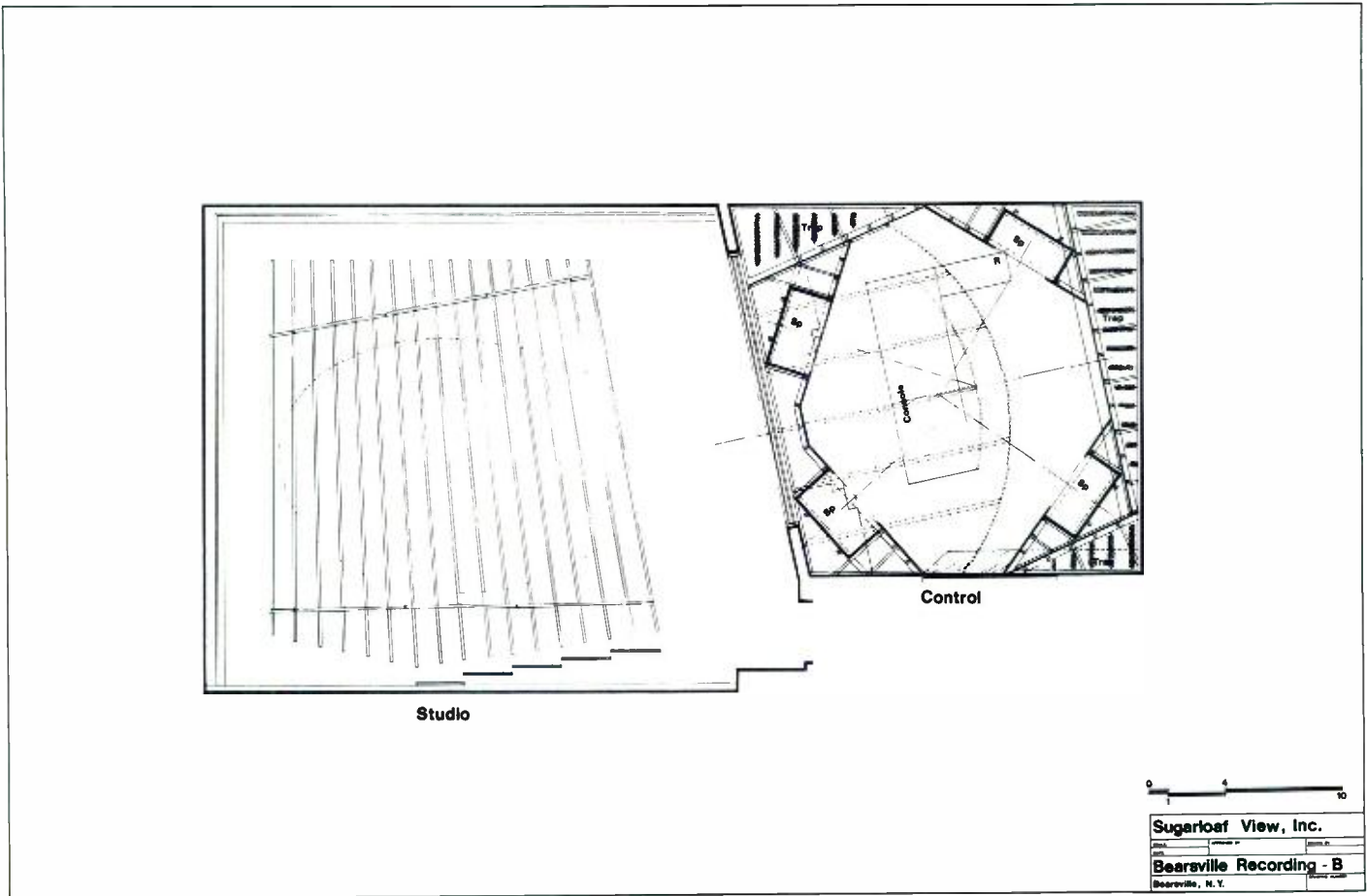


Paul C. Buff, Pres.

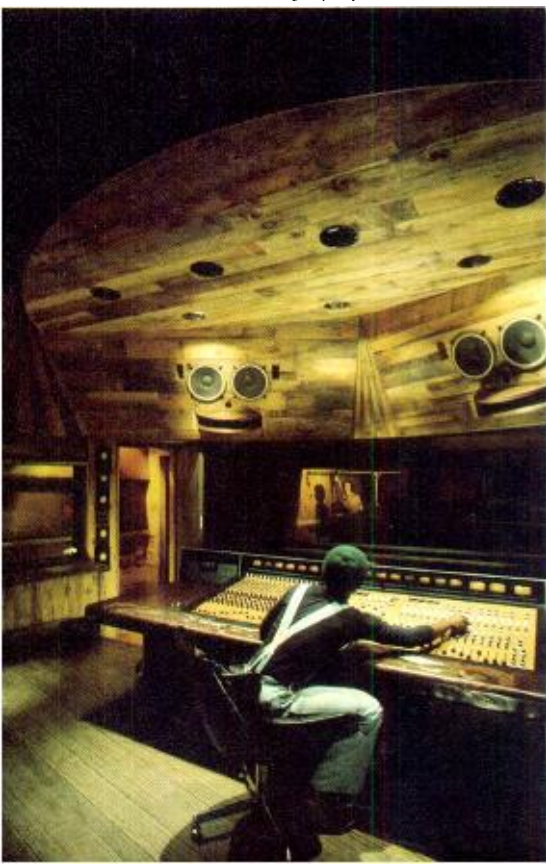
P.S. First deliveries of the Memory Plus System 2nd qtr. '76



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*Photography : Robert Wolsch*



direct general illumination, and 5) equally as important, a method for providing "mood lighting" – deemed necessary by the client due to the type of music being recorded in the facility. Most importantly, all this was accomplished quite economically. Again, as in the control room, prefabricated slat resonators and wall/ceiling acoustic panels were installed.

*Tomorrow*

These three descriptions, although much briefer than we would like them to be, provide examples of a certain type of thinking that we believe to be necessary in recording facility architecture. For years electronics people have always understood the nature of system's thinking. In a typical monitoring system, for example, there are no less than a dozen separate elements. In some instances manufactured by a dozen separate companies, yet no reasonable components without clearly understanding how they relate to each other. In recording studio architecture this type of thinking has not always been understood. For the most part, this lack of a system's approach is clearly a function of the building industry in general, yet we can think of no

better place to try and correct this than in these rather specialized architectural situations.

Over the years in electronics thinking the absolute number of parts per function has actually decreased (due to transistorization and miniaturization). We believe that this thinking should begin to take place in recording facility architecture. For example, in a project currently in our office, we are trying to develop a prefabricated broad band slat resonator which would also be an air conditioning diffuser and at the same time provide some indirect illumination. The number of individual components in a typical recording studio facility from an architectural (construction) point of view, must decrease if we are to affect any kind of economic reality at all. At the same time, as the number of hours spent in recording facilities increase, it is important to be aware of visual continuity within and between spaces and the positive effect this type of thinking can ultimately have on a user. A musician in a recording environment hour after hour must feel comfortable, both acoustically and psychologically. There is truly no reason why either of these should be sacrificed.



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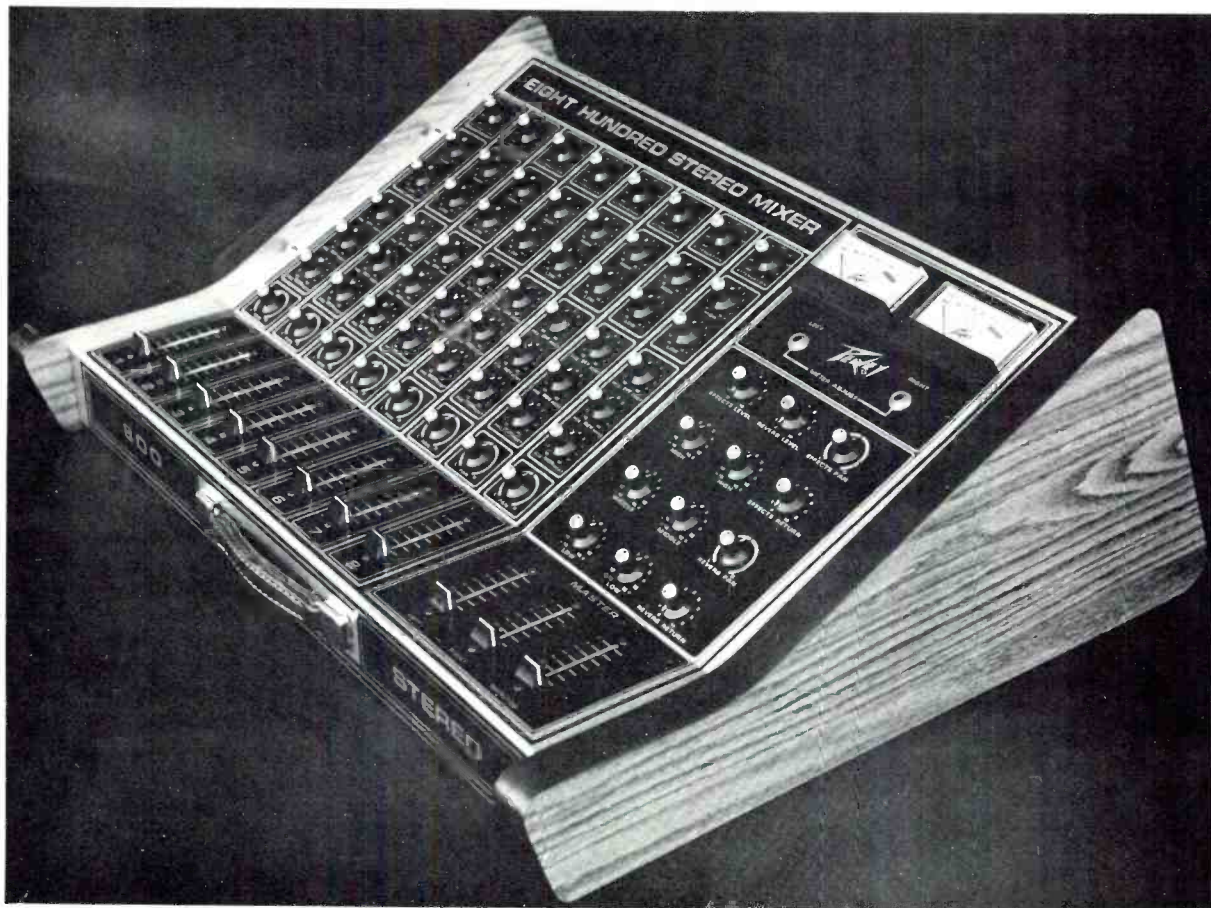
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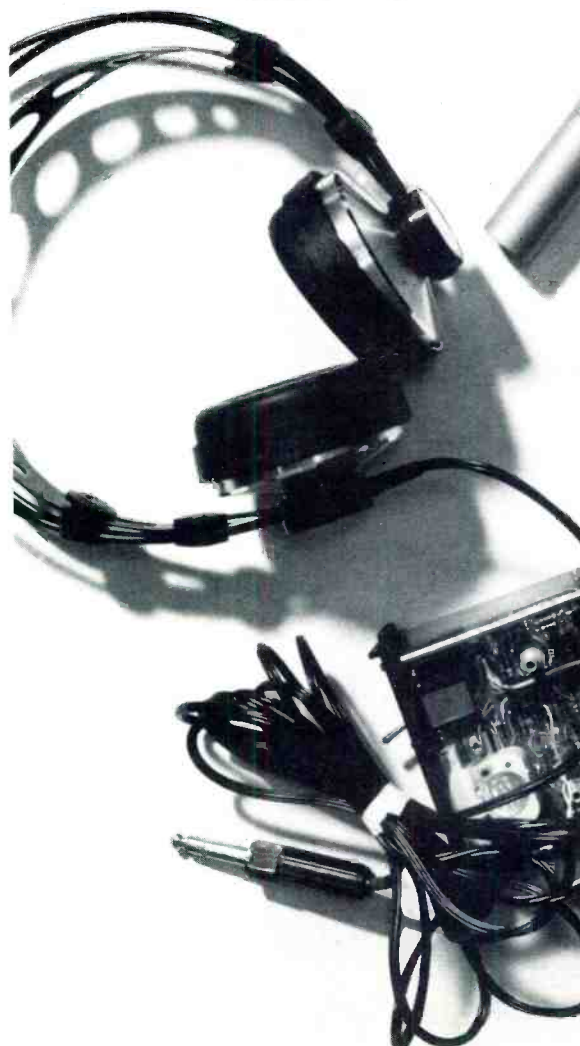


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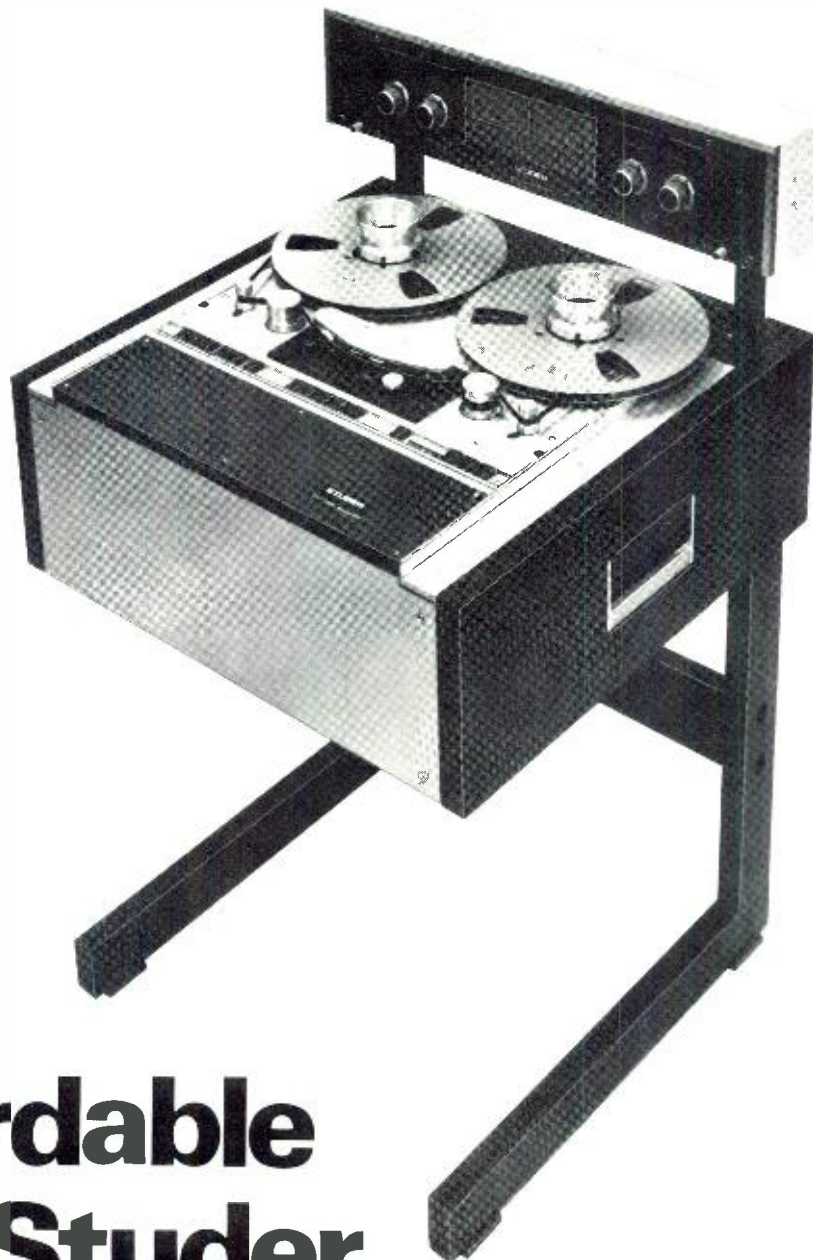
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## FLOURESCENT LIGHTING

### IN THE STUDIO

by Jerry Simon



Flourescent lighting fixtures are often the source of mysterious hums and buzzes in the studio environment. Tracing and trouble-shooting flourescent noise can be a time consuming task, and for the most part should be handled by a qualified electrician.

There are a few items that can be checked before you call him, though. The main thing is to determine the basic nature of the problem, whether it is mechanical or electrical.

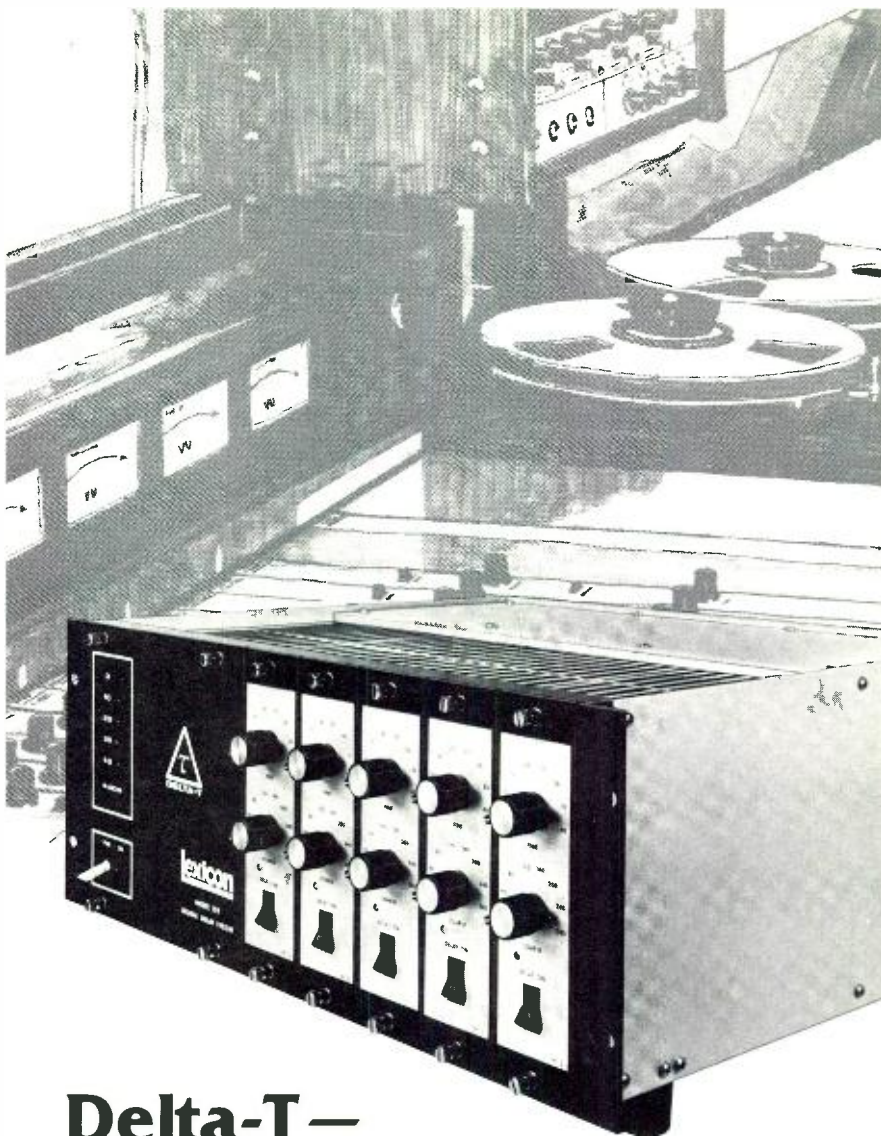
Mechanical noises are such things as ballast and magnetic hum, and the transmission of vibration through structural members.

Electrical noises include RF (radio frequency) buzzes in the monitors, pops (spikes) from arcing switches, hash from lamp and ballast deterioration, and generated harmonics imposed on the supply line.

Ballast and magnetic hums are caused by the vibration of parts inside the ballast housing and the fixture itself. These vibrations are caused by the alternating magnetic field from the ballast and show up as a 120 Hz hum coming from the fixture or from its general location.

Mechanical noise is perhaps the easiest to control. Remoting the ballasts is the most common and simplest method of handling mechanical hum, although it may not always be the most economical or practical. When ordering new fixtures or when replacing ballasts, make sure that the sound rating of the replacements are the highest possible. "A" ratings are the quietest.

Acoustic transmission problems from fixtures can be controlled by placing sound deadening materials between the fixture and the structural member supporting it. Rubber grommets may have to be used to isolate supporting screws (making sure that the fixture remains properly grounded). Lockwashers should be used when screws are subject to vib-



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ration.

Isolating the fixture from the structure may reduce the noise to an acceptable level. Most codes require that materials in direct contact with a fluorescent ballast and its housing have an acceptable fire rating (normally 1 hour). This should always be kept in mind when selecting the deadening materials.

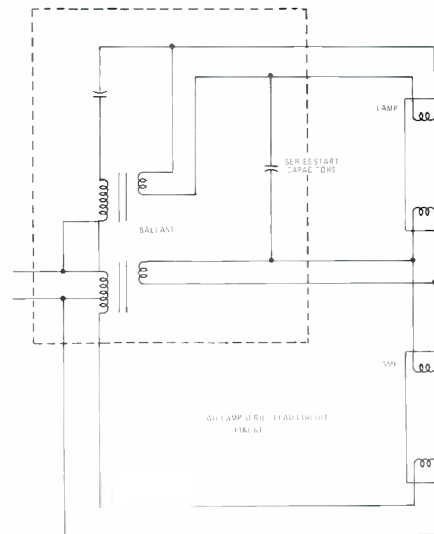
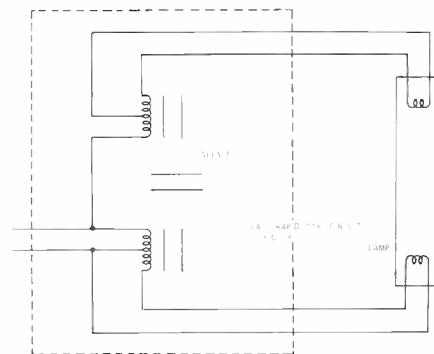
One of the easiest ways of locating rattling parts is to generate a low frequency tone at a high volume on the monitors which will cause structural members to vibrate. By manually applying pressure against parts of the fixture, problem areas can be identified. Soft rubber can be placed between loose parts to stop rattling, and putties or mastic can be applied to non-visible areas of resonating surfaces. The fixture may resonate at more than one frequency, so the testing should be done through a range of frequencies. Again, don't forget fire rating requirements for the deadening materials.

Perhaps a short discussion of what fluorescent lamps are, and how they operate will help our understanding. Fluorescent lamps are gaseous-discharge mercury arc devices. The arc in the low pressure mercury vapor is struck by the action of the energising line voltage. The mercury arc itself emits radiant energy in the ultraviolet range which is converted to visible light by a phosphor powder coating the interior of the fluorescent lamp tube.

Because a fluorescent lamp is an arc discharge device, the greater the current passing through it, the lower will be the arc resistance. Without some sort of device to limit the arc current, the lamp would draw so much current that it soon would destroy itself. The most practical way of limiting lamp current is the inductive ballast. Figures 1 and 2 show typical methods of connecting inductive ballasts in one and two lamp rapid starting applications.

Rapid start fluorescent lamps are the most prevalent commercial installations found today. Rapid starting of the lamp is accomplished by applying a low voltage to the arc electrodes at each end of the rapid start tube to preheat the electrodes. Having the electrodes at an elevated temperature makes it easier to strike the initial arc. After the arc is established, electron and ion bombardment will tend to raise the electrode temperature still further to sustain the arc after initial turn on. Note that there are no starting devices required in a rapid starting fluorescent system.

The arc discharge effect used to produce the radiant energy to excite visible white light from the fluorescent tube



phosphor is the cause of the electrical noise fluorescents are so notorious for. The arc can only be sustained as long as the applied power voltage exceeds a certain threshold value. This value is generally around 50 to 70 volts. When the line voltage drops below this range instantaneously, the arc extinguishes and draws no current from the power system at all. When the line voltage rises above the ignition threshold, current is drawn instantly causing a switching transient effect to be reflected into the power system. The arc discharge doesn't care which way it goes through the tube. After all there are two cathodes, one at each end of the tube, so the fluorescent is independent of exciting voltage polarity.

Just about everyone is aware of the stroboscopic effects of the fluorescent light pulses occurring at twice the exciting power line frequency. Each of those light pulses is accompanied by a current surge in the power system. These current surges are responsible for two effects that are of concern to audio people. One is that fast rise and decay of the arc discharge current. This is the cause of the buzzing associated with fluorescent lighting systems. The second effect is that of the non-linear load that fluorescent lamps provide for the power system. Since the load is substantially removed during the



periods when the 60 Hertz line voltage value is less than about 50 volts there tends to be a rounding of the AC power line voltage peaks. This is just plain old 3rd harmonic distortion induced by a non-linear load condition. This harmonic distortion is a problem we will talk about a little later.

Electrical noises show up eventually in the monitors. They are usually more difficult to deal with than acoustical vibration noise.

RF noise (buzzing) is generated in the fluorescent itself, and it is transmitted into the environment in three main ways: direct radiation from the lamp, reflection through the ballast into the line which serves as a transmitting antenna, and direct coupling through the line to the equipment. The line induced noise can be controlled by using RF filters (sized to load and voltage) in *each* fixture or ballast enclosure. RF from the lamps themselves can be reduced by using fixture lenses that are manufactured with RF screens. There are two types. One has a wire mesh or louvers in the lens, and the other has a "splash" of copper across the surface of the lens. The detectable RF interference ranges are about 500 to 1700 kHz and 2 to 200 MHz.

The prime draw-back of the RF screen

and filter approach is that of cost. However, if a distance of 8 feet or more between the lamp and RF sensitive device is maintained it *may* preclude the need for screening. Installation of RF line filters are relatively inexpensive, and can be factory installed.

The problem of noise generated by fluorescents that are close to the end of their useful life is yet another bothersome occurrence. The solution to this is simply replacement of defective lamps as soon as they are found to be failing.

A periodic program of lamp replacement will prevent lamp burnout problems from occurring. Most lamp manufacturers have a maintenance program with a cost incentive available. If all lamps are replaced at prescribed intervals they will set up a "lamp contract," which supplies lamps at a reduced price. The savings on the lamps will, it is claimed, offset the cost of maintenance labor.

The use of varistors and triac switches can be effective in reducing spikes from switches. Mercury switches may also be helpful. Popping may indicate a grounding problem and/or too heavily loaded circuits.

Generated harmonics on the supply line can be costly to eliminate or even control. Harmonics of the 60 Hz line fre-

quency are generated by the exciting current required by all discharge type lighting sources. They appear superimposed on the line voltage and can be responsible for as much as 20% of the total circuit current. Depending on the balancing of the loads on the entire electrical system (single or three phase), these harmonic components may cause problems in the Neutral conductor (see: "Understanding The Neutral" in the October 1975 issue of R-e/p). In any case, neutrals should not be reduced in size when discharge lighting is used.

In order to prescribe a cure or treatment for harmonic problems the symptoms must be carefully evaluated. The only real cure is in proper electrical supply system design. I know of one case where a studio refused to have any fluorescent fixtures at all and yet was having problems from his neighbor's system, next door.

In spite of all of the problems that seem to be involved, fluorescents are still one of the best sources of general illumination available. These problems should be considered in both the architectural and electrical design when building a studio. Trying to silence fluorescents after they are installed is a little like trying to keep a dog from biting, after he has his jaws around your leg.

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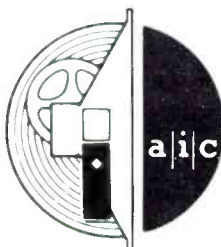
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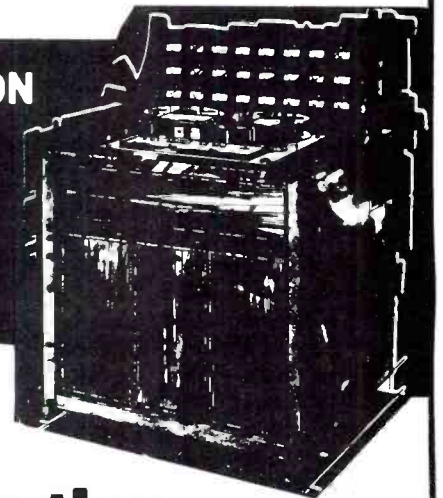
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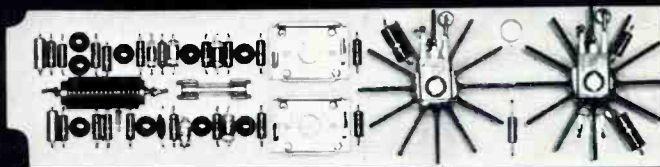
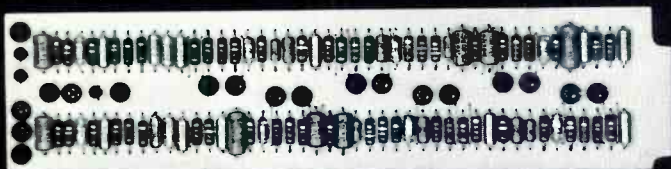
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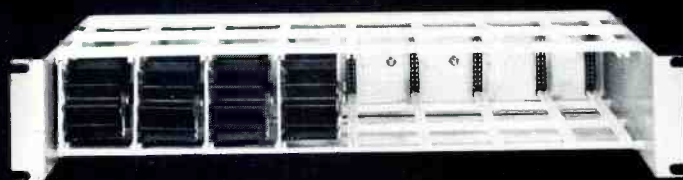
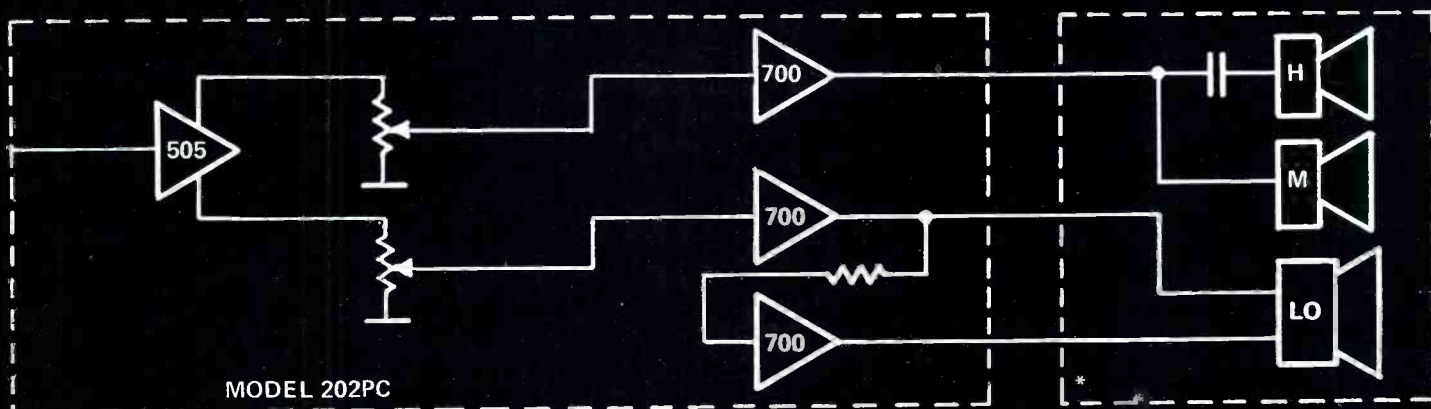


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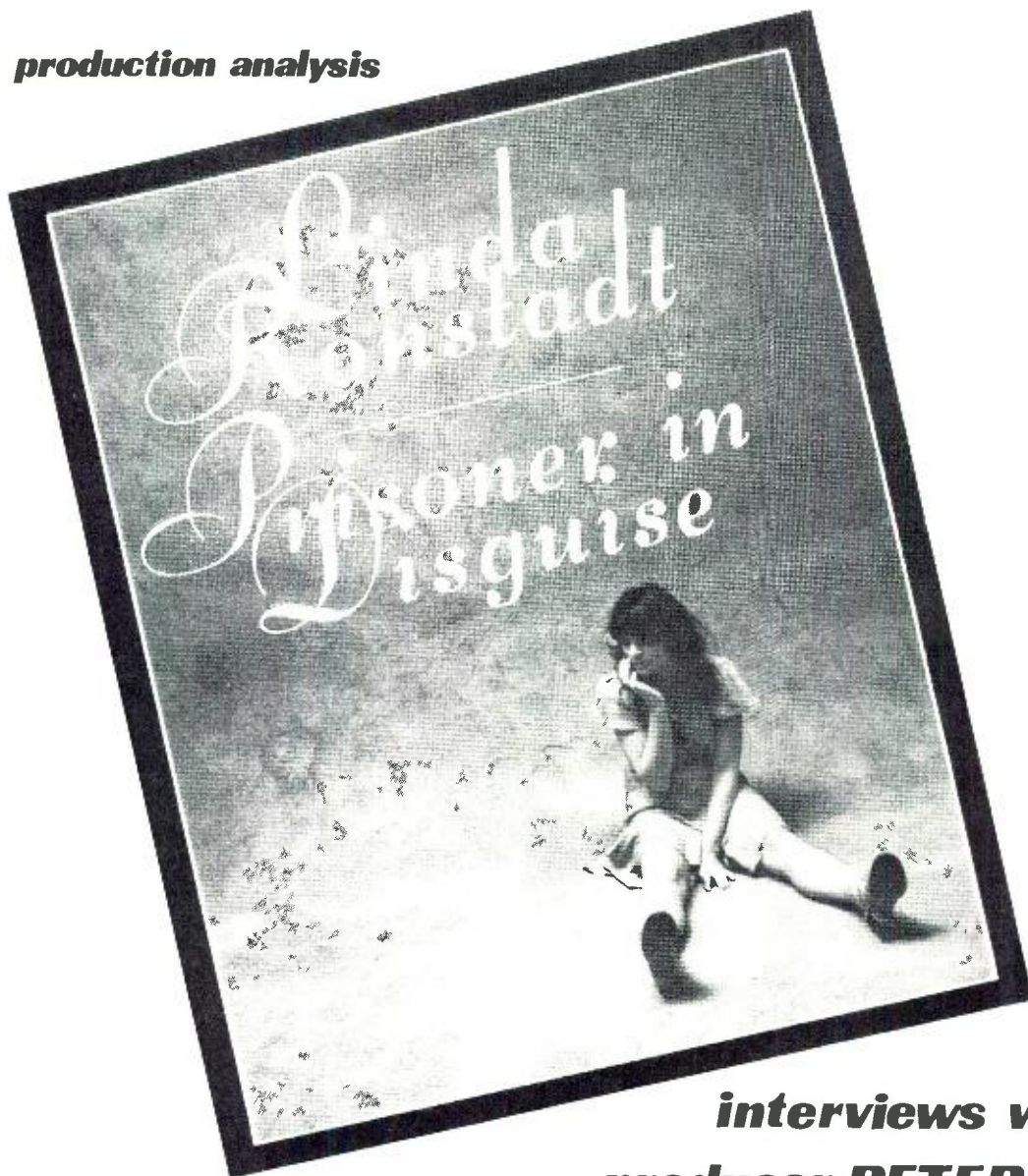
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**interviews with  
producer PETER ASHER  
and engineer VAL GARAY**

by  
Paul Laurence

*PAUL LAURENCE: Peter, how did you come to be involved in music?*

PETER ASHER: Well, I'd liked music all along. My mother was a professional musician — she played the oboe — and so I was brought up in a musical background, though at that time it was classical music. I started listening to rock & roll records probably the same time as everyone else did. I think before that, actually, I was listening to jazz.

*PAUL LAURENCE: What instruments were you playing?*

PETER ASHER: I learned the oboe for a while, and then I played double bass for about a year. I was listening to a lot of Woody Guthrie and stuff like that then,

and so I started playing my guitar just for fun, but I never really got to be good on any particular instrument. And then I met Gordon Waller at school, and we started singing together. He introduced me to the Everly Brothers and Elvis and all of that stuff, which I'd not paid a great deal of attention to before. We made our first record toward the end of '63 — "World Without Love" — and it came out in early '64. I'd been reading philosophy at London University, but left after two years because we had a No. 1 record and I thought it would be more fun to go on the road.

*PAUL LAURENCE: At what point did you begin to think about producing?*

PETER ASHER: I'd been involved in the mixing and production of Gordon and my records, and was very fascinated with the whole trip of the studio and making records, so I just sort of evolved into producing.

*PL: So you never had any formal realization like "Yes, I want to be a producer"?*

PA: No, I've never had any formal realizations yet! What happened was that when Gordon and I stopped working together, a friend of mine who used to be the singer with Manfred Mann — Paul Jones — was making records on his own and asked me if I would be interested in producing him. So I did.

PL: Was this on spec?

PA: No, he was on EMI at the time.

PL: Did you face any resistance as an "untried producer"?

PA: Not really, no. I mean, he was fairly successful at the time, and I had some standing at EMI even though it wasn't as producer, so there was no resistance, no. I did a few tracks with him, but none were really hits. There was one we did I liked, though. For the occasion, I had Paul McCartney playing drums, Paul Samwell-Smith playing bass, and Jeff Beck playing guitar, and it was great! It was called "And the Sun Will Shine" – a Bee Gees tune. I wish I had the tapes of it.

PL: How did you become part of Apple?

PA: Paul McCartney'd heard some of the things I'd done producing Paul Jones and asked me if I wanted to work with them. I was a friend of his anyway, so I was in on the period when he was inventing Apple and going through the whole "concept" phase. He asked me if I would be interested in producing some records for Apple, and I said "Certainly," and then – a couple of days afterwards, in fact – he asked me if I would like to be head of A&R, which sounded more powerful than it really was, of course, because it was mostly a coordinating function. To actually get signed by the label, you had to have a quorum of Beatles on your side. At least one, preferably two, which made things a little confusing. It wasn't as if I could just go out and sign someone out of the blue, though actually in James' case I pretty much did.

PL: How did you first hear or hear of James Taylor?

PA: He called me. We'd met once before, but I didn't remember. I still don't, actually. He was in a band with Danny Kortchmar called the Flying Machine whom I'd heard briefly in New York.

PL: Did James stand out in any way to you?

PA: No, not at all. I honestly don't remember him – I'd be lying if I said I did. Danny was my friend at that time because he'd played with Gordon and I on a couple of tours, and so I knew him very well – I stayed at his house a few times. I was really just visiting him, and so I just have a vague memory of the rest of his band. When James came to England, Danny gave him my phone number as a friend in London to call, and he called me and played me a demo he'd done. That was only a day or two after I'd started working for Apple, so I suggested he sign with the label and I'd produce his album, which he did and I did.

PL: What tunes were on that demo?

PA: A Lot of the tunes off the first album. "Something in the Way She Moves," "Sunshine, Sunshine" . . .

PL: When you signed James, did you in any way envision the rise of the solo artist?

PA: I thought he was tremendously good, and I thought people would like him. I didn't ask myself "Well, will he be 'The New Soft Rock' on the cover of 'Time' magazine?" No. It didn't occur to me or to him, really, to wonder about that. All he wanted to do was make records and have people like them and buy them. We thought that would happen, and it did, but exactly the sort of scale and aspect of it all I didn't think about much.

PL: I was always intrigued by all those little pieces between songs on James' first album. Whose idea was that?

PA: It was a cooperative idea. It was my idea to try and give each track a different instrumental texture, and to use Richard Hewson – who was a friend of mine – to do the arrangements. He was a classical writer who'd not done any arrangements for rock & roll records before, and from that sprang the idea of working out interludes to join the songs together.

PL: Were you in on the legendary "Sour Milk Sea" by Jackie Lomax?

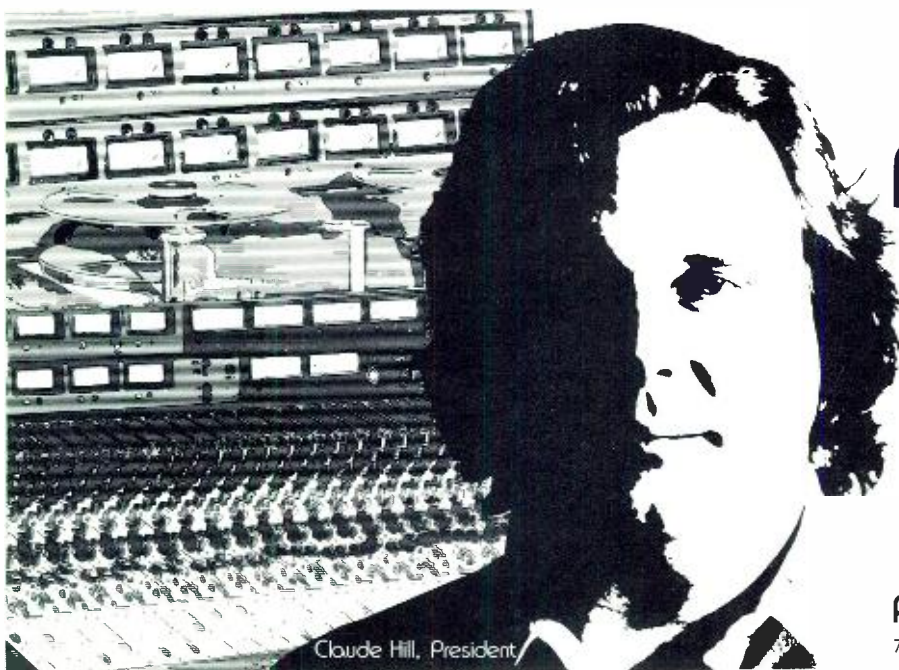
PA: I didn't know it was legendary. I think I was there – I went to a bunch of his sessions. Now is that the one that Clapton and Ringo played on? I went to a session with Clapton and Ringo which might have been "Sour Milk Sea" – I think it probably was – that was at EMI. Then I went to some others at Trident and he had some other people, but I'm fairly sure the one with Clapton was "Sour Milk Sea."

PL: Of what "school" of production would you say you are? What kind of producer are you?

PA: I really don't know.

PL: Well, who's a producer you feel a kinship with?

PA: I don't know, I don't really feel any "kinships." I know producers I like, certainly. I like Gus Dudgeon a lot. I love the way all the records Gus makes sound – I love the things that happen on them. I like Paul Samwell-Smith also. They tend to be the ones I know as well. Gus and Paul are both people that I like a lot personally and admire their work at the same time. There are producers that I don't know who I admire too, like Arif Mardin.



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Also Jimmy Miller — I like a lot of the things he does. I like the stuff he did with Spencer Davis, I thought what he did with the Rolling Stones was much better than anything they'd done previously. I think he's a percussion freak too, which I am as well.

*PL: Are there any things in particular in your own production that you could point to as having been influenced by these people?*

PA: No, I really couldn't. You see, trying to talk about what a producer does is terribly hard, because no one that wasn't there actually knows anything about what they do. I mean, I might say "Oh, I love the drum sound Gus got" or the thing they did with the so-and-so on this, and it might not have been him at all! It might be the engineer, it might be the artist ..... You might congratulate the artist on the way they sang something and it wouldn't be them, it would be the producer going "How about doing it this way?"

What exactly does the producer do? It's hard to answer. By the same token, it's hard to judge producers. And one can admire producers even as much for what they *don't* do as for what they *do* do. Like the first Joni Mitchell album, which David Crosby produced. If you listen to it, your instinct might be to say "Well, what do you mean 'produced'? There's

nothing there. There's just her and her guitar," but in fact, that was the production coup of the age! At that time, when you made an album, everybody wanted to put strings on it and do a real sort of serious thing, and it was Crosby saying "No no no" to all those people at the record company that made the album so great. Or so I'm told. And so that's why, to try and define particular aspects of a producer's work that you like, it's hard to say.

*PL: How did you come to produce Linda Ronstadt?*

PA: I started by managing her. She asked me to manage her, and I did. I started managing her as she was just finishing the "Don't Cry Now" album. I can't remember exactly how it came about, but the whole album had been through quite a lot of confusion with different people and taking a long time. I was just trying to help get it done. We were trying to find a producer for the next album, but we really couldn't decide on one. It wasn't initially our idea that I would do it, but that was the way it ended up, as much by default as by anything else.

*PL: Did you have any sorts of ideas about how she should be produced or how you were going to produce her?*

PA: Well, I suppose I wanted to try to make "clearer" records — you know? —

*... its hard to judge producers... one can even admire producers for what they don't do... as for what they do do...*



more structured. A bit less organic sort of country — what Linda calls "Granola Rock" — which is the way I've been thinking more and more anyway. I've always liked productions where you can hear what's going on. In Linda's case, I just wanted to make clearer, more interesting records.

*PL: Two things in particular about Linda's records stand out in my mind as having begun since you started producing her: the double lead guitar work and the bass becoming more prominent. Might those things have been planned?*

PA: It's not really calculated beforehand. It's like when you're doing the drums for a particular song, you try to make them sound the best they can for that song. So

*continued....*

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as you're doing it, you'll say "Well, let's try a little of this, a little of that, try this kind of mike, do this, do that . . ." until you get something that seems to be right. But it's not like in front you're going to say "Now for this track, we've got to have this exact effect," so it's something that is built up as it goes along.

*PL: Do you court the country & western market at all?*

PA: No. I really don't know much about country music. Linda knows a lot more about it than I do, and the country song choices on the albums are always hers, of course, subject to my okay. But no, I don't court it. I just try and make the best record of each song. When it's a country song, obviously . . . you do it country!

*PL: How is the material selected for each album?*

PA: She chooses some, I choose some. She has pretty firm ideas and she's got a very good ear for what she'll sing well.

*PL: About how many songs are under consideration for each album?*

PA: I have somebody I trust listen to most of the stuff that comes in, which is hundreds and hundreds and hundreds of songs — literally so. We're getting five or six songs a day now for Linda, which doesn't sound like much, but actually it

adds up ridiculously in a few weeks. It's a great many, and they come in all the time.

*PL: Has Linda recorded any of the tunes that have come in through the office?*

PA: No.

*PL: Has anybody?*

PA: No.

*PL: So you mean you've gotten ten million tunes . . .*

PA: And done none of them. That's currently the truth, yeah. But you never know. I mean, you do have to keep listening. That's what James Taylor did — call up with a tape. To a certain extent, I feel obliged to listen, or at least have somebody I trust listen to most of what I'm sent.

*PL: Do you encourage Linda to write?*

PA: Yes. As a matter of fact, she has just written her first song and it's very good.

*PL: Whose idea was it to record "You're No Good"?*

PA: She'd done it live for some time, so it was her idea, I guess. I'd always liked the song, and the minute I heard her do it, I thought it was a single if we just got the right arrangement of it. It was hard to find the right way to do it. We did the track two or three times with different

rhythm sections before I found a way that I really liked. We did it with a black rhythm section one time — who were great — but it wasn't really quite right for the way she sang it, and one other way. We ended up by doing just guitar, bass, and drums, with Ed Black playing electric guitar. He plays sort of a band-y rhythm part underneath, with Andrew playing drums and Kenny playing bass. Everything else was overdubbed.

*PL: How about "When Will I Be Loved"? Was that you with your Everly Brothers influence?*

PA: No, that was Linda. Again, she'd done it live for quite a while, so that was her idea. Most of the tunes on that album were ones that she'd either been singing before or had decided to do.

*PL: Is Linda always there for the basic tracks?*

PA: Yes. She always sings when we're doing tracks, and is tremendously involved in how the track feels and everything, but once that's done, then she tends to let a lot of the other stuff go by. I mean, when Andrew and I are putting on hours and hours of handclaps, tamborines, cabasas and cowbells, and 15-hour guitar overdubs and stuff, that she doesn't stay around for.

*PL: Does she direct the band at all? Would she say "Let's syncopate that little part there?"*

PA: Yeah. Sometimes not as specifically as that, but if it's not feeling right to the way she sings it, she'll say "No, this bit goes like that" and she'll sing it in the way she wants it to be. Then we have to fit it around her. In other words, the records are based entirely around the way she sings the song, and if they weren't, they'd be impossible for her to sing to. That's the key to the whole thing.

*PL: Does she present any special problems or challenges as a vocalist?*

PA: Getting a good vocal sound on her is very hard, and it's very easy to make her voice sound less good. Limiting especially has to be done with extreme discretion. I don't know why, but her voice shows up the deficiencies of a limiter more than any other I've ever worked with. You can tell, and she can tell. If you put a limiter on her vocal — even if it's hardly on at all — she can tell the difference immediately. Not in terms of the limiting, but of what the electronics of the limiter do to the *quality* of her voice. The less her voice has to go through, the better it sounds, because it shows up anything! Putting it through any kind of electronic stuff tends to affect it, and so we use as

Peter Asher . . .

continued on page 33 —

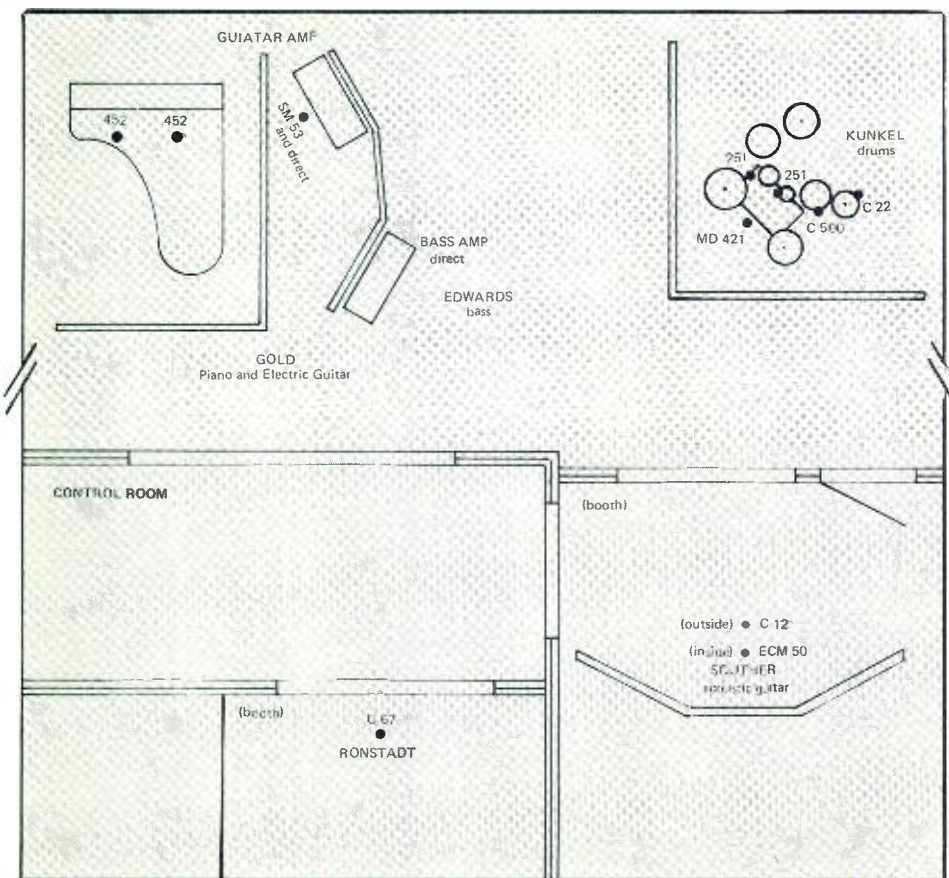


FIG. 2 General studio setup for the basic tracks for the "Prisoner in Disguise" LP at the Sound Factory (Hollywood)





**VAL GARAY:**

Most of the time they cut the basic track as two or three pieces – very rarely are her tracks more than three pieces. Linda’s energy when we do tracks is great! She always does live vocals and most of them we end up using. There’s a lot of live vocals we used on “Prisoner in Disguise.” “Many Rivers to Cross” is a live vocal, with maybe a part punched in that we didn’t use. “Tracks of My Tears” is a live vocal, “I Will Always Love You” is an overdub, “Hey Mister” is a live vocal, “Heat Wave” is an overdub, “Silver Blue” is a live vocal.

Unless she’s having a problem with her voice, I record her exactly the same. I always use a 67. It’s the finest vocal mike that Neumann ever made. They stopped making them many years ago because of the cost, so they started making an 87, which is a cheap reproduction of a 67. You pay \$1000 for a used 67 if it’s in good condition, an 87 you can buy for \$600.

As far as EQ goes, I use a Lang PEQ-2. One day, I was sitting back in the shop, and I was analyzing sibilance on voices and thinking “What happens if you add a lot of very high end to something – taking the sibilance and *increasing* it?” We’ve had these Langs sitting here for years and never used them, and so I started going through this book back there that tells what the frequency curves of Langs are. I’ve noticed that the curve goes from 20,000 all the way down to 2,000 on a Lang, which means it hits a pretty broad span of the voice. When you start adding 20,000 to a voice, it takes that sibilance and smooths it out – it makes this incredible air around it. You can really hear it work. I mean, if you listen to “Prisoner in Disguise,” her voice has got so much “breath” to it it’s incredible! You never hear the 20,000, but the taper’s so smooth going up past the end of the frequency range that it just puts this beautiful edge to it.

We spent about 15 hours one night doing the lead guitars on “You’re No Good.” Andrew and Peter and I were destroyed with it – we freaked over how it came out. When Linda came in the next day, we played it for her grinning, waiting for her to die when she heard it, and she went “I don’t like that.” So she asked somebody else to do it over a different way, completely different. Peter, as patient and as open as he is, said “Sure,

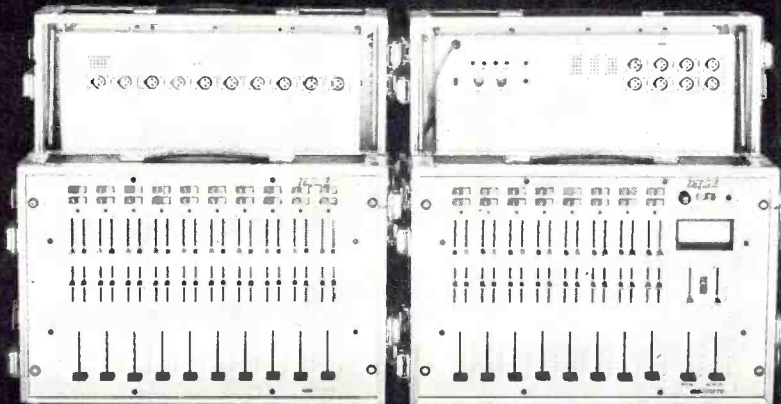
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*continued . . .*

we'll try it if you don't like this," but we were all astounded. She was just hearing a bluesier, funkier approach to it than Andrew's Beatle guitar solo, which is what it was. So we were all down about it and everybody went home, and the next day she came in and said "Peter, I love it the way it is."

We did a lot of things to get that sound. It's a Stratocaster going through an MXR Noise Gate and being brought direct through the board, which gives it that synthetic kind of texture. Then we compressed it with an 1176, and after that, a Kepex set on the fastest possible release time. This is after a tremendous amount of compression, so what happens is that the minute he stops playing a note, it shuts off, and then the next note hitting it has to fight its way through the first. So it holds it for a second and then lets it go, causing it to increase like crazy the impact of the note. It's expanding it. Then we took out some mid-range and added some 10k. I never really do anything with the low end.

There are four guitars – four actual passes – in the middle playing that solo: two playing the melody and two playing the harmony. We'd do the melody at one speed and double it at a slower speed, and the same with the harmonies. That's why it has that incredible ring to it, because the timbre goes up an octave.

The real secret to that sound is because of a machine that I was using here that was broken. It's this EMT unit that was originally designed for auditorium use which they only made nine of. It's a stereo device – you can put one thing in and it comes back in stereo – and there are three different selectable delay speeds. It was made to solve the problem in a large auditorium where the speaker is speaking, but by the time the sound got to the back of the room, it was behind his spoken word. Now if you pipe this into the P.A. system, it's delaying it however many milliseconds from the front half and slowing it down as it goes back, so that as he talks, the voice is all moving at the same time.

What happened was that John Phillips got a hold of it in England and brought it back with him – this was about five years ago when I was working on the Mamas and Papas' last get-together album – and he brought it down one night to try something and never took it back. It's been here ever since! It's an EMT Sound Retardation System, and it's a very interesting device. It's just a round recording disc inside of this box with three recording heads and three playback heads. It's a tape delay in a sense, but it's selectable – 25 milliseconds to 250 milliseconds. You can choose one

speed or all three at once, which gives you a really crazy sound. The point is that the disc was screwed up and running erratically, and each time we stacked another guitar on, there was this wavering sound, which caused that thing to get huge! Not only did it get bigger in size because of the wavering of the disc being broken, it just kept increasing the power of it. In other words, you could put that solo anywhere in the track as you mixed it and it would just *dive* at you!

The mix for "You're No Good" was a killer. This was when most of the things had been recorded and Peter wanted to start mixing. We came up here and started to mix that song, because that night we both had the feeling of "This is it" – you know, "Let's mix it." We started mixing at 7:00 at night and walked out of here at 11:00 the next morning. The last mix we did was the one we used! It was a marathon.

We used a slightly different kind of guitar sound on "When Will I Be Loved." I remember, we had a track that we'd mixed four times and couldn't get the way Peter wanted called "That'll Be the Day" – that old Buddy Holly thing. So they were stuck for a song. She'd been doing "When Will I Be Loved" live, and they decided to try it. So we got Kunkel together that night and just cut it. The solo was four guitars again – two on the melody and two on the harmony. The odd thing about it was that "You're No Good" took 15 hours, but "When Will I Be Loved" took us about four. I mean, we ripped right through it! I don't copy it to the point of using the exact same settings, but I remember enough to where I can come up with that sound consistently.

It's become a very popular sound. Andrew got called on a session one day, and the guy pulled out "When Will I Be Loved" and said "Now this is the kind of sound we want," not knowing Andrew'd played that solo. So Andrew put him on. He went "Oh, you mean sort of like da da-da-da da-da-da....." Played the whole thing, and the guy went – you know – "My God!"

"Heat Wave" is a similar kind of solo. Did Peter tell you about how we did that? That's the movie of the century! They cut it about three times and could never get the time consistent, so Andrew put down a high hat track onto the 24-track. Then we listened to it and took the best four beats – the best bar – and made a tape loop. Now we took that tape loop and transferred *that* back to the 24-track on the whole roll of tape. It's a click track now, in perfect time. Then we started cutting the track. We never got a whole take that was perfect, so we took the best verse and chorus and went 24-to-24 six times. Then we cut it together and made the song, so

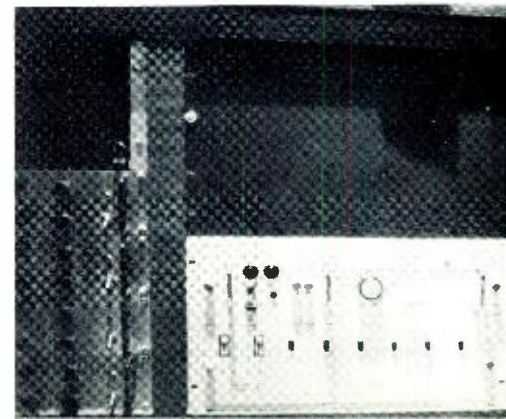
it's almost the same verse and chorus through the whole song. For the actual track, it was Andrew on drums and Kenny playing bass, and then Andrew and Peter put everything else on. For some reason, shuffles are hard to keep in perfect tempo. If you start speeding up or slowing down, it loses the feel.

We create a lot of artificial acoustic guitar sounds on these records too. Outside the guitar I use an AKG C12 or a Neumann KM86. Then, clipped to the soundhole of the guitar – on the inside – I'll sometimes use an ECM50 as well. The ECM 50 picks up a lot of the pick and the high part of the strings, so I take it and roll all the bottom out of it and add a lot of high end. That gives you that really smooth, "tinsel"-y sound, where the outside mike has a lot of distance and air to it.

With drums, I fake stereo, if you know what I mean. I get three tom-toms to move in stereo with only two microphones, which are kind of overheads in a way. I place the microphones and set the levels so that you've got a perfectly spread three drums with the middle tom right in the middle. I never get anything up high to pick up the cymbals, but I always seem to get enough.

The overhead drum mikes that I use are Telefunken 251s. Our<sup>s</sup> sat back in that mike locker for years – nobody ever used them for anything! Depending on the drummer, for the snare mike I use a Sony C500 or a Sennheiser. It's an MD441U D series – a supercardioid dynamic microphone, which means you get very little high hat leakage into it, no matter where you put it around the snare. It depends on how close to the high hat the drummer puts the snare as to how much isolation you can get on the high hat. If a drummer plays with a real close high hat – if it's hanging over the snare drum – any kind of mike you put in there picks up a ton of high hat, and you end up with too much high hat all the time. In a case like this, I use the 441, which almost eliminates the high hat, meaning that I can bring it in with the high hat mike the way I want it. I discovered this pretty much by accident. When I was doing some remote mixing

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for Linda, the Record Plant truck used this on the snare at that Howard Cosell live show we did in San Diego. I just soloed the snare inside the truck and heard this nice fat sound and very little leakage, and I said, "Wow, I wonder what they used?" I ran up on stage and it was a 441U.

Garay Asher Author Laurence



Peter Asher . . .

continued from page 30 . . .

little as possible and as much hand-riding as possible while we record as well as while we mix. Of all the limiters we've tried, the little one that's built into the board at the Sound Factory — an API — seems to work the best. For EQ, we use a

Lang at 20,000. The 20,000 itself doesn't do anything, but the curve comes down and the little bit of 20,000 seems to give it the edge that I like.

*PL: How does she do vocals? Do you find that the earlier takes are better, or do they get better as they go along?*

PA: The first one or two are usually the best. If we don't get it pretty quickly, we'll take a break or change songs or something. If she does it too many times, it gets too "thoughtful" and doesn't sound good.

*PL: Which of all her vocal performances do you consider her best?*

PA: I think "Many Rivers to Cross" on the new album is my favorite vocal performance of hers. It might have been the first take, or maybe that was even the live vocal. We've used a couple of her original vocals. "You Can Close Your Eyes" was a live vocal on "Heart Like a Wheel," "Hey Mister, That's Me Up on the Juke-box" — some of it was live too.

*PL: What were the circumstances surrounding the making of the "Prisoner in Disguise" LP?*

PA: It was after a tour, I think. We didn't have a lot of the songs when we started. We had some we knew we were going to do, and some that we were just leaving till later on. The album we'll be starting

soon is actually more together in terms of pre-planning than that one was. I forget exactly what Linda'd been doing before it, but I could easily look it up. I'm very bad at remembering that kind of stuff. That's why I put the dates on the back of all my albums even if for no other reason than to enable me to remember when we did it. I credit everything I can think of.

*PL: About how many days did you spend recording and mixing it?*

PA: I would think we probably did about fifty days or so for the recording. Mixing didn't take too long. Most of the mixes took only three or four hours, four or five hours, some six- or seven-hour mixes. And then there were about three we mixed again.

*(at this point, the "blindfold test" was initiated and "Prisoner In Disguise" was put on)*

LOVE IS A ROSE

I was sitting on Neil to give us a song — actually through Elliot, his manager — and this was on an album that Neil made and never put out. He sent me the album to see if there was anything on it that I liked, and I picked this song, and we did it.

"Love Is a Rose" was fairly quick — to get the track anyway. We spent a lot of

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time redoing the acoustic guitars because they have a lot of extra little parts. Also putting the harmonica in.

PL: Did Neil's version have this acapella "get-down" here?

PA: No, his version was completely different.

PL: Were you thinking of the Olivia Newton-John records here — the bass vocal part and having all the instruments drop out?

PA: Mmmmm. Yeah, we jokingly referred to that as the "Olivia Newton-John Harmony." I don't think that was what made us think of it, but that was part of it. The acapella section was created in the mix, because everyone played all the way through the song on the track.

### HEY MISTER, THAT'S ME UP ON THE JUKEBOX

This was an easy one to do because, of course, Russ Kunkel knows the song inside and out from James. We did it with just piano, bass, and drums. It was a double bass, actually, which we miked with a 47 and a little ECM50, each going down on a separate track. Then we overdubbed a steel and the background vocals, and the ARP and strings, and that was it.

PL: Did Russ come in via the Flying Machine too?

PA: No, I found Russell when we were going to do "Sweet Baby James" and were looking for musicians to do the album. He was playing with John Stewart at the time. I went to a John Stewart rehearsal and fell in love with the drummer.

PL: Why has there been such a large turnover of musicians in Linda's band?

PA: Well, that's mostly that it's just very hard to find really good musicians who will go on the road, and especially when you can't pay much money, which was, up till a year ago, her situation. I mean, the really good guys want a great deal of money to go out on the road.

PL: How did the current musicians come to be in her band?

PA: She's known Kenny, the bass player, for a long time, and he's great. Then we found Andrew. Actually, they'd been working together vaguely before that time, and she liked him, but she thought of him mainly as a piano player. I think discovering how good he was and what he was so good at was pretty much me. Finding a good drummer was one of our biggest problems. We finally found one — Mike Botts — who's incredible, and we'll be using him on the next album. Up till now, we've never had a drummer she's used live that she could use on the records.

### ROLL UM EASY

Lowell taught Linda this song. Little Feat do it completely differently. He does it as sort of a solo number.

PL: He's certainly one of the best writers in this genre.

PA: He is, yeah. He's a genius. I love "Long Distance Love" off the new album — it's a masterpiece of a song.

This was the one Nigel Olsson played on, which was fun.

PL: How did that happen?

PA: I called him up and asked him to do it. It was because I wanted this kind of drumming — super heavy and loud. He plays with these huge, fat sticks, plays with gloves on — leather driving gloves — and just kills the drums! He has a huge snare drum about this deep, and it's great.

We had a lot of drum overdubs on this. On that "K-gung gung" effect — we dubbed those in separately with special mikes. Sometimes for a tom-tom overdub like that, we use a close mike and a slightly far-away mike, and a shotgun mike way across the room, maybe. You get a real snappy sound.

This is Lowell playing slide. He put his guitar through some of his own equipment — an MXR compressor and a noise gate — then into an amp, out of the amp, and then it was compressed again. There's two parts — there's a part and a harmony, which are in and out in different spots. There's also a delay on both — an Eventide Digital Delay — so it's actually going from side to side on the two parts.

PL: Just what exactly does a noise gate do?

PA: It takes the noise out. What they do is just switch things off when there's no music coming through. If you've got a bunch of noisy stuff in there, like Lowell's all turned up, the noise is quite loud. In other words, there can be complete silence coming out of the amp, and you just go "whaang" and the note comes out, and the minute the note stops, it's silence again.

### TRACKS OF MY TEARS

PL: Is this a song where you took two channels off one acoustic guitar?

PA: This was an acoustic guitar sound we spent a long time on, but I can't remember exactly what we did. Each one is only one track of tape, so I really couldn't say. This is a good case in point, where really we just keep trying different things until I say to Val "That's good," so at this point, I might not know exactly what we've ended up with.

PL: In looking at all the different permutations of people who sing background vocals, one might assume that you're a background vocals freak.

PA: I like background vocals. I like



harmony singing altogether, obviously — I used to do it for a number of years and so yes. Also, Kenny and Andrew are excellent background singers, and very inventive. They're a pleasure to work with.

These backgrounds here took hours, because it's a real hard part to get real in tune. We tried two or three different sets of people before we got them to sound right. I knew the parts I wanted, because I'd worked them out at home by myself. Don Francisco is the guy who used to play drums in Linda's band, and he's one of the people singing in here. He's got a nice high voice.

There's a nice guitar overdub here. Danny Kortchmar was in the studio doing some other overdub for me, and he played on this, which I just kept at the very end. It's just like a little reggae rhythm guitar part that comes in under the steel solo. Just gives it a nice flavor.

#### PRISONER IN DISGUISE

This was completely live. She and J.D. sang out in the big room, sitting opposite each other, with Andrew playing the piano. That was it. We actually fixed one line of it afterwards, where they didn't sing together. It was in Linda's vocal, but you can never tell. The problem would be if there was too much of *her* on the acoustic guitar, by fixing it, we'd have heard the old one as a ghost. Like if John David made a mistake, we couldn't have fixed it without replacing the acoustic guitar.

*PL: How many pieces, passes, and tracks of strings do you have here?*

*PA:* Now on this one, we spread the strings out a whole lot. There was a track each for flutes, oboes, viola, viola, celli, and two for the standup bass. Then we doubled the violas and celli and bass, so there were like 10 tracks of strings.

*PL: Why do you use David Campbell for the string arrangements?*

*PA:* Because he's very good, and he takes a lot of trouble. We usually tell him pretty much what we want, he writes it, and then the day before, we get together with him, a viola player, and a cello player and run over the parts exactly so we can rewrite them, if necessary.

#### HEAT WAVE

This track is just packed full of stuff. It was a solid 24-track tape by the time we finished it, even though it's only a few instruments, because there's so much percussion and extra parts. Everything's doubled and trebled. Andrew played everything except the bass.

*PL: How do you like working 24-track?*

*PA:* I like it. 24-track enables you to spread things out, and gives you many more options. I've often wished that I had more than that! I went out to James'

#### 24 TRACK ALLOCATION FOR "HEAT WAVE"

- 1 lead guitar harmony
- 2 bass drum
- 3 drums, left
- 4 drums, right
- 5 snare
- 6 bass
- 7 handclaps
- 8 handclaps, (Time Cubed)
- 9 piano, high
- 10 piano, low
- 11 rhythm guitar, left
- 12 rhythm guitar, right
- 13 ARP String Synthesizer (Time Cubed)
- 14 acoustic guitar, left
- 15 acoustic guitar, right
- 16 live vocal
- 17 tom overdub
- 18 conga
- 19 ARP String Synthesizer
- 20 vocal overdub
- 21 lead guitar
- 22 vocal overdub
- 23 vocal overdub
- 24 BGs combined

session the other day, and they were doing a thing that I was really jealous of — which the Sound Factory can't do. All the machines out at Warner Bros. have the EECO synchronization system, so they cut this track on 24, and then they wanted to put all these background vocals on it — they were putting Crosby, Nash, and James singing oohs and aahs — so they did a stereo mix of the original 24 — onto another 16-track in synch, and then put like 12 tracks of background vocals on, and then mixed them all back down, which not only gave you extra tracks, but it also saved running the 24-track back and forth across the heads 500 times, which does definitely save you something. That's one of the bummers — the more you overdub, the more you lose.

#### MANY RIVERS TO CROSS

This is a song Linda and I had both loved for a long time. It's on that "Harder

'They Come" album and in the movie.

*PL: I'm surprised that Jamaican music is just now making it in the U.S.*

*PA:* Well, people tried to bring it over back in the 60's and it didn't work. It's been big in England for about 10 years. Don't forget "My Boy Lollipop" by Millie Small. They recut it in England and kind of spoiled the groove, but that was a reggae hit, in fact.

This is a lovely guitar sound on this solo. We spent years on this one.

*PL: Andrew's solos are so very intricate. Does he normally work them out at*

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home?

PA: No, we mostly work them out in the studio. If he works them out without me, then it can be boring because he'll come in and I'll change it all, so he mostly works it all out at the time.

### THE SWEETEST GIFT

This is a song that Linda and Emmylou had sung together already. It was done live with David Crisman and David Lindley and Glen D. Hardin. I think the vocals were live too. Seems to me that Linda and Emmy were both in the booth, because it's hard to sing together if you're too far apart.

I let Linda mix it — Linda and Val — because she knew how she wanted to do it. I wasn't even there.

PL: Do you try not to limit the acoustic guitars?

PA: No. We always limit them a bit, but they're not squashed like they sometimes are.

### YOU TELL ME THAT I'M FALLING DOWN

This one we did with Andrew live and then overdubbed James' part afterwards. Whenever James plays on something, you know it couldn't be anyone else. He's a great player, he's the best for this.

Oh, the accordion part on this was funny — it took three of us to do it! We wanted this particular sound of a musette, and we found this accordion with a musette stop. I don't know exactly what a musette is to this day, but it's a nice sound. It's sort of reedy and nice. We put it on a little table, with one guy holding it down, Andrew playing the chords, and me doing the phrasing with the squeezing. We didn't want any bass in it, so we didn't use the buttons at all.

### I WILL ALWAYS LOVE YOU

PL: Who are these background singers here?

PA: They're black studio singers — very good. I think Carly had used them on a track and loved them, and recommended them to me.

We overdubbed all these arpeggio guitars with Andrew, and then overdubbed all the strings and percussion.

PL: Val showed me your percussion suitcase.

PA: Oh right. That was a Christmas present from Andrew. He put it all together — a whole suitcase of percussion instruments, some of which he made. He assembled all that stuff and gave it to me. They're all great too. Previously, we used to rent a lot of our percussion instruments and borrow a lot. At one time we had a particularly great tamborine that later got stolen.

PL: What was so great about it?

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... the percussion suitcase.

PA: It just had a great sound. It was very fat. It was actually two taped together. Andrew and I went into a music store and spent hours bashing them all until we found one pair that we liked. We bought them and taped them together. I don't know what brand they were. They usually do seem to end up being the expensive ones that are good, not surprisingly.

#### SILVER BLUE

This song has got a million guitar overdubs on it. All the things in the background are direct guitar. It's just a super bright kind of sound. There's two different layers of it. The first layer comes in here, and then when it gets to the next verse, another set comes in with a slightly different sound. There are four guitars - two pairs - as far as I can remember. With things like all the different guitar sounds, it's important that credit be shared between Val and Andrew and me, because a lot of the ideas are Andrew's as well. It's definitely a cooperative effort.

PL: You've had such consistently clean records over the years. Just how much do you have to do with the overall recorded sound? Do you prefer certain types of mikes, for example?

PA: I tend to let the engineer do what he wants and then tell him what I don't like or do like about the way it sounds. I tend to forget what microphones are called, apart from anything else, and end up describing them by size and shape. Some producers will go "Oh I always use an 8320 and a 9110," but I don't do that. Usually, whatever an engineer has found to be best for his studio and his technique and his board is where I start, and unless I don't like it, we don't change. And when you've found an engineer and a studio you like - which I've done - that tends to be what you stick with. Val Garay is the engineer that I use, 'cause I like him. He's good. He likes the kinds of sounds I like, and when we don't agree, he doesn't mind being told what to do.

PL: What is it about the Sound Factory that you like?

PA: Firstly, the most important thing about a studio is the engineer, which people do tend to ignore. I mean, if a studio looks sufficiently great, people say it's a great studio, but with a bad engineer, it's the worst studio in the world. The second most important thing is good maintenance. The most irritating thing is when the studio keeps going wrong. The Sound Factory goes wrong too - they all do. The technology is such that things do go wrong, but if they go wrong with fairly moderate, modest frequency, that you can tolerate. I've been in studios where serious things go wrong all the time, which usually means they were not fixed properly in the first place. When they *did* go wrong, the people kind of fudged and then they go wrong worse.

The Sound Factory is a very good-sounding room, the monitors are good and fairly realistic . . . I like the arrangement of the different rooms, so that if you want to separate people, you can. You're not obliged to, but it's a great advantage to be able to have, for example, John David play acoustic and sing and not have a problem with that later on. This kind of situation enables you to make clearer records and also to fix things better. The room situation works well, and everyone can still see each other - to some extent - through the windows.

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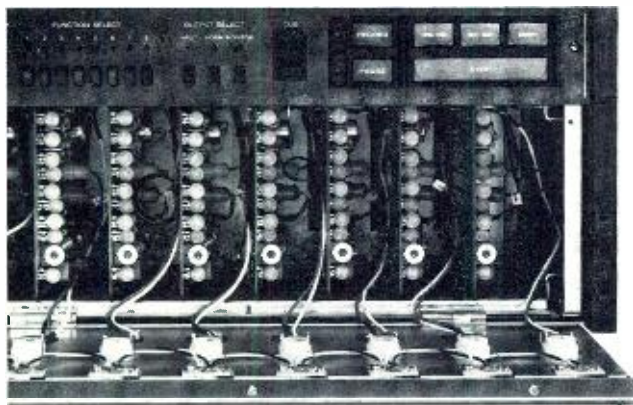
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# VIDEO for the AUDIO MAN

by

Oliver Berliner with Rob Lewis

Despite the fact that television receiver manufacturers continue to regard audio as little more than a necessary evil — to the extent that, were they to use a high quality audio amplifier and speaker in their sets, the abominable noise and distortion inherent in their cost-saving design shortcuts would make recorded programs virtually unlistenable — despite this boldfaced disdain for audio quality on the receiving end, major television studios and the networks have acquired audio facilities that rival those of recording studios.

This apparent upsurge of interest in and attention to audio at the broadcasting and may (let us hope!) be in anticipation of the day when TV receivers are routinely equipped with high quality audio sections, perhaps with output jacks for feeding an existing hi-fi amplifier and speaker system. Whether or not this is the case, there are other factors that have contributed to a new awareness of audio among television broadcasters, not the least of which has been the popularity of televised rock concerts. When TV sound men first began dealing with major rock acts in live performance situations, they were often amazed to find the groups using more sophisticated equipment to feed their on-stage monitor systems than the studio had available to handle the broadcast audio going out over the air for consumption by millions!

But the TV producers caught on quickly, and the technical supremacy of the recording and sound reinforcement people was short-lived, as TV studios raced to upgrade their audio facilities. Now, in fact, the situation seems to be reversing itself, as the dawn of a "New Age" of video begins to appear over the horizon, propelled by snowballing technical advancements (just as the advent of multi-track recording and miniaturized solid state components triggered a "New Age" of audio in the 60's). The coming of video discs, commercial cablevision networks, projection TV, and inexpensive computer-type hardware all signal a revolution in both form and content that will have people whose expertise is strictly limited to audio struggling to keep up with the exciting new developments in electronic images.

Having "graduated" from audio to the fascination of video a decade ago, this writer feels that the audio professional will inevitably come in increasing contact not only with conventional broadcast video, but with industrial grade (closed circuit) teleproduction as well, which seems destined soon to come of age in the

record industry, to cite only one example. Imagine the attractiveness of closed circuit TV for introducing new artists at discotheques and in record stores, for auditioning acts without leaving the office, for presenting new "product" to affiliates, for intermission entertainment in niteries, etc. Beyond these relatively mundane applications of existing technologies, one can only speculate on the myriad ways video systems will soon penetrate our lives. Perhaps, then, a basic understanding of some of the technical features of video would not be out of place for the forward-looking audio professional.

## THE ESSENTIALS OF VIDEO

Absolutely essential to any discussion of video *vis-a-vis* audio is an understanding of the fundamentally different nature of the two signals. Mathematically, both types of signal can be characterized as single-valued functions of time (which is to say that they can be transmitted over a single pair of wires), but the similarity virtually ends there.

Audio signals, after all, are essentially pure *analog*s of the sensory information that they carry — feed an audio signal of sufficient power into a transducer (speaker) and — ignoring imperfections in the equipment — what you will experience is a re-creation of the original acoustic event that produced the signal. By contrast, if you feed a video signal into a simple electro-optical transducer — let us say a light bulb or an oscilloscope — what you see may be of some theoretical interest, but will bear no resemblance whatever to Johnny Carson or the Sunday Night Movie!

Evidently, then, the video signal has been somehow "encoded" in a fashion that the audio signal has not. In fact, a moment's reflection should make it obvious that *some* type of encoding is necessary to fit a complex sensory impression containing dimensions of length, width, brightness, and color into a signal containing only one variable: voltage. Fortunately, the human visual system is of great help here, since its response time is slow enough that if we use a rapidly moving spot of light to "paint" a picture a couple of dozen times every second, the eye will perceive a steady, unfllickering image. The possibility of exploiting this "persistence" phenomenon led to the "raster scan" method of formatting a picture, wherein an electron beam is deflected across a phosphor screen in a series of horizontal lines as shown in Fig. 1. The U.S. (or NTSC) television

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system uses 525 such lines, arranged in what is termed a 2:1 interlace. This means that only half the picture lines are scanned during any one pass (or "field"), with the next field filling in the spaces left between the lines in the previous field. The entire odd field-even field scan sequence is termed a "frame," and is completed 30 times each second in the NTSC system.

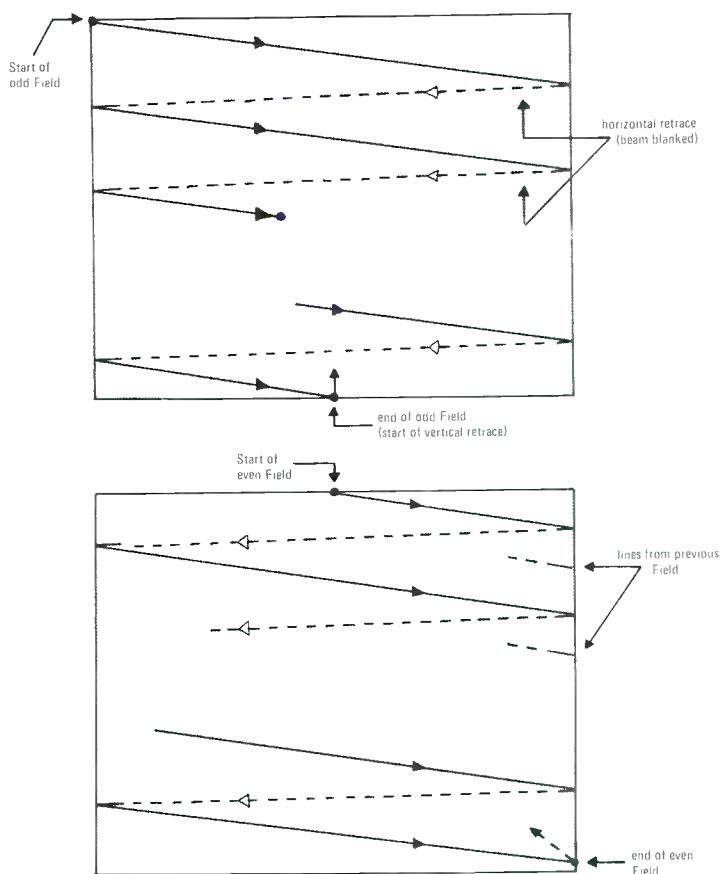
While this raster-scan format is conceptually simple, it requires the transmission of a large amount of "house-keeping" information to make sure that the receiver puts each line of the picture in its correct place on the screen, and that the electron beam is turned off ("blanked") during the "retrace" intervals when it completes a line or a field and must return to position itself for the next sweep.

All of this complex timing and control information — the virtual heartbeat of the entire video system from camera to receiver — is given the collective name "sync," and is actually composed of several different components which are fed in various combinations to all cameras, video tape recorders, special effects units, and other components in the studio, as well as being mixed with the actual picture information in the "composite video" signal that drives the station's monitors and modulates its

transmitter. The components of sync include Horizontal Drive, which synchronizes the sweeps across the picture tube, Vertical Drive, which does the same for the bottom-to-top transitions, and Composite Blanking which turns the electron beam on and off at the proper times. A fourth output consisting of mixed Horizontal and Vertical Drive is also used, and is termed "Composite Sync." In color video systems, two more signals must be provided: the Color Subcarrier (a 3.58 Hz sine wave), and the Burst Flag, more correctly called Burst Gate.

The source of all these signals in a television studio is a piece of hardware called the Master Sync Generator, which can either produce the sync signals from its own crystal-controlled time base, or operate in a "Gen Lock" mode. The Gen Lock circuits enable the sync generator to extract timing information from the incoming signal from the network or from the station's own remote unit, and lock onto this external time base so that the studio's equipment is essentially "slaved" to the external feed. It is this capability that makes possible the synchronization of millions of receivers, tuned to many different stations across the country but all operating in lock step with the network's master oscillator in New York, which is atomically controlled and incredibly precise. It also makes pos-

Fig. 1 NTSC Raster Scan Format — odd and even fields of 1 frame shown.





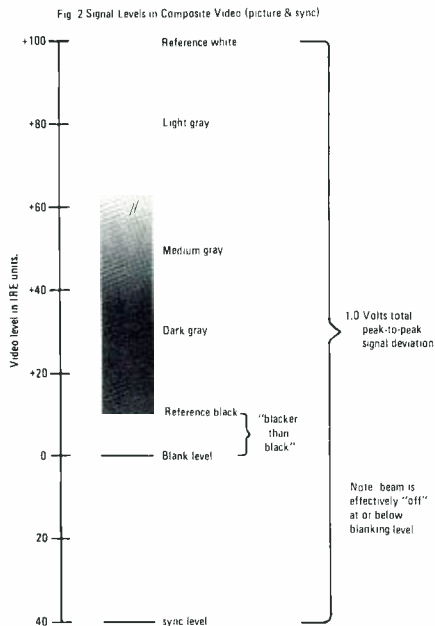
sible the switching between cameras, VTR's, etc., without jumps or "glitches" in the received picture.

Keep in mind that up to now no mention has been made of the actual picture information — the signal that controls the brightness and color of the scanning spot as it flies across the face of the TV screen at blinding speed. Without this information, our sync pulses would give us only a nice, steady, blank screen! The video information must somehow be superimposed on the sync signals in a way that allows the receiver to separate the two.

Separation of sync from picture signals is accomplished by making them of opposite polarity. Refer to Fig. 2 and note the voltage level marked "Blanking Level." This is the zero level, or baseline of the video signal, and by definition any signal voltage below blanking level is sync, while any signal above blanking level is interpreted as picture information.

The standard peak-to-peak amplitude of the composite picture + sync signal is 1 volt, which is arbitrarily divided into 140 "IRE units" (named after the old Institute of Radio Engineers, now the IEEE). Initially 1.4 volts composite video was standard, but this has been all but abandoned. Note that the IRE scale is linear, not logarithmic like a dB or VU scale. Sync pulses have a level of -40 IRE units, while the peak picture level (corresponding to the brightest white the TV set is capable of) is +100 IRE. Picture levels less than +100 IRE correspond to darker and darker shades of gray, all the way down to "reference black," which is 7.5 IRE (sometimes set at 10 IRE). Video levels of less than 7.5 IRE are referred to as "blacker than black."

Fig. 3 shows a simple scene (consisting of a wall with a vertical white stripe separating a black area from a blue area) together with the composite video wave-



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form that would be generated during one horizontal sweep by a black and white camera (Fig. 3b) and a color camera (Fig. 3c). Reading from left to right along the time axis in Fig. 3b, we first encounter the negative-going horizontal sync pulse, which instructs the receiver (and the camera as well) to reposition its scanning beam at the left edge of the screen. Since this pulse drops below blanking level, it also turns off the beam so the retrace operation is not visible on the screen. Next, the video level jumps briefly back to blanking level, then to +10 IRE (black) as the sweep across the picture actually begins (point A in the figure). When the camera hits the white area (at B), the video level goes abruptly to +100 IRE, then at C, it falls to an intermediate level since blue is somewhere between white and black in brightness. At D the sweep has been completed, and the video level again drops briefly to 0 in preparation for the next line's horizontal sync pulse (E).

The addition of color to the basic picture complicates matters considerably.

Referring to Fig. 3c, note the addition of the "Color Burst" (between the sync pulse and the start of the picture), and the chroma signal, which consists of a sine wave superimposed on the "luminance" (brightness) signal when there is color in the picture. The color burst must be 8 to 11 cycles of a 3.58 MHz sine wave, and is used as a *phase reference* with which the ensuing chroma signals may be compared. The chroma signal is also a 3.58 MHz sine wave, but its phase and amplitude are modulated according to a complex formula to impress the desired color information (basically, chroma *phase* specifies *hue* and *amplitude* determines *saturation*). Thus, in Fig. 3c, note that the black and white portions of the picture contain no chroma signal, but the blue section does. Fig. 4 shows the video signal produced by a color bar generator, as displayed on a special-purpose oscilloscope called a waveform monitor. The sync pulse and color burst can be seen on the left of the screen, followed by the white bar (containing some spurious chroma modulation), six color



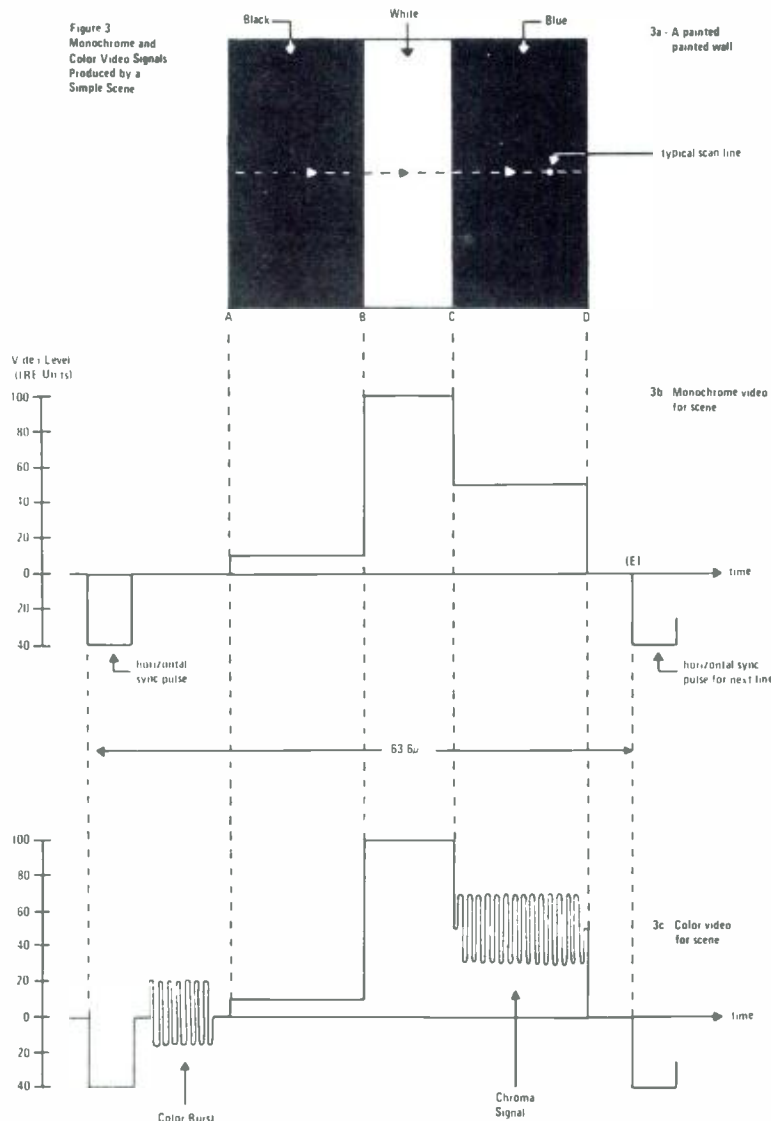
Figure 4: Waveform monitor colorbars display of "75% bars" (the first, white, bar is of 75 IRE units intensity) of 100% saturation (modulation level of the 6 intermediate bars of color between white and black). Color reference burst, S.C. precedes each horizontal sweep and appears here twice (the second time is preparatory to the next horizontal sweep of the bar's test signal).

photo: Ultra Audio Pixtec

bars, and finally a black bar, followed by the sync and color burst for the next line.

The complexity of this system and the critical tolerances involved may come as quite a shock to the audio man accustomed to ignoring 10 or 15 degrees of phase shift in an amplifier, transformer, or equalizer. The fact that it takes only a few feet of the 75 ohm coax cable used for carrying video signals around the studio to produce appreciable phase shift at 3.58 MHz means that two color cameras with perfectly matched characteristics will give entirely different results if the cables connecting them to the master video control console are of different lengths! (Imagine a comparable situation with microphones in a recording studio!) To deal with this problem, plug-in delay lines (measured in nanoseconds) are used throughout the studio to ensure consistent colorimetry between different cameras, VTR's, etc.

Because of the large amount of information in a video signal, it requires a much wider bandwidth than the 20 kHz required for audio. A black and white picture requires a minimum bandwidth of approximately 2.5 MHz, with 4.5 MHz required for color. Insufficient bandwidth in a video system has an effect analogous to rolled-off high frequency response in an audio channel — that is, poor transient response and a loss of fine detail, which translate in visual terms into a muddy and blurred picture that is incapable of resolving intricate detail such as a pin-striped shirt. With the bandwidths specified, the NTSC system is capable of resolving approximately 360 vertical lines across the full width of the picture — the resolution of horizontal lines is of course limited to a maximum of 262 by the raster scan format. The U.S. television standard, by the way, is the worst of all the world's systems in this regard — the PAL and SECAM systems used in Europe both use a 625 line picture coupled with





superior vertical resolution for at least a 25% improvement over the NTSC format's 525 line picture.

In audio a signal to noise ratio of 56 dB or better is mandatory and certainly not unattainable; however in video, 46 dB is considered excellent (Noise appears in a picture as the familiar "snow"). There are all sorts of distortions that can plague video, many more types than in audio, but the simplest test in this area is to check a camera's ability to reproduce a standard test chart. Among the problems that commonly occur are errors in the luminance-chrominance relationship, hum, "tilt" (poor low frequency response), differential gain and phase errors, improper gray scale reproduction, ringing, overshoot, and so on. One helpful capability of video systems in tracking down these problems is the provision for "Vertical Interval Test Signals" (VITS). These are reference signals (analogous to the calibration tones at the beginning of an audio recording) that are transmitted during lines 16 through 21 of each field of a picture\*. With the help of these signals, it is possible to check and verify that all links in the signal chain are operating properly - without interfering at all with the transmitted picture.

*\*Lines 1-21 of a picture are not seen and form the black bar that is visible between frames when you "roll" a picture with the set's vertical hold control.*

#### TELEVISION AUDIO

The audio portion of television holds few surprises for the recording engineer. Audio signals are generated, routed, mixed, and processed virtually the same as in any studio, with the final mix of course being mono and possibly equalized and limited a bit more heavily in view of the poor quality of the receiver. The final audio feed is usually sent to the station transmitter over land lines, while the video may be relayed via microwave links. In the transmitter, the video is broadcast by amplitude-modulating the picture carrier, while the audio is transmitted FM on a separate carrier 4.5 MHz higher in frequency than the picture carrier, using the same 75 microsecond high frequency pre-emphasis that FM radio uses. Overmodulation of the video carrier may cause it to interfere with the audio channel - this is called "intercarrier buzz" and is usually heard as a 60 Hz hum in the audio, corresponding to the 60 Hz video field rate.

#### CONCLUSION

These, then, are the basics of video, and will hopefully serve as a jumping-off point for those who may want to delve more deeply into the abundant literature on the subject. For the engineer whose work may one day include work in teleproduction, such an adventure should be time well spent.

## What's Happening in Broadcast Audio



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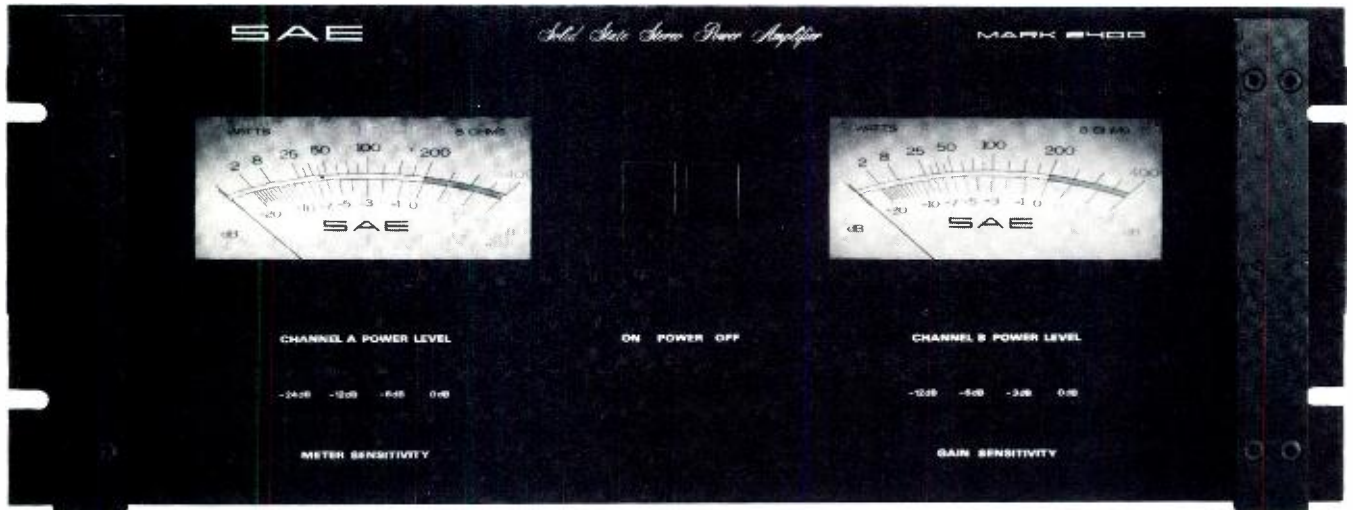
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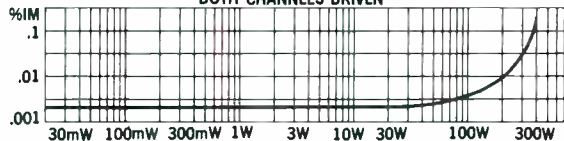
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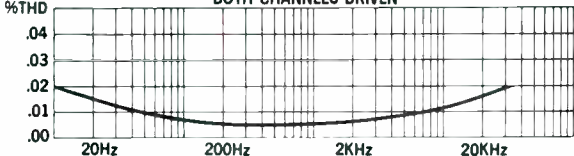
**POWER**—200 watts RMS, per channel, both channels driven into 4 or 8 Ohms from 20Hz to 20kHz at no more than 0.05% Total Harmonic Distortion.

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2400 TOTAL HARMONIC DISTORTION @ 8 OHMS, FULL POWER 40V RMS BOTH CHANNELS DRIVEN



## Other Specifications:

IM Distortion from 200mW to rated power at 4 or 8 Ohms with any 2 mixed frequencies between 20Hz and 20kHz at 4/1 voltage ratio..... 0.05% Max.  
 Input Sensitivity ..... 1.5 volts, RMS  
 Frequency Response at rated power.....  $\pm 0.25$ dB, 20Hz to 20kHz  
 Noise ..... Greater than -100dB below rated power  
 Transient Response of any Square Wave ..... 2.5  $\mu$  sec. rise and fall time  
 Slew Rate ..... 40 V/ $\mu$  sec.  
 Dimensions ..... Front panel: 19" Wx7" H, Chassis: 11" D (excluding handles, controls and connections)

Specifications comply with FTC requirements for power amplifiers.

**RELIABILITY**—Series-Output circuitry assures high current capability without loss of wide power bandwidth, low leakage current or super high slew rate. High demand reliability is built in through the use of 8 triple diffused output transistors.

**VERSATILITY**—The 2400 is a very efficient power package, weighing less than 42 lbs. and having a depth of only 11". Available in black rack mount (as shown) or our traditional satin gold and black.

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**COMMENT**—You'd have to look a long time to find a power amplifier that delivers so much value. Superb power, superior performance and total reliability makes the SAE 2400 truly the \$750 alternative.

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# New Products



## NEW STUDER A-67 1/4 INCH RECORDER

This newly introduced machine is available in full track mono and half track head configurations in portable, rack mount and console mountings.

Features include 3 speed crystal controlled servo capstan drive; servo tape tension control on both take-up and supply motors; and tape timer reading in minutes and seconds. The A-67 has been designed for ease of user servicability incorporating plug-in transport and audio electronics with all audio electronics accessible from the front panel for alignment.

The A-67 is now available at prices starting at \$2,400.

WILLI STUDER AMERICA, INC., 1819 BROADWAY, NASHVILLE, TN 37203. (615) 329-9576.

Circle No. 138

## GRANDSON III, MODEL 110-T, A NEW GENERATION IN THE 110 LINE OF AUDIO CONTROL CONSOLES FROM AUDITRONICS.

This is the third unit in the popular series designed specifically for use in live performing arts.

Included to bring studio quality to live dance, music and theatre are quadraphonic mixing, presetting and full theatrical communications. Up to 16 input positions may be combined to 8 mixing busses. Presets distribute the quad busses to each of 8 outputs.

Theatrical communications interfaces into headset intercom, backstage cue/page, lobby paging and talkback to stage and audience.

GRANDSON III is modular, expandable, exceptionally rugged for touring and a compact 38" wide by 32" deep. All the features of earlier Grandsons are retained including phantom condenser microphone power, outstanding performance specifications, and a full line of optional accessories.

Design concept is one emphasizing the unique theatrical requirement for sound distribution in addition to sound mixing. Its functional design and concise simplicity make it truly an artist's instrument capable of amazingly subtle interpretations of sound. Only connection of input and output lines is required to make the 110-T the sound control center for a performing environment.

Eight VU meters, quad positioners, 4 eight output presets, separate stage and audience mixing, 2 effects send/receive channels, and stereo control room monitoring w/solo function combine for full capability.

To accommodate the exceptional dynamic range requirements of theatrical application 20 dB headroom is provided

over +4 dBm output. And each input position provides a stepped input sensitivity control handling levels from -70 dBm to +20 dBm, at the microphone input!

Each input position provides a linear motion attenuator and a three knob, six frequency equalizer providing 12 dB boost or cut at 80 Hz or 150 Hz, 1.8K or 4K Hz, and 7.5K Hz or 12k Hz, in/out switch, and Hi-Lo cut. Switchable selection between two inputs which may be either microphone or line level and transformer isolation are incorporated.



on-off switch with indicator light and controls for effects sends A and B appear on each input position. A quad positioning control and multi station switches at each input position provide assignment to one or more program output busses simultaneously.

AUDITRONICS, INC., 180-B SOUTH COOPER ST., MEMPHIS, TN 38104. Phone: 901/276-6338.

Circle No. 139

## NEW UREI FEEDBACK SUPPRESSOR BOOSTS GAIN-BEFORE-HOWLBACK IN SOUND SYSTEMS

The new Universal Audio Model 560 Feedback Suppressor from UREI is a low cost sound reinforcement tool for use in a variety of acoustical environments.



## Creation of the new Calibration Standard filled a need... the acceptance of Stanton's 681 TRIPLE-E is unprecedented!

It was no accident!

The Recording industry needed a new calibration standard because it had been cutting discs with higher accuracy to achieve greater definition and sound quality.

So, the engineers turned to Stanton for a cartridge of excellence to serve as a primary calibration standard in recording system check-outs.

The result: the new calibration standard, the Stanton 681 TRIPLE-E.

The rest is history!

Major recording studios adopted it . . . as did many of the smaller producers. Radio stations across the world put the 681 TRIPLE-E on all of their turntables, both for on-the-air broadcasting and for disc-to-tape transfer.

And, audiophiles by their purchases have voted it the outstanding stereo cartridge available.

The Stanton 681 TRIPLE-E offers improved tracking at all frequencies. It achieves perfectly flat frequency response beyond 20 kHz. Its ultra miniaturized stylus assembly has substantially less mass than previously, yet it possesses even greater durability than had been previously thought possible to achieve.

Each 681 TRIPLE-E is guaranteed to meet its specifications within exacting limits and each one boasts the most meaningful warranty possible. An individually calibrated test result is packed with each unit.

As Julian D. Hirsch of Hirsch-Houck Labs wrote in Popular Electronics Magazine in April, 1975: "When we used the cartridge to play the best records we had through the best speaker systems at our disposal, the results were spectacular".

Whether your usage involves recording, broadcasting, or home entertainment, your choice should be the choice of the professionals . . . the STANTON 681 TRIPLE-E.

Write today for further information to Stanton Magnetics, Inc., Terminal Drive, Plainview, New York 11803



All Stanton cartridges are designed for use with all two and four-channel matrix derived compatible systems.

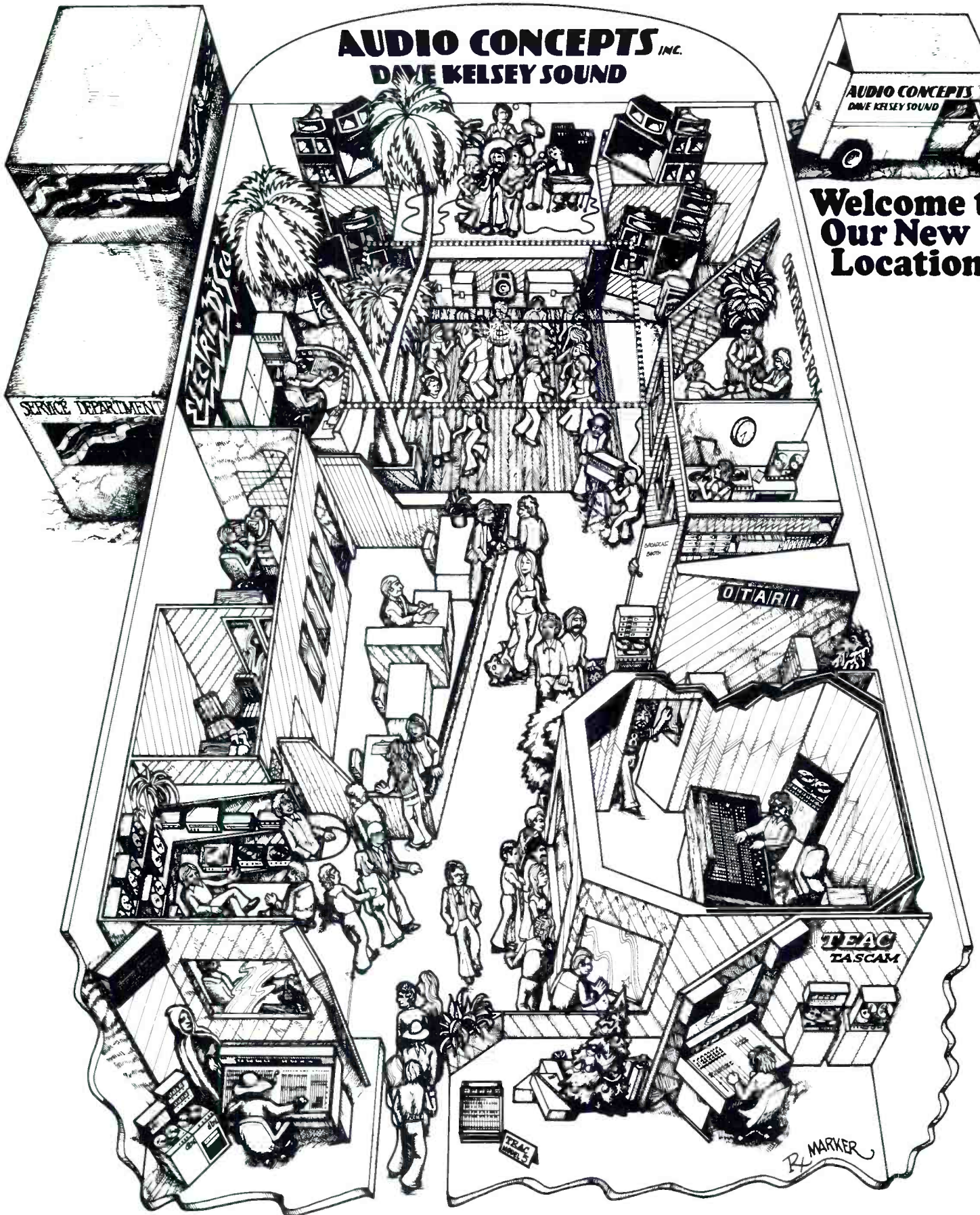
Circle No. 140



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By centering the unit's four 1/6 octave notch filters on a sound system's most prominent resonant frequencies, gain can be increased typically 12 dB and intelligibility improved. Each filter is tunable, 60 Hz to 6000 Hz in two ranges. Notch depth is adjustable to -20 dB.



The 560 can also be used with more sophisticated broadband and/or 1/3 octave equalization methods for reducing microphone proximity effects and troublesome residual resonances.

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

Circle No. 142

### YAMAHA NOW OFFERS 24 AND 32 CHANNEL MIXING CONSOLES

In response to the demand for additional input capability, Yamaha has created the PM-1000-32 and the PM-1000-24: 32 and 24-input X 4-mixing bus, these consoles are, in essence, "stretched" versions of the original 16-input PM-1000. Built in the same tradition of top professional performance and rugged reliability, the larger consoles are every bit as roadable as the field-proven PM-1000-16.

The 32-channel main frame, 58½" wide, is used for both the 32 and 24 channel configurations; since the main frame already contains all the connectors, transformers, wiring, and power capacity necessary for 32-channel operation, 24-channel consoles may be expanded to 32 channels by unplugging the 8 blank modules and plugging in 8 input modules.



The larger main frame makes it possible to provide 8 large, illuminated VU meters — 4 for the Master and 4 for the Monitor outputs — plus 2 Echo output VU meters. Additional space on the rear is occupied by another 16 XLR-type, transformer-isolated inputs, as well as individual phantom power ON/OFF switches for all 32 input channels. This permits some channels to be connected to unbalanced equipment (without need for auxiliary isolation transformers) while, simultaneously, other channels can energize condenser microphones. Two identical, self-contained power supplies

share the load, thereby enhancing the system's dependability.

Standard features include a 4x4 Monitor Mixing matrix; provisions for Direct Playback of 4-track tape machines, a Talkback system (mike input, preamp, PTT switch, bus-assigned and direct output); two Echo/foldback mix buses; a 2-frequency Oscillator for set-up, reference and testing; and a Headphone mix section with jacks for two pairs of stereo headphones. Each input channel has: a Cue button, a smooth-tracking linear Fader, a precision 11-step Input Level switch, a 2-knob/5-band Equalizer, a 2-frequency High Pass Filter, a Phase reverse switch, a Pan pot, dual Echo mix controls, and 4 bus-assign switches.

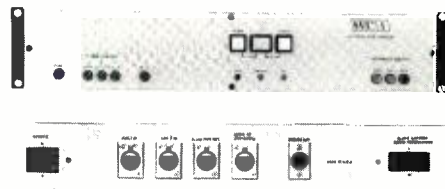
Consoles are supplied ready to use, and include a comprehensive instruction manual covering a variety of topics from illustrated XL connector wiring to a definition of dBm, dBV and dB SPL.

YAMAHA INTERNATIONAL CORP., COMBO INSTRUMENT DIVISION, P.O. BOX 6600, BUENA PARK, CA 90620.

Circle No. 143

### MCI ANNOUNCES A SLAVE DRIVER USED TO LOCK AN MCI TAPE RECORDER TO ANY OTHER RECORDING DEVICE

All of the components needed to complete a MASTER-SLAVE recording system are available in this new single



unit, either as standard equipment or as optional plug-in cards.

The Master recorder may be any type of recording equipment which is capable of delivering a 50 Hz or 60 Hz signal which is synchronous with the film or tape movement. In normal use one track of both the Master and the Slave are used to record and play back the 50/60 Hz positional information. Some other ways of securing positional information are:

"Frame" (Station Sync) information in Video Recording may be filtered out of the video channel and used to synchronize the Slave recorder.

A recording channel may be divided into Low Frequency (50/60 Hz) and High Frequency (above 200 Hz) program signals. This channel can be used for any recording which does not require full Low Frequency response, such as a Speech Only Program Channel, Automation signals, or Cue signals.

A Carrier system may be used for the 50/60 Hz Positional information. In this system, the Low Frequency Reference signal modulates a High Frequency Car-

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## ANNOUNCING MCI'S JH-500 SERIES PROGRAMMABLE MIXING DESK

### SPECIFICATIONS

THE MCI JH-500 SERIES is available in two frame sizes (JH-528, up to 28 inputs, and the JH-542, up to 42 inputs) with choice of eight CUSTOM METER PANELS for VU meters or BARGRAPH displays (DIN peak/VU/Accumulate) including PHASE meters. MCI SPECTRA VUE Spectrum Analyzer, ECHO RETURN into the quad busses, additional EQUALIZERS for ECHO SENDS and two FADER WRITING STRIPS are optional. ALL STRAIGHT LINE FADERS ARE CONDUCTIVE PLASTIC. The standard PATCHBAY has space for maximum of 756 patchpoints (JH-542; JH-528 maximum 504 patchpoints) including TIELINES and switchable MULTS (JH-542-4; JH-528-2). Detent monitor and send TRIMS, alternate PRODUCER MONITOR CENTER and METERS which follow the monitor are only a few of the many unique features of the MCI JH-500 Series.

#### INPUT/OUTPUT MODULE FUNCTIONS

**BUSS SELECT:** 32 (Odd/Even panable, LED indication, solo, trim).  
**EQUALIZATION:** 4 Point (140 million possible curves, switchable between monitor and channel, switchable pre/post EQ patchpoint, EQ only SOLO, EQ in/out SWITCH).  
**HI-FREQ:** Shelf or peak at 8, 10, 12, 15 KHz  $\pm$  10 dB  
**LOW-FREQ:** Shelf at 30, 60, 100, 150 Hz  $\pm$  10 dB  
**MID-RANGE I:** Half-octave steps from 150 Hz to 7 KHz  $\pm$  14 dB  
**MID-RANGE II:** Half-octave steps from 180 Hz to 8.5 KHz  $\pm$  14 dB  
**MIKE INPUT:** 20dB Pad, switchable, mike trim, 30dB range.  
**MONITOR:** Quad, 45mm conductive plastic monitor fader, F/B and L/R pan, MUTE, WET-ECHO switch, 6 sends for echo or cue with individual PRE/POST select switch (2 mono sends on 45mm conductive plastic slides, 2 mono sends on rotary con-

Examine the specs for MCI's new JH-500 Series console and you'll agree it's a whole generation ahead of any mixing desk previously available. It functions as a signal processor par excellence, and is automation-ready. For more information, or to learn the name of the nearest MCI U.S. or overseas distributor, contact us today.



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 Phone: (305) 566-2853 • TELEX: 514362

#### AUTOMATION:

controls, 1 stereo send with pan), monitor reverse switch.  
 3 controls (VCA WRITE, VCA UPDATE, MUTE WRITE). 8 automation functions plus grouping and echo return. NO NULLING necessary prior to update.  
**GROUPING:** 8 VCA groups, 8 mute groups, MASTER mute and clear.  
**INPUT CONTROL:** 4" conductive plastic fader, with  $\infty$  mute switch, VCA overload indicator, reversible with monitor fader, mike/line switch, MUTE and SOLO switch.

#### TECHNICAL DATA

#### MIKE PREAMP

Input impedance without pad: 300 ohm  
 Input impedance with pad: 1.2 K ohm  
 Output impedance: 2 ohm  
 Nominal output: -6 dBm  
 Distortion at—  
 0dB in, +28dB out, 50Hz: .025% total harmonic  
 -50dB in, -6dB out: .012% IM  
 -40dB in, 0 dB out: .005% IM  
 0dB in, +26dB out: .026% IM  
 Equivalent input noise with 44dB gain: -126dB  
 Mike Preamp headroom: +34 dB

#### CHANNEL CIRCUIT

Signal to noise: > 75 dB  
 Input impedance to fader: 4 K ohm  
 Output impedance of channel out: 100 ohm  
 Nominal output: +4 dBm  
 Max. output at .5% Dist., 1KHz: +27 dBm  
 Distortion at nominal output (IM): .07%  
 Distortion at +24 dBm out (IM): .09%  
 Separation between adjacent channels assigned to adjacent busses, mike in to line out at 1KHz: 85 dB  
 15KHz: 65 dB  
 Max fader attenuation: > 80 dB  
 Max system output (line amp. out): +27 dBm

#### MONITOR CIRCUIT

Input impedance to fader: 4 K ohm  
 Separation of quad mix busses 1KHz: 75 dB  
 15KHz: 65 dB  
 Nominal output: +4 dBm  
 Max. output at .5% distortion: +27 dBm  
 Distortion at nominal output: .06% IM  
 Distortion at +24 dBm out: .08% IM  
 Output impedance of quadmix: 100 ohm  
 Signal to noise: > 75 dB  
**OVER-ALL SYSTEM** 20Hz to 20KHz  
**FREQUENCY RESPONSE:** 20KHz to  $\pm$ .5 dB

*Specifications subject to change without notice.*



rier Tone (for example - 14 kHz). The modulation method may be either FM or AM. The composite signal is then recorded as an addition to any program channel.

In the playback system, the Carrier Tone is separated from the audio portion of the channel, is Demodulated, and the positional information is used to Lock the Slave recorder to the Master.

In MCI's new device, a Phase Locked Loop system is used to lock the Slave recorder to the Master so that any variations in the speed of the Master machine are faithfully reproduced by the Slave machine.

MCI says that - With the Master machine running, a lock is achieved in less than one second after the start of the Slave.

Previous systems built for this same purpose have been plagued by increased "Flutter" in the Slave machine. MCI says that the flutter increase with their new device is less than .02% (Din weighted @ 15 IPS).

The Slave Driver will work with all models of MCI recorders with no changes to the standard machine.

MCI INC., 4007 N.E. 6TH AVENUE, FT. LAUDERDALE, FLA 33334. (305) 566-2853.

Circle No. 146

#### SPECTRA SONICS MODEL 1032-32 AUDIO CONTROL CONSOLE

Now in full production the new audio control system incorporates the latest concepts in flexibility and multiple signal routing.

**INPUTS:** The Model 1032-32 provides inputs for 32 microphone, 32 line, 32 tape, seven line level direct to control room monitor, and four echo returns. **OUTPUTS:** There are 32 direct outputs, four echo send, four quad, two stereo, one mono, four control room monitor, two studio and Cues A, B, and C outputs.

A 15 frequency graphic type equalizer is included on all 32 inputs and also on echo return. The 32 VU meters are switchable to provide full monitoring to include control room monitor, quad, echo, stereo, mono, and Cue C. There are straight line attenuators for all inputs and mono, plus two four-gang for sub-mix and one for quad, a two-gang attenuator is used for stereo. A Model 800 Signal Generator is incorporated for level

setting and calibration; the talkback facility is on all 32 direct outputs and also in studio, quad, stereo, mono, and all three cue functions. Tape remote controls are provided for five tape recorders/reproducers and a 480 point jack bay field for 96 inputs, 52 outputs, 32 buss/amplifier internal patching, twelve multiple, seven tapes, four echo return inputs, 16 spares, 66 blanks for potential added applications, and four Model 800 Signal Generator outputs.

The outstanding performance, precision workmanship, sequentially arrayed, conveniently located controls, all are combined in a precision audio instrument to satisfy the most demanding and innovative audio engineer. Some typical performance specifications are:

Frequency Response,  $\pm 1/4$ dB 20HZ - 20kHz; Signal/Noise Ratio (Microphone Input), not less than 82.5dB below +4dBm output for a -50 input (50 ohms source); Signal/Noise Ratio (Line Input), not less than 87dB below +4dBm output for a +4dBm input; Total Harmonic Distortion, less than .01% at +18dBm (1kHz); Intermodulation Distortion, less than .02% at +4dBm; Crosstalk, not less than 60dB at 20kHz (typically 80dB).

Priced at \$56,576.06.

SPECTRA SONICS, 770 WALL AVE., OGDEN, UTAH 84404 (801)392-7531.

Circle No. 147

#### WHITE INSTRUMENTS MODEL 142 SOUND ANALYZER

A real time analyzer designed to be used primarily as a monitor for program material, the unit incorporates a 28 by 11 LED matrix for the display of 27 one-third octave channels from 40 Hz to 16 kHz plus one broadband channel for overall indication of level. A front panel switch selects display ranges of 10 dB, 20 dB, or 30 dB. In addition, the input is calibrated in 10 dB steps from -30 dBm to +10 dBm.

Each one-third octave channel is peak reading. The decay time can be varied from 0.1 seconds to 2.0 seconds in discrete steps. This allows the engineer to adjust the display to suit his application.

The Model 142 has a built-in pink noise generator of the digital variety. The pink noise signal is available at both the front and rear of the unit and is presented at a level of 0 dBm.

continued . . .

#### New Interface Electronic Crossover

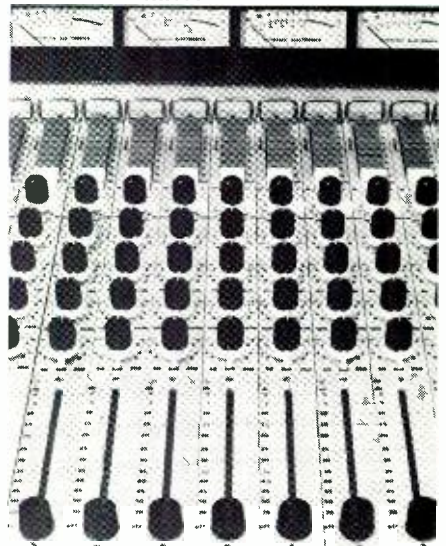


Three-way tuneable crossover has crossover points fixed at 3db. down. It is tuneable 130-1700 and 110-14000 Hz, with all outputs in phase at all frequencies. No null crossover and 12 db/octave Butterworth response. It has 600-ohm transformer outputs at 8 volts rms maximum. Voltage gain is 2 maximum. Distortion under 0.1%. Rack mounted panel measures 1 3/4". Price \$295.00.

#### Stage Monitors

Model 24X4-24L Stage Monitor Mixer provides eight completely independent monitor mixes of 24 inputs with three frequency equalizing and slider channel master on each input. Options include 16 X 4 mainframe, balanced 600 ohm + 8dbm outputs, and foam lined trunks. Combination module Model 100K for both stage monitoring and master recording.

#### Series 300 Mixers



Designed primarily for recording studios, Interface Electronics mixers are also now increasingly being used in sound systems because of their flexibility, ruggedness, reliability and portability. Track masters are used as submasters (up to eight with the Series 300) and the mixdowns provide for feeding each submaster to right or left or any shading between, with mixdown masters used for right and left sound system masters.

Now in fully wired mainframes with input and output connectors and integral-lighted four inch VU meters, the Models 16X8, 24X8 and 30X8 can be supplied with Talk-Slate module for recording studio use or in a foam-lined trunk for portable use. Price of the complete 24X8 is \$10,340.00

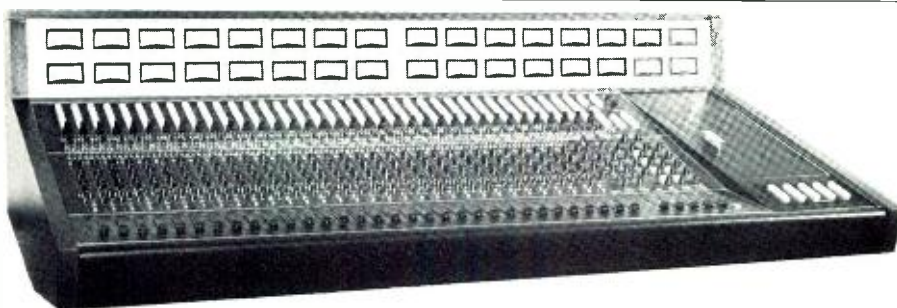
#### INTERFACE ELECTRONICS, INC.

3810 Westheimer/Houston, Texas 77027/(713) 626-1190

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**Ohio:** Sunset Sound, Columbus (614) 239-6945  
**Penn.:** Short Sound Systems, Pittsburgh (412) 761-2724  
**Tenn.:** Carlo Sound, Nashville (615) 356-0202  
**Texas:** Interface Electronics, Houston (713) 626-1190; United Audio, San Antonio (512) 684-4000

Dealerships still open in some areas.



Two CMOS memory registers allow the engineer to store display information. This information remains stored as long as the unit is turned on. In the SAMPLE mode, "snap shots" of program material or of pink noise test signals can be stored in either memory for later viewing and comparisons. In the ACCUMULATE mode, either memory can be used to register the highest peak readings during any segment of program material and viewed later to ascertain whether or not some maximum level was surpassed.

Suggested applications for the Model 142 Sound Analyzer include program material monitoring, recording and mix-



down analysis, portable system adjustment, tape equalization and calibration, transmission line equalization, frequency response testing, and many others. Of particular value will be the dual memories for before-after comparisons.

The Model 142 is 3-1/2 inches high by 8 inches deep on a standard rack panel. The unit weighs approximately 10 pounds. The front panel is black anodized

brushed aluminum. Either 115 or 230 Vac power at 15 watts is required.

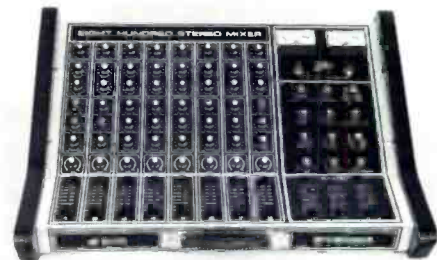
The suggested list price for the Model 142 is \$3200.

**WHITE INSTRUMENTS, INC., P.O. BOX 698, AUSTIN, TX 78767. 512/892-0752.**

Circle No. 149

### PEAVEY 800 STEREO MIXER

The 800-S Mixer is the latest addition to the Peavey line of professional sound reinforcement equipment. This new Stereo mixer features 8 channels with the latest variable negative feedback circuitry. Each channel has separate low and high equalization as well as a slide level control for maximum tone control and output level. Pre and post capability for monitor, reverb, and effects send controls, individual channel attenuation and stereo pan add to the system's versatility. A master section features slide level controls for left and right main and monitor as well as low, mid, and high equalization for both left and right mains. Also included is master level, return, and pan controls for the effects and reverb busses. Two lighted VU meters with screw adjustments are located above the master section.



The rear panel of the 800-S features eight low 600 ohm and eight high 50K ohm inputs; left and right main and monitor outputs; auxiliary input panel, and a stereo phone jack for taping out.

**PEAVEY ELECTRONICS CORP., P.O. BOX 2898, MERIDIAN, MISSISSIPPI 39301. (601) 483-5365.**

Circle No. 151

### NEW TOP-OF-THE-LINE DIGITAL DELAY SYSTEM FROM EVENTIDE CLOCK WORKS INC.

The 1745M ('M' for MEMORY) replaces the earlier 1745A, with improvements in performance and previously unobtainable special effects. The 1745M is a fully modular delay line employing Random Access Memories for delayed signal storage, instead of the older shift register technology. By using RAM's, it is possible to vary delay in an almost continuous fashion, instead of relying on multiple taps. The new Eventide system can have up to five outputs (two are standard), all of which may be individually adjusted to any delay up to 320 milliseconds, or, in the DOUBLE mode, up to 640 milliseconds at reduced frequency response. The exclusive REPEAT

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mode permits capture and continuous repetition of short signal segments for "looping" effects.

NEW effects include the direct generation of true flanging by "sliding" one output past the other in time, producing the familiar frequency cancellation. Precise matching of the two channels due to the digital signal processing allows extremely precise cancellation and thus a deeper effect. A small amount of true pitch changing is available simply by varying the delay time, and a variable ratio pitch changer module is scheduled for introduction at the Spring AES convention. Other modules to be announced include automation-compatible remote control.



Besides extra delay, the delay line features improved dynamic range (greater than 90dB) and more versatile signal level indicators. Power consumption has been drastically reduced by the use of CMOS circuitry, eliminating the requirement for an external heat sink and reducing ventilation requirements.

Price: Standard, 2 outputs, 320 ms \$4100.00.

EVENTIDE CLOCKWORKS, INC., 265 WEST 54TH ST., NEW YORK, NY 10019 - (212) 581-9138.

Circle No. 152

#### FRAP WIND INSTRUMENT PICKUP

New from FRAP, a wind instrument pickup which is capable of picking up any wind instrument be it woodwind, brass,



or even drums, without picking up any key, valve, or other extraneous noise. The pickup looks at the air column and is virtually insensitive to extraneous mechanical vibrations. Anti-feedback characteristics are inherent in the design of the transducer.

The transducer is available in two styles: One, with nickle silver backplate, can be made to fit any flute, the other, with screw mounting, screws into a hole tapped for a 10-32 screw. It can be mounted in any wind or brass instrument. (We recommend mounting it in an extra mouthpiece), or in a drum. The unit is 1 3/16" in length and 7/16" in diameter. The preamp comes in two models, the model being determined by the preamp: The W-200 measures 5 1/2 x 4 1/4 x 2 5/8" and is powered by four 9-volt batteries, good for approximately 100 hours. A 'FRAP Quik-Check' key chain battery checker is included. The W-250 measures 9 5/8 x 5 1/2 x 2 5/8", and is powered by 18 C-cells, good for approximately 1500 hours. The W-250 comes with built-in instrumentation grade preamps housed in 14-gauge stainless steel. They are transformer coupled to be compatible with recording studio and P.A. equipment. They will also work with instrument amplifiers.

This pickup is flat from 20 to 20,000

Hz. It gives the accurate reproduction and clean signal that FRAP pickups are famous for. It will not distort at high volumes and it has ultra low noise characteristics. Anti-feedback characteristics are inherent in the transducer design. The transient response is limited only by the amplification equipment used. The W-200 and W-250 FRAPs are ideal for high quality recording, performing, and use with synthesizers or electronic effects.

FRAP, BOX 40097, SAN FRANCISCO, CA 94140. (415) 543-5458.

Circle No. 154

#### NEW HELPINSTALL MODEL 110 PIANO SENSOR

This model designed for grand and upright pianos includes all of the equipment usually supplied with the Model 75 Upright Piano Sensor, plus new adjustable support pieces and an additional longer electromagnetic sensor to facilitate installation on grand pianos.

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section and support two others underneath the remainder of the strings. The two support bars underneath feature screwdriver-adjustable height controls, and foam pedestals isolating the pickups from vibration of the sounding board on which they rest.

The passive mixer supplied with the unit provides three input controls, master volume and tone controls, and features both high- and low-impedance outputs. Typical installation time for a grand piano is five minutes.

List Price \$325.

HELPINSTILL DESIGNS, 6124 JES-SOMINE, HOUSTON, TX 77036 (713) 765-3770.

Circle No. 155

### SOUNDCRAFTSMEN PROFESSIONAL SG2205-600 EQUALIZER

Front panel pushbuttons control line or tape equalization when used with conventional audio systems or separate stereo outputs for multiple system equalization flexibility. In addition, a tape monitor circuit is also provided for monitoring equalized program material during production use.



Due to the necessity of unity-gain during equalization, the SG2205-600 utilizes four Light-Emitting-Diodes in a visual front panel display controlled by zero-gain level controls for precise input vs. output level balancing. The L.E.D.'s also indicate input overload during recording or playback.

Specifications include: S/N-96dB/distortion — .05/±12dB boost or cut each octave/total output level control 18dB/600 ohm output/Toroidal and ferrite core inductors.

The SG2205-600 front panel is black anodized aluminum, 19 inches in length for installation into standard rack configurations.

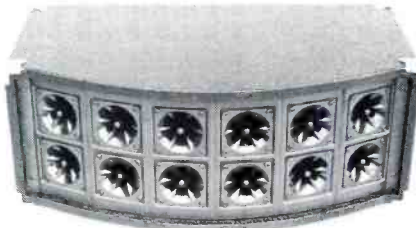
Price \$399.50.

SOUNDCRAFTSMEN, 1721 NEWPORT CIRCLE, SANTA ANA, CA 92705. (714) 556-6191.

Circle No. 156

### PEAVEY T-12 TWEETER BANK

The Peavey T-12 tweeter bank is designed for PA and commercial sound applications to increase projection of the upper frequencies and high end dynamics.



The T-12 contains twelve Piezo super tweeters in a convex enclosure with level control and parallel jacks.

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PEAVEY ELECTRONICS CORP., P.O. BOX 2898, MERIDIAN, MS 39301.

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### NEW CL&S TWIN DRIVER, PORTED BASS CABINET

Known as the GGM, this fiberglass twin driver, ported bass cabinet is designed for use in the 35Hz — 1500 Hz range as a high level bass guitar speaker system, or, with high frequency horns, for club



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Circle No. 159

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The most notable feature of the new accessory is its provision of half-octave bands centered at 31.5, 45, 63, 90, 125, and 180 Hz, with full-octave bands at 250, 500, 1000, 2000, 4000, 8000, and 16000 Hz (all ISO standard frequencies). The extra selectivity at low frequencies gives much-needed control over room and speaker resonances, which often produce bass irregularities too abrupt to be effectively controlled with an octave equalizer. With the GE-2, a solid, well-defined bass sound can be obtained in virtually any room, with virtually any program and any reasonably good speakers.

## TOPPING OFF OUR LINE The New Dual Analog Delay

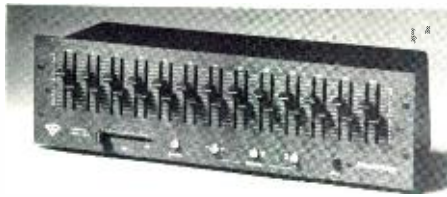


Multi-Track, manufacturers of the Dual Equalized Reverb and the Vari-Band five section parametric equalizer, now brings you the first Analog Delay Line. A recent development in integrated circuit technology has enabled Multi-Track to produce an audio delay unit of uncompromising quality. Unlike digital delay lines, this unit stores the audio as an analog signal, not a digital code. The result, a wider frequency response, no quantization distortion, natural sound, and a lower price. Each of the two channels is capable of up to 49 msec. in 1 msec. increments and can be cascaded for up to 98 msec. of delay. For the full story on this audio breakthrough, write to Multi-Track. For the full sound, contact your local Multi-Track dealer for a demonstration.

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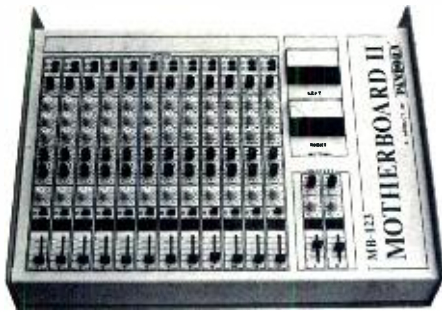
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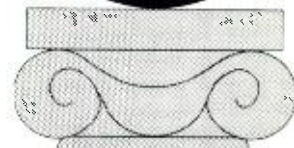
**WANTED:** Studio manager with proven ability to make money, to buy into and take over existing 16-track facility in major East Coast city. Strong technical, musical background helpful but not necessary. We can handle engineering, maintenance, musical and sales tasks, but need organization and leadership, a new console, and other equipment. The studio has 16-tr, dbx, Yamaha grand, B3, JBL monitors, an unusual floor plan, and much potential. Make it your own.

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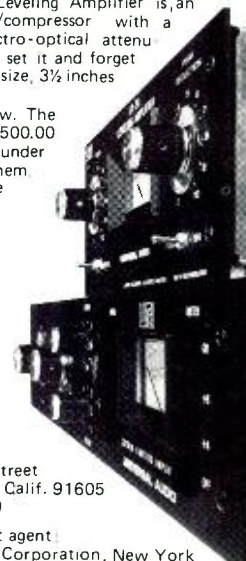
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**DAMPING RATE (dB/sec.) FOR VARIOUS CABINET MATERIALS**

(Note: Center frequency of octave band)

CABINET MATERIAL	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz
1/2" particleboard, woodgrain finish	500	500	220	375	500	750
3/8" veneer core hardwood, woodgrain finish	375	350	250	200	220	500
Molded plastic, ribbed rear construction	500	40	70	105	300	375
3/16" high density hardboard	33	38	150	200	500	500
Sheet steel, (approx. 18-20 gauge) woodgrain finish	7½	17½	27½	43	100	400

NOTE: Individual values in themselves are not as important as the relative values. Specimen size, for example, would affect actual values but not relative values. All specimens tested were of identical size. The higher the number, the better the damping.

supervision of Mr. Lyle F. Yerges, well known acoustical consultant.

Other materials, commonly used in the manufacturing of audio appliances were tested; these included molded plastic, high density hardboard, veneer core hardwood, and sheet steel. The damping rates were measured at Hz levels from 63 to 2000. At every level but one, particleboard proved equal or superior to all other materials, leading to the study's conclusion that "Particleboard is superior to all of the other materials tested, exhibiting the highest damping rate . . . Further, its decay curves were always smooth and straight, indicating no harmonics or resonances. No other material performed as well in this latter respect."

Tables and other data have been published in a booklet, "The Sound and Use of Particleboard & MDF in TV-Stereo-Speaker Markets," which can be obtained free by writing to:

**NATIONAL PARTICLEBOARD ASSOCIATION, 2306 PERKINS PLACE, SILVER SPRING, MD 20910.**

**TOM HIDLEY SEVERS TIES WITH WESTLAKE, BOWS EASTLAKE AUDIO IN MONTREUX, SWITZERLAND**

In announcing formation of his new corporation, the former founder of L.A. based Westlake Audio, explains his move by expressing his preference for the European life style, as well as a belief that the potential for recording studio development in Europe over the next decade exceeds that of the United States.

Current Hidley designed European facilities include Threshold in London, the Manor in Oxfordshire, Strawberry Studios in Manchester, and Chateau D' Herouville in France. Eastlake designs are completed for Phonogram's new three studio central recording facility in Hilversum, Holland. According to the company plans are well advanced for IOCC's studio

in Dorking Surrey and Kingsway Recorders New Macklin Street Covent Garden project.

Eastlake will be represented in Scandinavia and the U.K. by Scenic Sounds Equipment. Exclusive representation of Eastlake's activities in all of the Americas will be through Kent Duncan of Sierra Audio in Burbank, California.

**10TH ANNUAL BRIGHAM YOUNG UNIVERSITY AUDIO RECORDING TECHNOLOGY WORKSHOP**

The tenth Annual Audio Recording Technology Workshop, it has been announced, will be conducted from June 21 through July 9.

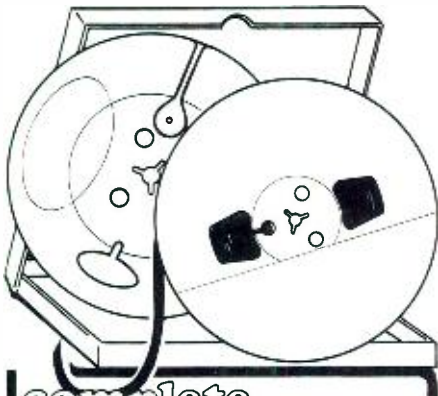
The format of the program for 1976 is similar to that of the past three years, with an emphasis on the application of basic electronics, physics and acoustical principles in the field of recording and sound reinforcement system operation. Once again, top professionals from the industry will participate in several of the workshop sessions.

Prospective students are urged to submit their registrations to reserve a place in the class of '76. Upon receipt of registrations, a packet of supplementary study materials will be mailed to each registrant for review and study of the fundamental materials that will be required in order to derive the maximum benefit from the course.

Three hours of college credit are available to those successfully completing the workshop under the regular accredited program of the Electronic Technology Department.

Further information and registration applications may be received by contacting **SPECIAL COURSES & CONFERENCES BRIGHAM YOUNG UNIVERSITY**

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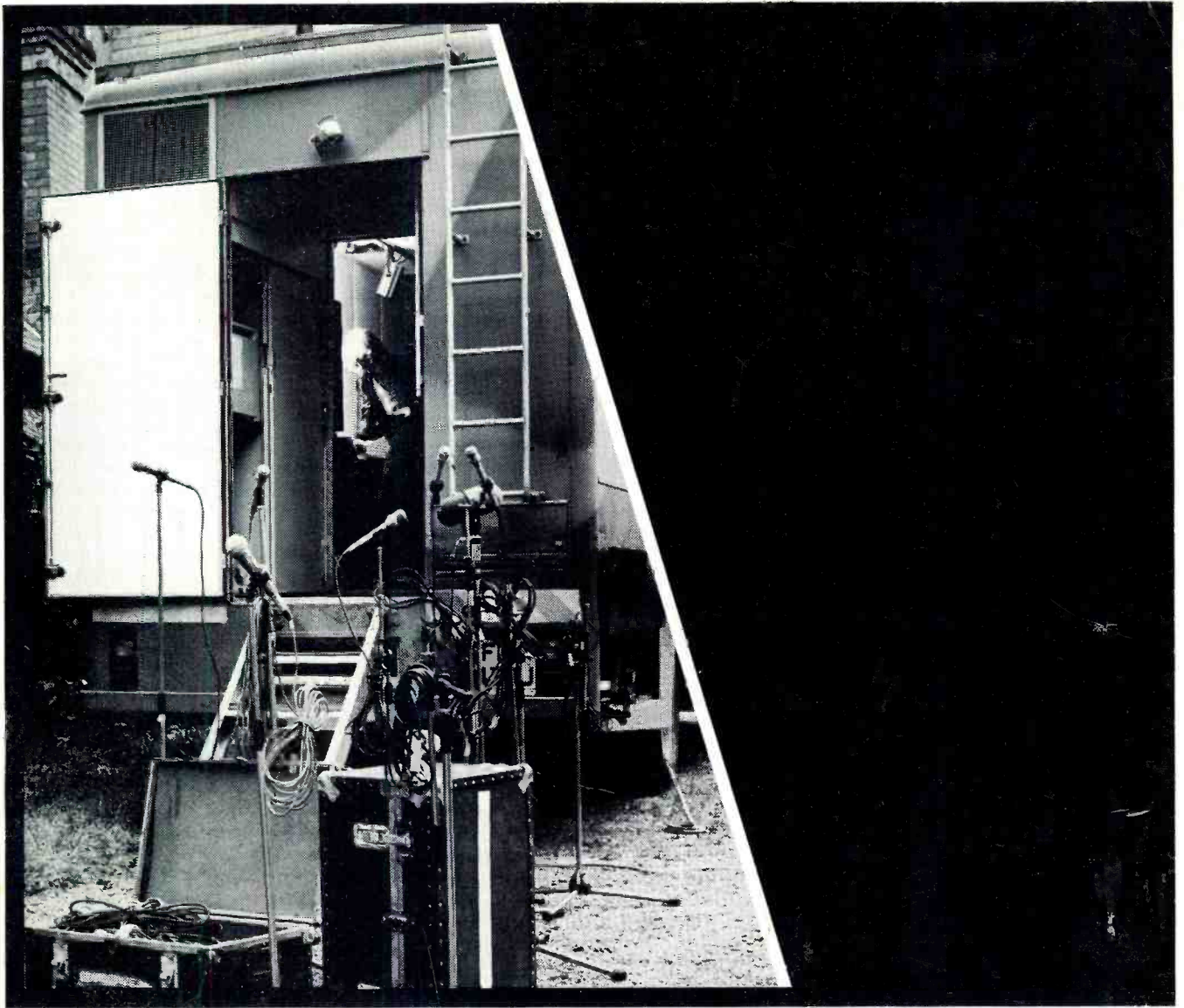
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