

R-e/p

VOLUME 4 NUMBER 5
SEPTEMBER / OCTOBER

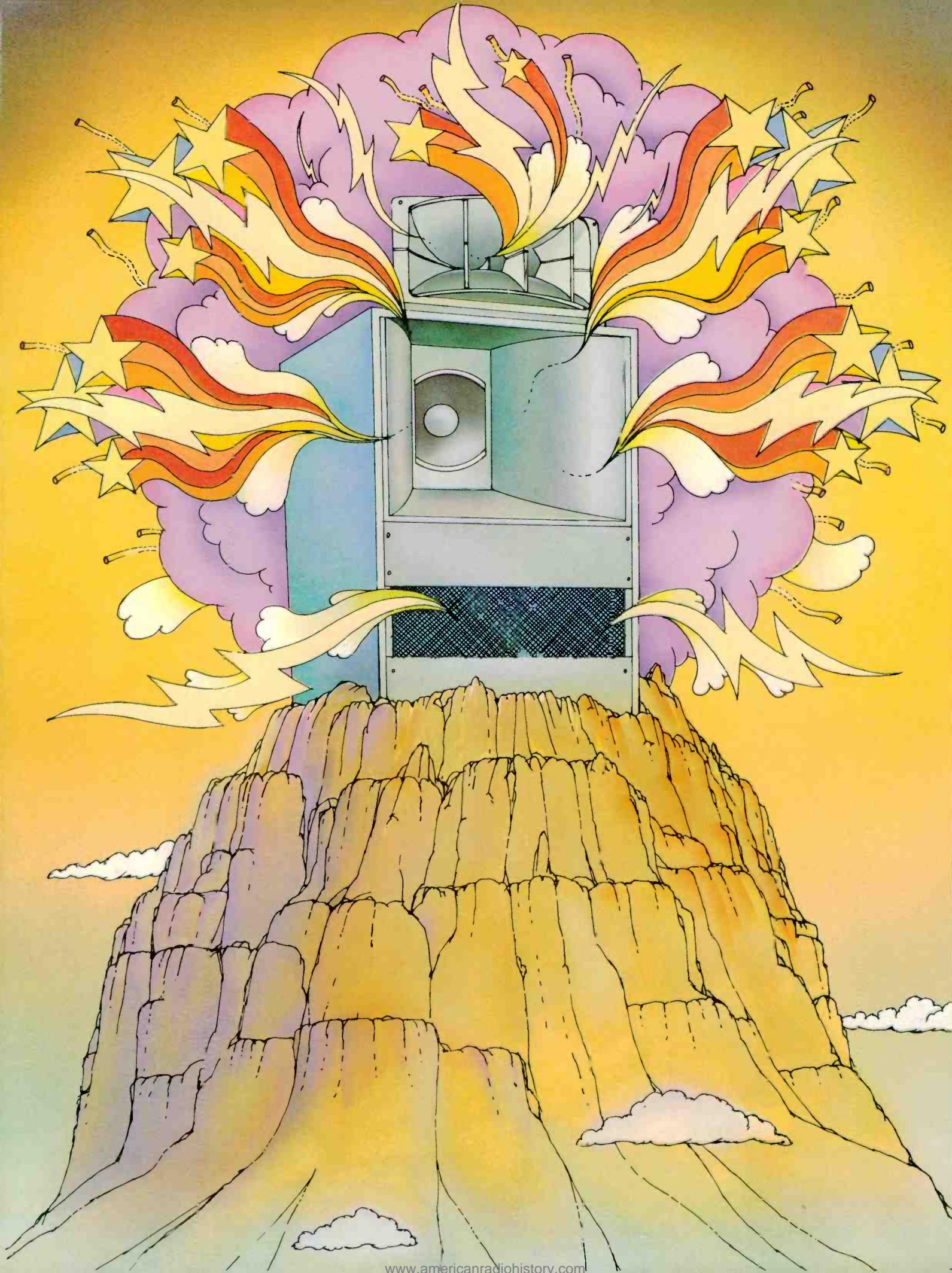


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Recording the Frank Sinatra
TV Special and album:
"OL' BLUE EYES IS BACK"

RELATING RECORDING SCIENCE • TO RECORDING ART • TO RECORDING EQUIPMENT



Altec, we challenge you.

Any company that achieves a position of leadership must be prepared to meet the challenge of innovation. In the recording industry, this is a particularly crucial factor—because constantly evolving musical material demands ever newer and better recording techniques.

For nearly 30 years, one name has dominated the studio monitor market. Altec. In 1973, Altec had more than twice as many speakers in recording studio use in the U.S. than its nearest competitor. And nearly as many as all other brands combined. (Source: Billboard's 1973 International Directory of Recording Studios.) That's leadership without question.

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NUMBER 1!



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PERFORMANCE: The SPECTRA SONICS Model 610 "COMPLIMITER"™ can accomplish, independently or simultaneously, limiting and compression functions with performance that is unequalled by most *linear amplifiers*. The minimal noise inherent in this system assures a low threshold of -40dBm and permits an input sensitivity substantially greater than other systems. Through the use of the most advanced circuitry, the Model 610 "COMPLIMITER"™ has the fastest attack time (100 nanoseconds to 2 microseconds). The "COMPLIMITER"™ allows undistorted recording and transmission at levels that are measurably higher than those commonly in use. In tape recording, for example, this "limiting only" mode eliminates approximately 6dB usually set aside for tape overload protection.

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RECORDING

engineer/producer

- the magazine to exclusively serve the recording studio market . . . all those whose work involves the recording of commercially marketable sound.
- the magazine produced to relate . . . RECORDING ART to RECORDING SCIENCE . . . to RECORDING EQUIPMENT.



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VOLUME 4 - NUMBER 5

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about the cover:
FRANK SINATRA as
portrayed in bronze
by renowned sculptor
ROBERT BERKS

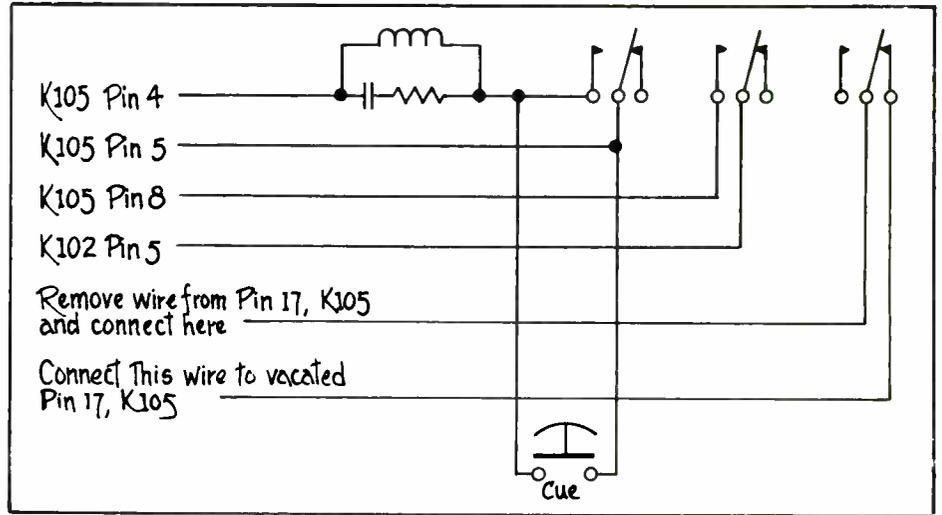
LETTERS and LATE NEWS

From the READERS _____

An editorial material rating of the most useful feature article, as gathered from the Reader Service Cards received prior to press time.

JULY/AUGUST ISSUE:

- I'M OKAY... YOU'RE OKAY...
by Gary Davis 34.1%
- A SIMPLE LOW-PASS FILTER
by Wayne Yentis 10.5%
- CREATIVE MIXING FOR BETTER DISC MASTERING
by Kulka, MacLeod, Malo 50.8%
- A MODIFIED EDITING FUNCTION FOR THE SCULLY 280/284 SERIES DECK
by Peter Butt 04.6%



FROM:
 Dave Michelson
 Production Supervisor
 Bonneville Program Services
 Bonneville International Corp.

As an alternative to the suggested modification for the Scully 280 editing function by Peter Butt, I would like to contribute the enclosed schematic which, I believe, is a more practical solution to the problem for the non-motion sense machines.

This system adds one more button to the transport, ala the old Presto, the best editing machine ever built, for cue function. Thus the edit-spill function is

retained on one button, not two (edit and start), and cue control is on its own button.

Installation of this button is best made 2-inches to the right of the existing edit button where, conveniently enough, Scully has seen fit to pre-punch the transport plate for easy installation. All one need do is drill a hole through the pot-metal face cover.

The necessary relay installation can also go in a factory pre-punched hole to the right of the existing relays on the transport chassis.

I hope this idea may be of some benefit to your readers.



TCS

As the industry has grown, so has the demand for larger and larger tape systems. Unfortunately as the number of tracks increases, the signal to noise, cross-talk, etc., gets worse. And if that's not bad enough, the price of a 24 track machine is almost double that of a 16 track.

A few years ago people started to consider the benefits of synchronizing multi-track machines. The result? The birth of a new generation of tape synchronizing equipment. The advantages are ob-

vious: unlimited track expansion with great audio specs! The cost? About half the price of a 16 track.

Our basic system features SMPTE Generator, Reader, and Synchronizer. Operating in conjunction with the TCS Reader, the TCS Synchronizer provides the requisite speed up or down error signals to capstans that can be either AC Synchronous or DC Servo controlled. The TCS Generator is NTSC

or PAL data rate selectable. A provision for optional data display and lever-wheel code preset allows SMPTE hours, minutes, seconds and frames to be read and/or pre-selected. Optional accessories offered include a Motor Drive Amplifier and "Search and Find" match-up system.

The Synchronization Generation has arrived — and it's about time!

*TCS—Time Code Synchronizing System

QUAD/EIGHT ELECTRONICS

Pete Butt's reply:

Mr. Michelsons' alternative approach to modification of the Scully 280 EDIT mode is quite applicable to the non-motion-sense models. It appears to grow a little more complicated when applied to motion-sense models, however.

I can only blame my neglect of Mr. Michelsons' method upon my reluctance to drill holes and to my parsimonious nature.

In addition, working with both types of decks, I wanted a single modification procedure equally applicable to both types of machines.

HAECO & CBS ANNOUNCE CROSS-LICENSING OF CSG AND QUADRATURE EQUIPMENT

In a recent announcement, Howard Holzer, President of HAECO, and Benjamin Bauer, Vice President of CBS Labs., announced the cross-licensing of the patent rights for Holzer's CSG (Compatible Stereo Generator) and a similar device known as the CBS Quadrature. Both devices are utilized to combine stereophonic mixes to a mono program with near-perfect aesthetic balance without a remix session. The Holzer CSG unit was introduced late in 1967 and the CBS unit some time later. The HAECO CSG will also produce encoded stereophonic discs or tapes which can be combined to mono at any time by merely combining

the two channels together. Under the terms of the agreement, CBS will make available (in their own studios only) the use of CSG's or Quadrature units to anyone desirous of availing themselves of these time and money saving devices. HAECO will also provide CSG units on a daily rental, or long-term lease basis to any recording studios. Neither HAECO nor CBS has any plans to market these units in the immediate future. Aside from the stereophonic CSG units, HAECO will also be leasing a CSG-4 which will permit discrete quadraphonic program mixes such as CD-4 to be combined into near-perfect stereo and mono mixes without going back to the mixing console.

MCI, INC. OF FT. LAUDERDALE ANNOUNCES WEST COAST DEALERS

Mr. G.C. (Jeep) Harned, president of MCI, Inc., has announced the appointment of two new dealers for MCI's line of professional recording equipment. The dealerships were awarded to Audio Industries of Hollywood, California, and Quad-Eight Electronics of North Hollywood, California. Both companies will represent MCI in southern California.

MCI is one of the few professional audio manufacturers that manufactures both recording consoles and tape machines. MCI's newest product includes the JH-100 transport with DC capstan servo drive. This new tape deck is part of

MCI's JH-16 and JH-24 tape machine.

UREI APPOINTS WARRANTY REPAIR REPRESENTATIVE

Associated Sound Systems, 5558 Ca-huenga Blvd., North Hollywood, California 91601 has been appointed exclusive Factory Authorized repair station for both warranty and non-warranty service of UREI, Universal Audio and Teletronix products, according to D.F. (Bud) Morris, UREI vice president and general manager.

Associated Sound Systems, headed by Michael Ragsdale and Michael Levey, has for several years performed contract electronic maintenance for recording and film studios in the greater Los Angeles area, which has already gained them wide experience in servicing UREI equipment at the end user level. During the past six months, Associated personnel have received extensive test and calibration training at the UREI factory, and have been performing warranty and non-warranty service on all UREI products for the past four months.

According to Morris, the shifting of customer repair service from the factory to Associated will provide expedited handling of warranty and non-warranty repairs, with no compromise in quality of workmanship.

For prompt service, units requiring repair should now be sent directly to Associated Sound Systems, rather than the factory. Telephone inquiries regarding service should be to Mike Levey, (213) 985-9200.

Money talks

WHETHER YOU'RE SPENDING IT, OR SAVING IT

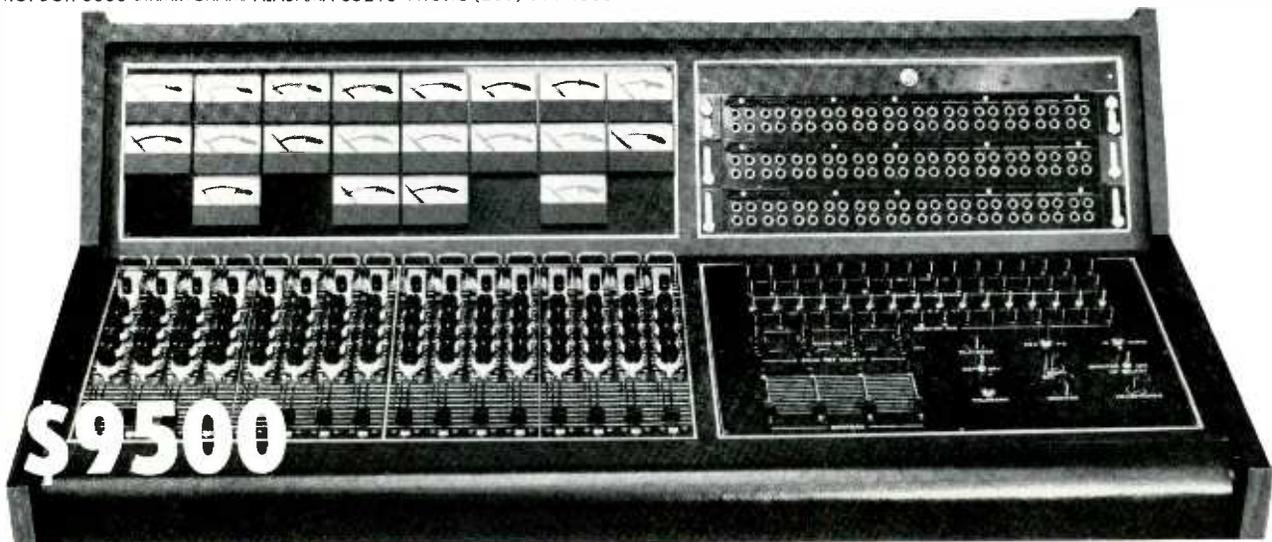
That's why it makes good dollar sense to consider the 100B-16 console for your operation. It's a completely professional 16 in-16 out unit with features you can't believe possible in a \$9500 console. There are no extras to buy and no hidden costs.

- All Solid State OP Amp Design
- Sixteen Track, Wet Monitor-Dry Record, Monitoring
- Nine Frequency Equalization (Low-Mid-High) on each input
- Plus 29 dbm headroom
- Distortion less than 0.1% at rated output
- 20 VU Meters
- 144 Patch Points
- Studio Talkback
- 2 Cue Systems
- Pan Pots on each input
- Conductive Plastic Linear Attenuators
- Compact Size: 28 x 48 x 15 inches
- Frequency Response: + 1 DB 20 — 20,000 Hz.

M MAZE CORPORATION

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**DON FOSTER, PRO-AUDIO PIONEER
SUCCEUMBS**

John Donald Foster (1910 - 1973): Most R-e/p readers will remember Don Foster as the author in recent issues of several excellent audio research and recording applications articles. Regretfully, only a few knew him more deeply as the finest kind of human being, as well as a truly innovative designer and engineer of audio products, and during World War II the inventor and developer of significant electronic ordinance devices.

A true broadcast pioneer, Foster was one of the earliest radio sound-effects men. The number of shows, only one of which was the "Shadow" series, on which he worked is legend.

A Columbia Broadcasting System employee for 20 years, Don was very much involved in the technical evolution of color television and video tape recording.

Among the major honors accorded Don during his life was his selection to supervise all audio and recording activities during President Eisenhower's tour of India and Italy.

Don is survived by his wife and four children.

**BURNETT, KENNY ASSUME NEW 3M
MINCOM DIV DUTIES, RELOCATE TO
ST. PAUL HEADQUARTERS**

Robert F. Burnett has been appointed to the new position of sales manager,

consumer/professional products of the 3M Company's Mincom Division.

Burnett had been market manager of professional audio products in Camarillo, California since 1970.



Burnett



Kenny

Thomas W. Kenny has been appointed to the position of market manager, consumer/professional markets, Mincom Div, 3M Company.

Kenny joined 3M in 1961 as a service representative at the Camarillo facility and has held various sales positions within the Division since that time.

Both Burnett and Kenny will relocate to 3M headquarters in St. Paul, Minn.

**PRODUCERS - ARRANGERS WORK-
SHOP TO BE PRESENTED BY IN-**

**STITUTE OF AUDIO RESEARCH IN
NEW YORK NOVEMBER 15 - 18**

A four day workshop exploring topics of major importance and interest to producers and arrangers will be presented by the Institute of Audio Research, Inc. Thursday, November 15 through Sunday, November 18, in New York. The workshop will cover audio recording and technology topics relevant to both the producer and arranger.

Experts in the field will discuss automation and quadruphonics in a forum-type conference with the students. Also, the workshop will cover studio technology, monitoring, session preparation, signal processing, control room techniques, stereo tape to disc transfer, and microphones. Discussions on microphones will explore the characteristics, applications and techniques of recording strings, horns, acoustical and electronic instruments.

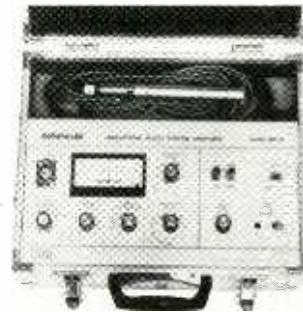
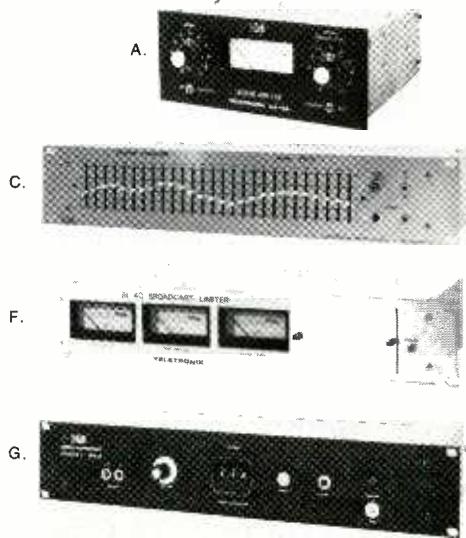
One day of the seminar will be spent at Ultra-Sonic Recording Studios, 16 track fully Dolbyized facility in Hempstead.

Fee for the Producers - Arrangers Workshop is \$250.00. Course outline and schedule are available by contacting Irv Diehl, Institute of Audio Research, Inc., 64 University Place, New York, N.Y., 10003.

**NATIONAL COUNCIL OF RECORD-
ING ENGINEERS FORMED**

The National Council of Recording Engineers, or (NCRE) founded by engin-

**More people
are hearing things
our way!**



Model 100-A — Sonipulse Room Equalization System

- A. Model LA-3A — Leveling Amplifier
- B. Model 920-16 — Cooper Time Cube
- C. Model 527-A — Active Graphic Equalizer
- D. Model 1176LN — Limiting Amplifier
- E. Model 565 — "Little Dipper" — Filter Set
- F. Model BL-40 — Broadcast Limiter
- G. Model 963 — Digital Metronome



"MOD ONE" — Broadcast Console

eers from across the country, has recently been formed to: create an exchange of ideas among engineers, encourage manufacturers to live up to their claims, evaluate equipment and disseminate results among members, provide manufacturers with a central forum for suggestion or evaluation of new equipment ideas, and intends to promote a higher state of the art within the industry.

Membership is open to any professional working in the sound industry who is not directly involved in the manufacturing or sale of equipment. The membership fee of \$10 per year will be used to cover printing and mailing costs for the organizations frequent newsletters.

Requests for membership applications should be sent to: NCRE, P.O. Box 8659, Universal City, Calif. 91608. Inquiries may be addressed to Larry Levine, A&M Records, 1416 N. LaBrea Ave., Hollywood, Calif. 90028.

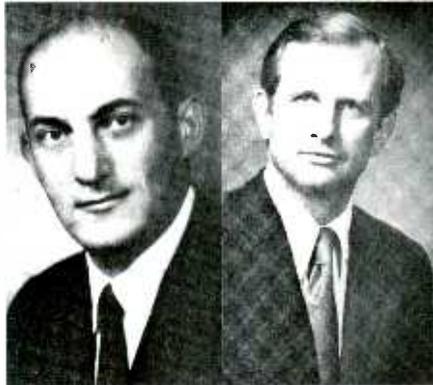
GARNICK ELECTED ELECTRO-VOICE PRESIDENT, WOODBRIDGE NAMED MARKETING EXECUTIVE

Philip Garnick has been elected president of Electro-Voice, Inc., a subsidiary of Gulton Industries, Inc., it was announced today by Walter F. Gips, Jr., Gulton president and chief executive officer.

Mr. Garnick succeeds Joseph Marks who continues as a corporate Gulton

vice president.

Prior to joining Gulton as a corporate group vice president in January, 1970, Mr. Garnick's top management assignments included vice president of manufacturing operations with The Harvey Group, Inc., and vice president of engineering and vice president of marketing operations with Sigma Instruments, Inc. He acquired his B.S. degree in electrical engineering from Northeastern University, Boston, where he later returned for graduate work in advanced mathematics. He has designed and conducted a number of industrial marketing courses and seminars.



Garnick

Woodbridge

Jahlleel D. Woodbridge has been appointed to the newly-created position of executive vice president of marketing for Electro-Voice, Inc., a major subsidiary of

Gulton Industries, Inc., Philip Garnick, Electro-Voice president and a Gulton corporate group vice president, announced today.

In making the announcement, Mr. Garnick stated that Mr. Woodbridge will have total responsibility for all marketing, sales, and related support activities for Electro-Voice.

During the past three years, Mr. Woodbridge has been president of Gulton's West Instrument Division.

BOOK REVIEW

Ideas, Inventions and Patents an Introduction To Patent Information, by David Abernathy and Wayne Knipe. Pioneer Press, Atlanta, Ga.

The authors' motivation for writing this book was the realization that there was no such book in existence. In dealing with the process of patenting, the development of ideas in various stages of development, we realize that there were few books in print to help the beginner. When an idea is developing into an invention, the inventor needs help, some of which he ought to be able to provide for himself without having to ask an attorney, patent agent or patent attorney. So we have tried to provide some advice and facts to help an inventor, realizing that spending large sums of money and a great deal of time will be needed to perfect an invention and de-

More and more recording and broadcast people are looking to UREI for innovative products to create and control the hot new sounds of today's music. Many UREI products have become standards in the industry. Our solid state LA-3A Leveling and 1176LN Limiter amplifiers outsell all other limiters put together. Our 565 "Little Dipper" filter cleans up problems of noise, hums, whistles, etc., like nothing else will. Our 920-16 "Cooper Time Cube" creates quad sound out of stereo, stereo out of mono, or enhances volume simply and economically. Our 100-A Sonipulse room equalization system analyses frequency response over the full audio spectrum in less than 3 minutes. Its companion, 527-A Active Graphic Equalizer, offers 27 precise 1/3 octave equalizers from 40 Hz to 16 kHz for spectrum contouring or correction. Our new "Mod One" Broadcast Console is a modest cost little beauty with off-the-shelf plug in modules and features not found in most small consoles. It can be budget minded to fit present requirements and yet expandable for the future.

Contact us for complete technical specifications of all products listed.

keep those cards & letters coming!



a UREI company

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velop it to the patentable stage.

Questions about inventions and patents answered by this book: How can I get a patent? Who can patent? What is a patent? Why should I patent? How can I find a patent attorney? What is a patent agent? Will a copyright protect my idea? How long does a patent last? How can I make money from a patent? How long does it take to get a patent? When should I start to patent? How do I know if my idea has been patented? How many types of patents are there? and many more

Available from : R-e/p Books

118 Pages, soft cover, \$5.55 post-paid. Prepaid orders only. Send check or money order to RECORDING engineer/producer, P.O. Box 2287, Hollywood, Ca. 90028

POLYDOR AWARD BREAKS WITH TRADITION, THE 'GOLDEN GRAMAPHONE' TROPHY AWARDED TO BERLINER FAMILY

The Golden Gramophone trophy, normally awarded only to outstanding recording artists, has recently been presented (September 18 in Hamburg) by the Deutsche Grammophon Gesellschaft division of Polydor Records to Oliver Berliner, grandson of Emile Berliner, founder of DGG and inventor of the microphone, the disc record, the disc



player and the method of mass-producing discs from a single master. At a televised celebration in the Congress Center in Hamburg, whose keynote speaker was Dr. Gustav Heinemann, President of Germany, Mr. Berliner accepted for the Berliner family the tribute to his grandfather. The trophy is a gold 1/3-scale precise replica of Emile Berliner's original production "gramophone" (Berliner also coined the word).

*This discussion appears courtesy of
the R.B. Annis Co., Indianapolis, Inc.*

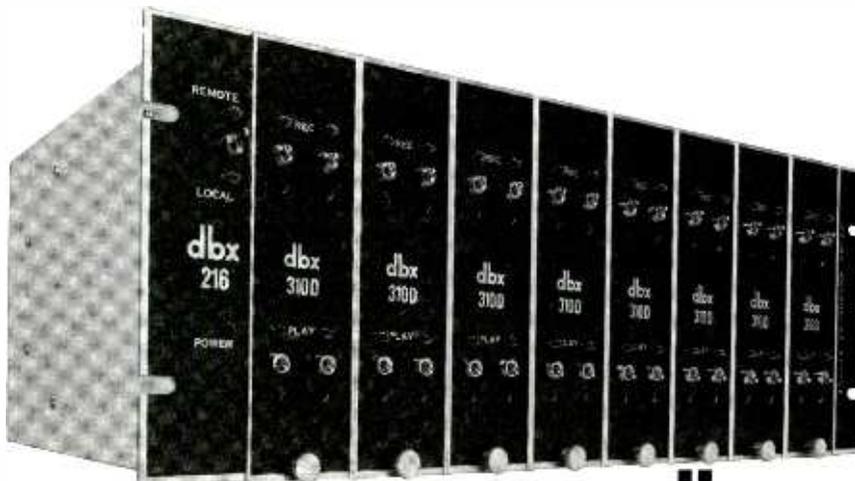
NOTES ON DEMAGNETIZING

Magnetic tape recording mechanisms, like a majority of other modern technological gadgets, comprise an assemblage of many materials. Predominant among

16 channels of noise reduction in seven inches of rack space. The system improves headroom by 10dB and delivers 30dB of noise reduction. Simultaneous code, decode and bypass functions can be selected at the panel or by remote control. Price, including a spare 310D module, is \$8,200.

Available from professional audio dealers or direct from dbx, Incorporated, 296 Newton Street, Waltham, Massachusetts 02154.

dbx 216 provides



dbx inc.

their important working parts is most apt to be that ubiquitous and versatile alloy of iron called steel.

Steel is chosen because it is inherently strong, it can be readily worked into many useful forms and it is relatively cheap. Sometimes it is chosen because of its superior magnetic permeability, the ability to "conduct" magnetism some thousands of times better than any other common material. This property is used to advantage in all kinds of electromagnetic equipment such as transformers, relays, electric motors and tape recording heads.

Steel for such electro-magnetic components is not only designed for high orders of permeability, but it must also be magnetically "soft" as well, with a very low value of "magnetic memory" or retentivity. In other words, when the influence of any magnetizing force is removed, such magnetically "soft" steel retains a very small amount of magnetism as a residual.

In contrast to the above "soft" magnetic steels, there exists a wide variety of magnetically "hard" steels. These are usually more highly alloyed, they may be heat treated or perhaps work-hardened for strength, wear resistance or hardness etc., wherever superior mechanical characteristics are necessary.

Such magnetically hard materials have a somewhat lesser ability to conduct magnetism but have a relatively good "magnetic memory". Should magnetically hard steel be exposed to magnetism, even if only for a fraction of a second, it will "remember" the exposure by retaining a fair portion of the original magnetism, becoming a secondary source of magnetism in its own right, acting somewhat like a permanent magnet. There are all shadings of magnetically soft to magnetically hard steels, with most mechanical components such as capstans, guides, rollers and springs falling in the middle to hard range so as to obtain superior mechanical strength and wear characteristics.

Unfortunately, but naturally the magnetic coating on recording tape is very sensitive to extraneous magnetism inasmuch as the recorded signal itself is only a modulation of the residual magnetism retained in the thin layer of magnetic coating compound. Exposure to subsequent magnetic fields of any consequence degrades the recorded signal. This degradation is proportional to the strength of such subsequent magnetic field exposure and somewhat to the number of times the tape is played or "wiped" across such fields. Degradation is noticeable as a loss or attenuation of the higher recorded frequencies as well as a noticeable increase in unwelcome background noise, which can amount to several dB.

Steel capstans and guides, usually being made of hard magnetic materials, are often major offenders in retaining unwanted magnetism which tends to degrade the recorded signal every time a tape is played.

Some tape recorders and magnetic sound projectors etc. are inherently bad actors because of "built in" extraneous magnetism in the tape transport area. In such equipment (and nameplates don't always mean too much), capstans and other tape transport components will be found to be rather highly magnetized and tend to stay that way in spite of any normal demagnetizing procedure.

One of the most common causes of such high levels of stubborn magnetism in components is due to their close proximity to an unshielded dynamic loud speaker. Such a speaker is one that has an external permanent magnet, located on the outside of the field structure. This type of field construction generates full magnetic potential between the front and rear of the speaker assembly, creating a strong and extensive stray magnetic field area that can induce high values of undesirable magnetism in any steel tape transport components located in the area. Such loud speakers are o.k. in themselves but their extensive stray field is "poison" in magnetic recording gear. This is in contrast to dynamic type speakers where

the field magnet is internal, contained within a steel pot-like structure where most of the magnetic potential appears across the annular voice-coil gap, where it should appear.

Beware of any magnetic sound equipment having built in loud speakers with external magnet type fields that radiate stray magnetism all over the place. These are easily checked with a pocket magnetometer before you buy. If you already have one, the only permanent cure is to remove the offending speaker to a more remote location or replace it with one of the internal magnet, self-shielding type speakers. After making this change, you can then demagnetize the tape transport components with every hope of success. Some portable recorders have permanent magnet field type drive motors that are efficient from the standpoint of conservation of battery power, but they radiate a rather strong stray magnetic field which, in some cases, encompasses the tape transport area.

There are many other sources of magnetism that can directly or indirectly magnetize steel tape recorder components. Every time an electric current flows, a magnetic field is generated. The intensity of this field is proportional to the amount of current flowing. Whenever switching is done in an inductive circuit there is a random chance of creating a

"switching surge" which causes a momentary high current peak. Capacitors, often employed in electronic circuits, can also create high peak charging currents. Often the circuitry includes a multiple turn coil where the magnetic effect of the current is multiplied in proportion to the number of turns. Any steel within the area of such field will become magnetized, a portion of which will be retained as residual magnetism. Care should also be taken not to bring magnetized tools or other magnetic devices near steel tape recorder components. Even the effect of the earth's magnetic field should not be discounted. This source of magnetism is ever with us. Remember - the mariners magnetic compass is actuated entirely by just the horizontal component of force created by the earth's field.

Typical for most of the U.S.A., the vertical component of the earth's magnetic field is considerably stronger than the horizontal component, due to the fact that the field dips down about 70 degrees toward the north. This steep angle of dip is due not only to curvature of the earth's surface but also to the fact that the effective magnetic pole area of the earth is displaced and located considerably below the surface.

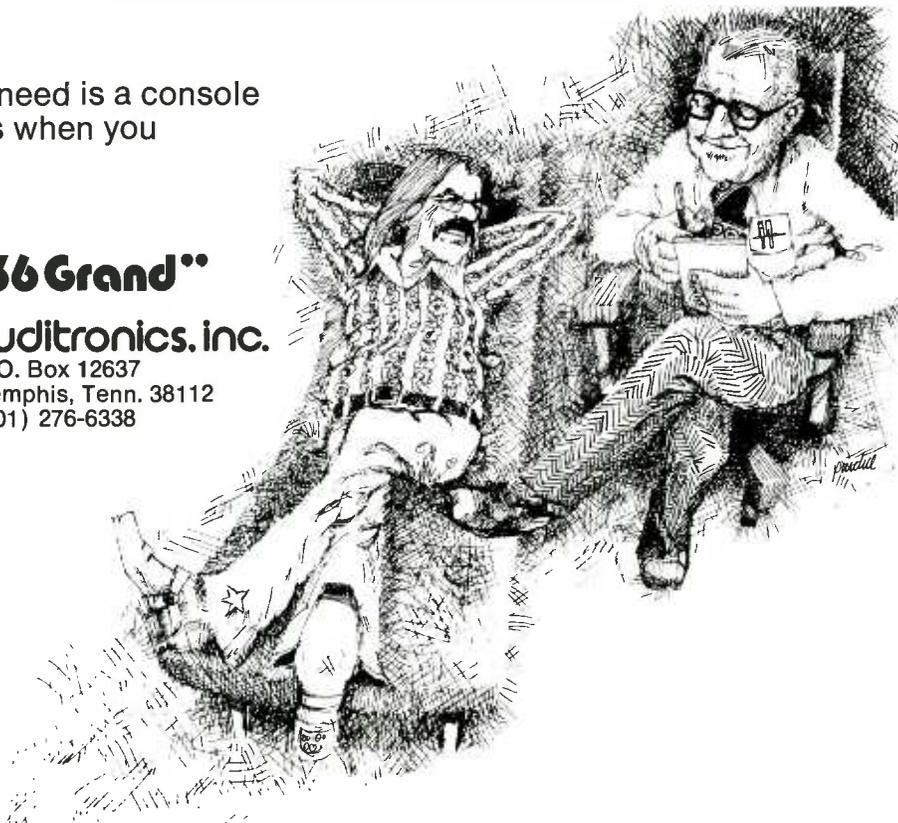
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What you need is a console
that works when you
get it.

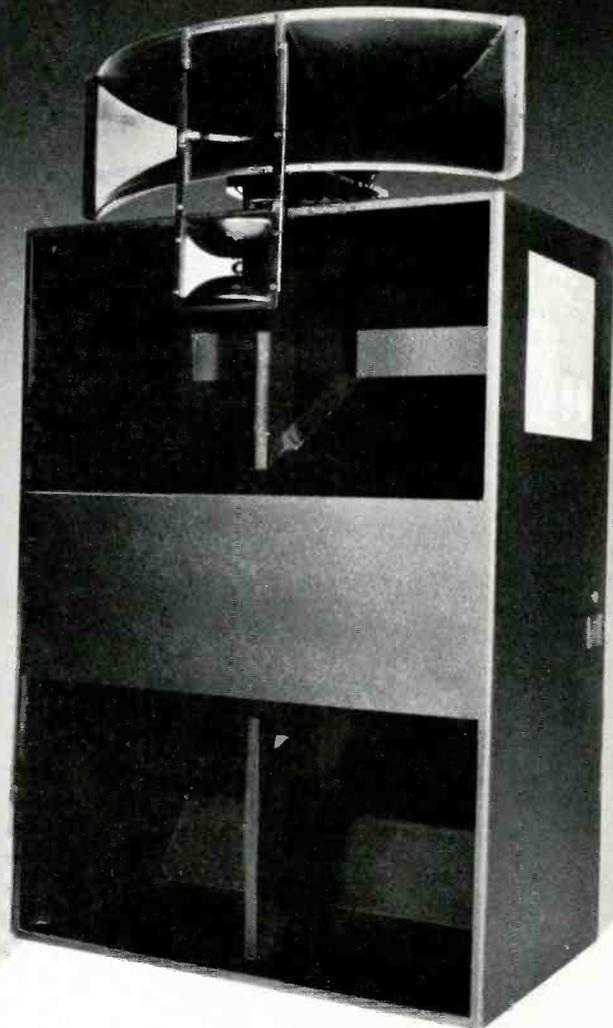
That's the
"Son of 36 Grand"



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Memphis, Tenn. 38112
(901) 276-6338



If you want to lay down
a 113 dB signal*
flat from 28 to 18,000 Hz,
radiating through an angle of 120°
the SENTRY™ III is it.



On the other hand,
if you need 4 dB more level
on axis, and are willing to
give up just 22 Hz of bass, consider
the SENTRY™ IVA.

*4' on axis with just 50 watts, with
optional SEQ Active Equalizer. Response
without equalizer, 40-18,000 Hz.

Both monitor systems share the same mid-range and high frequency speaker components. Both have tweeter protector circuits built in to save the systems from inadvertent damage. The Sentry IVA uses a dual-speaker, horn-loaded bass end for efficiency. The Sentry III uses a single speaker in

a vented enclosure for extended range.

Sentry III. Sentry IVA. The two best ways to recreate the actual sound pressure sensations and response range of live music... in the studio or in demanding sound reinforcement installations. From the innovators at E-V.

a **Gulton**
COMPANY

Electro-Voice®

ELECTRO-VOICE, INC., Dept. 931RP, 674 Cecil Street, Buchanan, Michigan 49107

Circle No. 109

Re/p 14

OL' BLUE EYES IS BACK!

Interviews with MGM Recording's Ed Greene
and Samuel Goldwyn Studio's Don MacDougall

by: WAYNE YENTIS
RAINBOW RECORDING
SANTA BARBARA, CA.

Ed Greene
The T.V. Special

Don MacDougall
The Album

Frank Sinatra's albums mean something to everyone, and his return to the recording studio, after several years of retirement, is of special significance in gaining perspective on the changes and developments in the recording arts. The Warner/Reprise album release "Ol' Blue Eyes Is Back", is backed by a companion TV Special by the same name sponsored by Magnavox, featuring stage productions of some of the same songs recorded on the album. The TV production involved recording a similar orchestral set-up and arrangement as the album recording, but in a different studio, with different equipment, with different engineers and crews, and with the additional requirement of being coordinated with television production. Ed Greene, Director of Engineering of MGM Recording Studios in Hollywood, was responsible for audio end result for both productions; and, although he didn't do the actual recording of the album sessions, he did the mixing of both productions at the MGM Recording Studios.

R-e/p: You did two sessions, one the record album, and then the TV special. There are different approaches in recording each, and it would be interesting to discuss these differences.

ED GREENE: I think it would be better for me to concentrate on the TV show rather than the album. I didn't record the album, I remixed it. It was recorded at Samuel Goldwyn Studios by a very fine mixer named Don MacDougall. They really wanted the feeling of that particular room at Goldwyn for the album. The TV recording sessions, although similar in many ways to the album, posed some very interesting additional problems. 16 track original recording was used on both, the tracks were laid out similarly, and the orchestra instrumentation was roughly the same, although the brass section was expanded to accommodate some of the arrangements used for the TV show. The things that made it different from the recording sessions were the various feeds and program mixes that were supplied from the audio truck to the main TV truck, and the other interfacing elements. We had to deal with a live audience, we had to accommodate the fact that Mr. Sinatra was on a hand mike, lavalier and boom mikes, and we had to do this over a physically large area. At the same time, close communication had to be maintained with all the production elements involved.

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Don MacDougall, the music scoring mixer at Samuel Goldwyn Studios, engineered the recording sessions for the record album. The recording studio, actually a vintage motion picture scoring stage, was outfitted with equipment oriented toward movie and TV production, and aside from a 16 track recording machine, the existing equipment was used.

DON MACDOUGALL: I was, well, not exactly apprehensive, but terrified when I learned I was to do a session with Frank Sinatra. The biggest thing was, that for the kind of set up he wanted it was going to be difficult to accommodate him. He had to be in the center of the stage in front of the conductor, Gordon Jenkins for the most of the things (and Gordon is lefthanded), so he had to see him from a different perspective. I put him in the middle of the stage, which could accommodate maybe 120 guys. I think the orchestra I had was just around 45 men. The room we used here at Goldwyn, Scoring Stage 7, has a unique history in that it was built way back in the late 20's for Eddy Cantor. They recorded orchestra and chorus, singers, dancers, everything, and they recorded them with 3 microphones. Historically, its a very old stage, and as I understand it Frank Sinatra did record there once before in the 50's. I think he did "Guys and Dolls" there. He's done some other things there too, he did an album with Lenny Hayton two or three years ago. To my way of thinking the stage is probably the finest acoustical room I've seen. It has a big music hall quality, yet if you baffle it properly, it can be intimate enough to be a very small room too.

R-e/p: Were there any particular problems with using the stage audio equipment?

DON MACDOUGALL: One of the biggest problems I had there was that the theater speakers that we have on the scoring stage are tuned for theatrical release, so the high end comes back off maybe at 9,000, and the bottom starts at about 100, so you don't really know what you have on the 16 track. For playback, I went through a 16 track matrix and over to a playback console on the stage. It wasn't ideal for playback because that high end was gone, and with those big Altec speakers out there you had to put so much through them in order for them to respond adequately, that I was kind of worried about distortion, but I never did hear any

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R-e/p: That's a significant difference. ED GREENE: The idea was to try and find microphones and suitable techniques that would yield results similar to the record.

R-e/p: What were some of the really tough things you had to solve?

ED GREENE: The tough problems were taken care of in a lot of meetings before the production. The director, Marty Pasetta, not only knows audio but really did his homework in all the problem areas and got the right people together so these were pretty well taken care of by program time. You don't keep somebody waiting while you fix a buzz or something, things have to be ready in advance. Otherwise, an artist is not going to feel comfortable, and the artist MUST feel comfortable, he must feel that everything is straight ahead and ready. So we really spent most of our time not operating the set-up, but simply setting it up, by getting rid of those grounding problems, by having the light man go through every cue he could imagine, with all the mikes wide open. The name of the game is to not have problems; its preventative medicine. In addition, Marty saw to it that we were covered in about six different ways for about everything short of a power failure.

R-e/p: Wally's truck was equipped with a lot of auxiliary equipment. Did you use most of this gear?

ED GREENE: We used everything in the

truck; they put the truck together based on the equipment we specified. Outboard mixers and some microphone input muting expanded the Heider API board to 77 inputs used. We used two basic recording set-ups. One was used for live recording and the other for two dance segments. These were video pre-recorded two days before the live show to audio music track playback with half recorded, half live vocal. This set-up is shown in the block diagram A. The live recording set-up is shown in block diagram B. Marty Pasetta had outlined the programming he felt was required to cover his post-production needs and these configurations were the result. The outputs were used as shown with some gentle buss limiting added to the rhythm and sweetening by two Spectra Sonics limiters. Ampex 440-4's were used for the audio music track playback, and 3M 16 tracks recorded two different program configurations. We could punch-up any combination of program on the monitor panel just to the right of the console. In addition, this monitor system also programmed three separate headphone mixes for the major sections of the orchestra: strings, rhythm, and winds and brass. The output of this monitor mix fed two UREI 1/3 octave filters, MacIntosh power amplifiers and finally two JBL 4310 speakers. The monitor system was equalized to mixer position using the UREI Sonipulse.

R-e/p: How about your choice of microphones?

ED GREENE: The hand microphone that we ended up with was a Neumann KM-83, believe it or not, an omni mic-

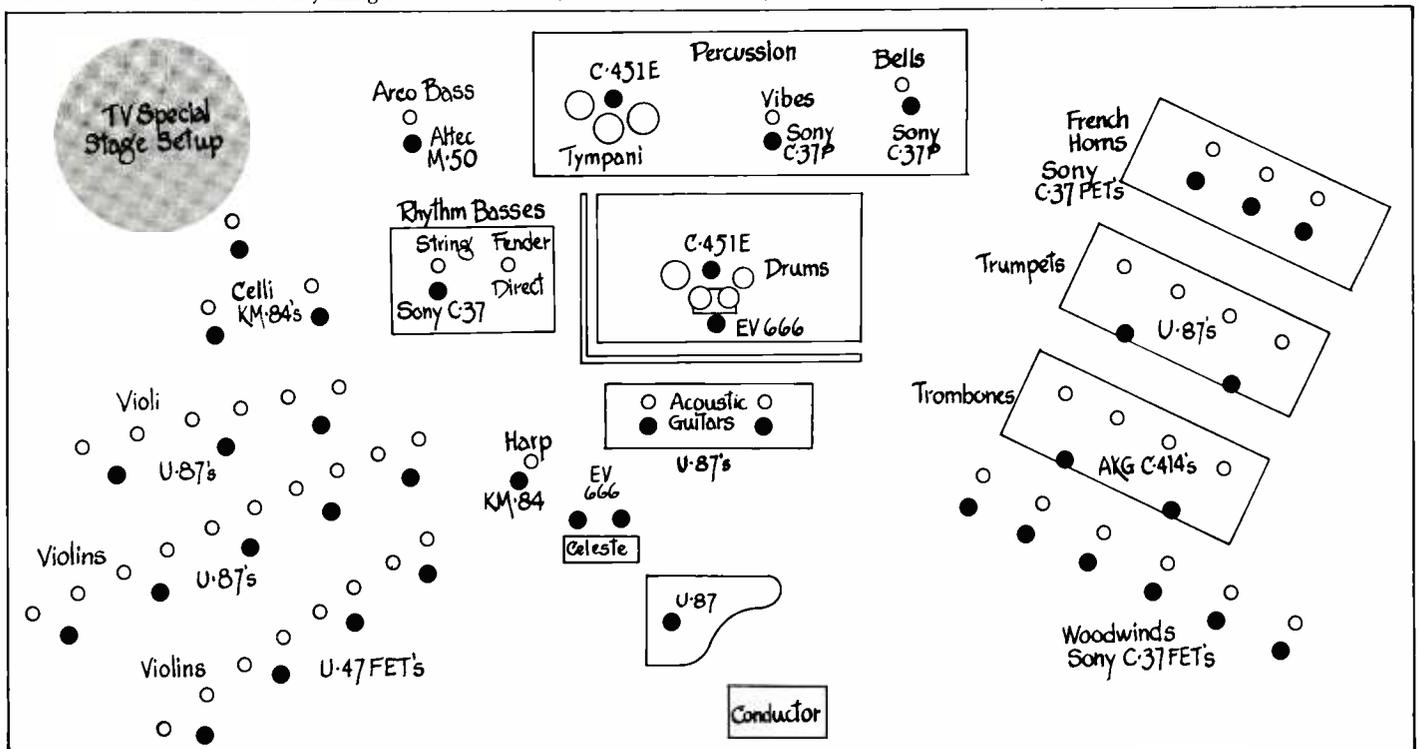
rophone. I hated to use the word "omni" around people who weren't really technically oriented because right away they said, "Omgod, that'll never work!" But, in fact, it worked very well. We must have tried 15 or 18 microphones and came down to about 5 that we tried on the show. I originally shied away myself from an "omni" just because you have to work it a little closer. But in this case, being the professional that he is, Mr. Sinatra worked it just beautifully.

On the segment of the show that required a lavalier we used an electret Sony ECM-50, also an omni, because its sound closely matched the KM-83.

The boom mikes, Sennheiser 415's were not used during the live show, but during the video pre-record two days before.

R-e/p: Is the KM-83 the same microphone Mr. Sinatra used on the album?

ED GREENE: No, a U-67 was used on the record, a cardioid used at some distance, about a foot and a half, so that there was really little change of perspective if he moved around a little. But the problem with using a cardioid as a hand mike is that unless you stay on axis, or keep the same angular and distance relationship to it, you're going to have a difference in sound illusion or quality. With an "omni" you get much less of that. That's one of the reasons for the "omni". Also, the KM-83 has no proximity effect; that is, there is no build-up of the low end as you get close to the microphone. So with some careful level riding, it makes a pretty nice sound against the orchestra. It's not a particularly unusual microphone, although



TV SPECIAL, BOARD INPUT ASSIGNMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Vln #1	Vln #2	Vla	V/C	Arco Bass	Harp	WW	WW	WW	Horns	Bones	Trumps	Perc Tym	Perc	Perc	Perc	★ Frank	Lim Ret	★ Frank (Spare)	★ Frank Lav.

once we had chosen it we couldn't find another one in town. So, we had one flown in from New York as a backup. The director didn't like the standard black pop filter, so we used a dull chrome grill from another microphone.

R-e/p: What were the areas of concern in dealing with the orchestra?

ED GREENE: Well, things like separation. You know, in this case we're dealing with arrangements from some of the best people around, and their arrangements lay pretty well, you know, listening to them live. What we had was pretty much a good standard orchestra set-up. It was generally set-up with strings, harp and basses to the left, rhythm in the center, and brass and woodwinds to the right. It was changed several times, more for logistical reasons than anything else. As far as baffling is concerned, we set up a plexiglas booth around the drums. That was the only baffle we ended up with, there were several others that were proposed but they either looked funny or they just weren't necessary. The trouble

with extreme separation is, although you may end up with tracks that are ultra separated, you lose a sense of "ensemble"; there's no orchestra left. It's just bits and pieces. Frankly, I think that show could have been recorded, not as well, but very well, with maybe 3 microphones, just to pick it up as an overall orchestra. I'm sorry that I didn't have them available.

R-e/p: Why, then, did you use this plexi drum booth?

ED GREENE: There was just a little splash into the harp and strings and into the acoustic guitars in front of the drums. It helped a lot to have that partition there, particularly for the up tempo songs with strings.

R-e/p: Since you had some isolation on the drums, did you use an elaborate mike set-up?

ED GREENE: No, I used two microphones. The drummer played with a well-balanced sound, that was Irv Cotler. It wasn't a set-up like some of the rock

things, where there'll be extra tom-toms and things like that. It was just a very straightforward set of drums. I used one AKG C-451E above and an EV triple six on the kick drum.

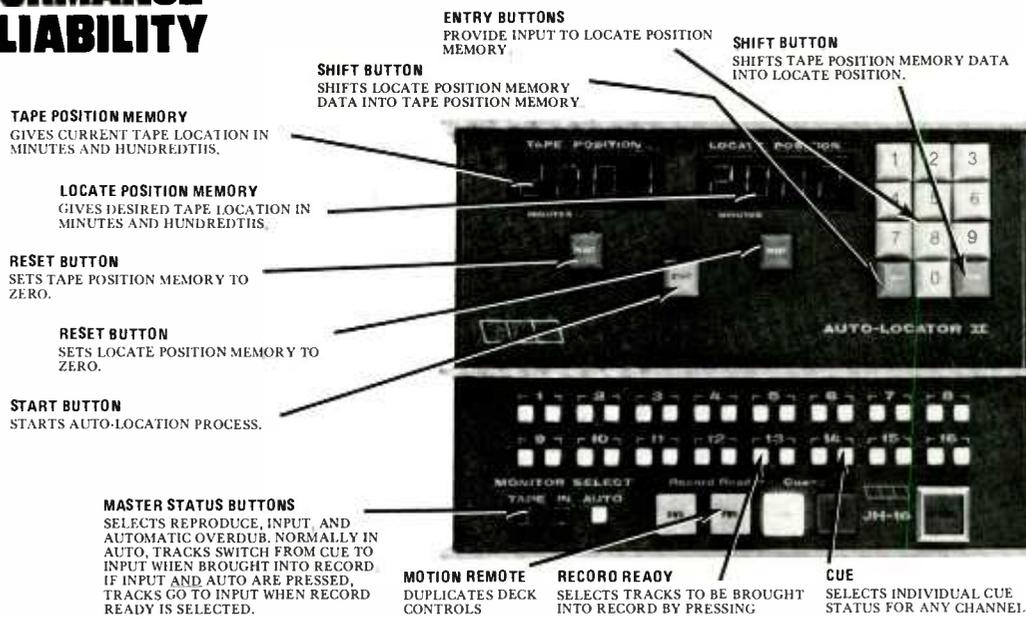
In the rhythm section, the Fender bass was taken direct, and on the string bass I used a Sony C-37FET just off the instrument. Ray Brown, having played that particular bass on many recording dates, knew where that mike would sound good. He gets a phenomenal sound from his instrument anyway. All of the musicians put out a really good sound. The object there was to simply pick up this good sound, and not try to manufacture anything. If there was an approach in miking and in pick-up, it was that, to try and simply arrive at what was there and not manufacture something in any way, especially Mr. Sinatra. His sound is not a manufactured sound, I mean, that's him.

On acoustic guitars we used a pair of Neumann U-87's which seemed to work very well. On piano we used a U-87 under the lid, at half stick. There was a

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WEIGHT: JH-16 CONSOLE - 405 lbs. (Shipped)
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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Perc	Drums	E/Bass	Key-Boards	Guitar	Guitar	Vln	Vln, V/C Bass Harp	WW	Horns	Bones	Trumpets	Guitar	Guitar	Piano	Celeste	E/Bass	Top Drums	Kick	Spare

celeste used on one tune. On that, we used a pair of 666's; celestes have a tendency to have little notes that ring here and there, and using a pair of mikes in parallel has a tendency to offset that a little. On percussion we used A C-451E on the tympani, and two Sony C-37 FET's for the rest, vibes and bells, etc.

Originally, I planned to use just a few microphones on the string section, but because we were a little concerned with the PA feeding into them and possible feedback problems, I decided to go in a little closer and use a mike for every two chairs. There were 18 violins, the first row had U-47FET's and the rest had U-87's. The 6 violi had U-87's.

R-e/p: Why did you have U-47's in front and U-87's in back?

ED GREENE: Really, they're all very close in nature, the 47's just gave a

little bit of an edge to the first violins, but they're all very close. The 47's came up on the board separately so I had some adjustment on them. In a couple

of the arrangements, it was necessary to bring up the first violins separately. The cello section had KM-84's, one for each instrument, and the "arco" bass had an M-50 Altec omni tucked-up in it. There was a KM-84 on the harp, in this case, about a foot and a half in front and on the harpist's right side, close to the low strings. The whole string section was on two tracks; violins on one and all the rest on the other.

In the brass section, there were a pair of AKG C-414's on trombones, a cardioid pattern set back a little so we could get more of a section sound. Remember, the idea was to try and get a concert kind of sound. Again, if I had my druthers, and if we'd had the tracks available, I would have put up some overall mixes. I think it would have been a lovely sound.

R-e/p: Was this the same kind of miking set-up used on the album recording date?

ED GREENE: Roughly. It was a little different on the album; they used some

different mikes, but it was more of a studio set-up on the album, where there was a little more baffling done in terms of the brass and percussion sections. The strings were very similar. The drum set was a little more elaborate.

R-e/p: Getting back to the TV session, was the orchestra on camera?

ED GREENE: There was a concert segment, yes, they were on camera for that. However, we had no restrictions concerning microphone replacement in the orchestra. None at all. The orchestra was large, with 51 pieces.

R-e/p: How did you mike the audience?

ED GREENE: There were 14 mikes for the audience, which were pre-mixed and came up on a single pot. The audience was distributed around the stage and the director did not want to see an audience mike. He didn't mind orchestra mikes, but audience mikes had to be out of sight. We used EV DL42's interlaced among the PA monitors way up in the ceiling.

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R-e/p: Did you handle the PA system?
 ED GREENE: No, the PA was provided by Hannon Engineering. There was a blanket of loudspeakers, as I recall, 10 or more, about 20' above the stage, that provided an even covering of sound over the audience stage. The PA mixer had a mult of each of the solo mikes on a separate feed, along with the rhythm mix and sweetening mix that were being fed to the Pacific Video truck. If it became necessary to favor rhythm at some point, for Mr. Sinatra to hear a cue, he could do that. Really, when we did our first run-throughs, it felt so good, it had such a good feel to it that Mr. Sinatra asked

that we pull the PA sound level way back, for more of a natural sound, with only slight reinforcement. Everybody seemed to hear very well.

R-e/p: What about clicks, pops, and buzzes?

ED GREENE: Well, it was the Heider crew that was called in on everybody's click and pop problems. They have such terrific experience in dealing with them. There were incredible grounding problems that were discovered as we set-up, but they helped deal with everyone of them. The hand mikes, for instance, were run and rerun several times to get out of the way of some of the lighting,

especially some of the dimmers. The AC for the whole audio set-up came from the Heider truck. All the electric instruments on stage and any audio equipment was powered by lines from the Heider truck, which was completely isolated.

R-e/p: Did you have to make many changes in set-up during the show?

ED GREENE: There were some changes made in the mixing depending on the nature of the tune; differences between a rhythm and brass tune, and a lush ballad sort of thing. The set-up was designed to handle that sort of thing, nothing more drastic.

R-e/p: Did you use any echo or EQ during recording?

ED GREENE: There were four echo chambers available, all AKG. We used them on the program mixes, but not on the 16 track recordings. One chamber was used on the vocal track of the program mix, another was available for the rhythm section but I didn't use it. A third was used on strings and brass in the program mix. Pacific Video had a chamber available to them which they used when they switched to a boom mike, which was controlled by their system. We coordinated levels so that our systems sounded roughly the same. But again, when it comes down to it, by the time the stage was set-up it became a concert hall, so it had some natural sound of its own. Aside from maybe enhancing the vocal a little bit, with just a gentle echo sound, there's really not that much to do. There's some to do, but not that much. I think what the producer and director were after was a very natural sort of feel, like you'd come on in a performance. That kind of live feel.

R-e/p: Was there any occasion for a stop or redo anytime during the performance?

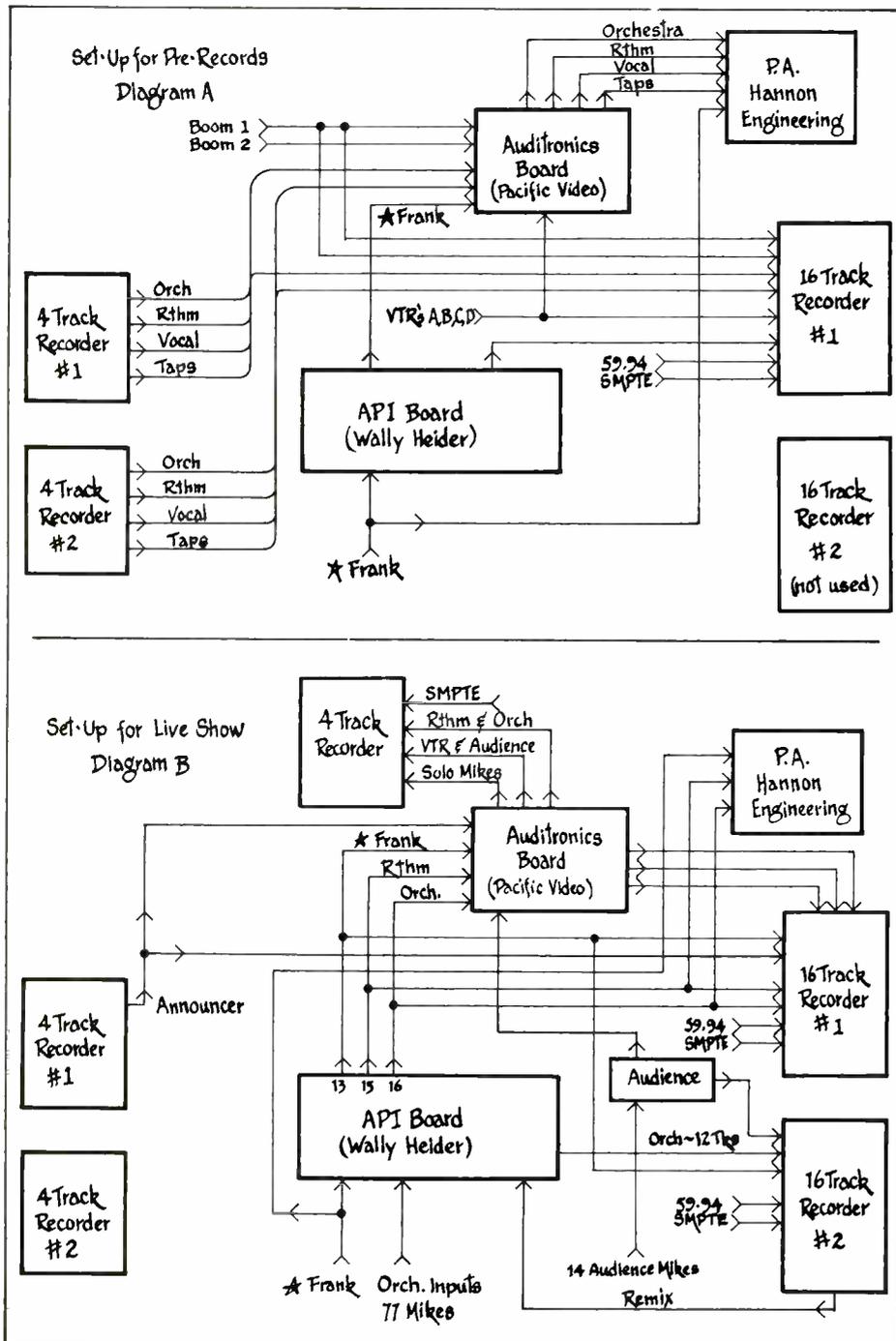
ED GREENE: It happened once, but it was just a minor thing. There were no retakes after that.

R-e/p: What about overdubbing?

ED GREENE: There was a chorus that was staged on a particular tune, and after the show we dubbed them on a track. Aside from that, there was none, although they may be doing some later.

R-e/p: Did you play your mixes of the album recordings in the truck for reference?

ED GREENE: Yes, I had not only a 2 track master of the album but a 16 track master there. But I had been living with that album tape for so long that I could tell right away if we were in the right audio ballpark. We spent quite a bit of time mixing that tape.



R-e/p: Did the fact that you were re-recording for a TV feed affect the way you mixed?

ED GREENE: I will provide a finished, complete mix of all music and vocals on a track, and the audience on a track. I may have to reference to the picture on a couple of shots for perspective, whether its a closeup or distant shot. But the overall sound we got on the program mixes seems to work pretty well with the picture, so its just a matter of touching up here and there when we remix the 16 track tapes.

R-e/p: How much rehearsal did you have?

ED GREENE: The show was shot actually in two segments. In one segment there was a dance number that was pre-recorded and shot to lip sync. The other segment was the actual performance night. We had a chance to hear the orchestra for two days before show night. We had actually done some of the pre-records only a half hour after hearing the orchestra for the first time. But by that time the room was pretty well set up. It was a pretty good room they built. Imagine, they took this huge bare sound stage, stage 19 at Paramount, and built everything specifically for this show. And at orchestra downbeat on the first rehearsal everything seemed to fall into place.

R-e/p: Are you mixing the album in quad?

ED GREENE: Yes, it's being done on discrete tape, and of course its for Warner/Reprise so they'll be using the CD-4 system.

R-e/p: When you mixed the album, was Mr. Sinatra in attendance?

ED GREENE: He wasn't there personally, but the arranger, Don Costa, was there and we'd submit some mixes. They'd come back with some notes, we'd make some changes, but they were minor changes, and again the whole thing was pretty much a straight ahead album. I made a few mixes on my own to try out a few things, but every time I introduced a gimmick, things like time delays on guitars, and little extra repeat echo things, they just seemed to get in the way, and I discarded them.

R-e/p: Who made the overall sound quality judgements for the TV date?

ED GREENE: Well, the arrangers and conductors, Don Costa and Gordon Jenkins, both stopped by the truck and gave their OK for the sound we were getting.

I'll be remixing the 16 track for the show at our MGM studios and I'm sure there'll be some additional judgements made after that.

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Subject: BOARD SIZES

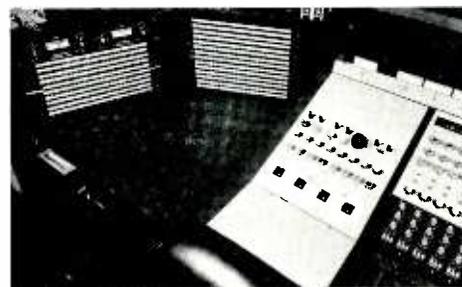
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Re/p: Would you change anything if you had to do it over again?

ED GREENE: I might add those overall mikes to the orchestra, just to get a little more ensemble feeling. Aside from that, I'll let you know.

Don MacDougall . . .
The Album

distortion. It was a nice warm rich sound. It sounded beautiful, but it didn't sound anything like it sounded at the dub-down studio over at MGM.

Re/p: What monitor system did you use?

DON MACDOUGALL: We had the same Altec A4's on the stage and in the control booth, but in the booth they were better, newer; they had been revamped and the high end was a little better, about to 10K. But all the playback systems were rolled off for theater release. You kind of fly by the seat of your pants. The board is a basic 24 channel board with 7 outputs. In this case, recording on 16 track, it didn't work ideally, for instance some of the tracks like the fuzz guitar and Fender bass that were recorded direct were re-

corded without being in the monitor channels. When we got to the dub-down stages, it was kind of a surprise. But we had it all.

Re/p: How did you approach the set-up procedure?

DON MACDOUGALL: Well, all the orchestral and vocal elements were broken down to 14 tracks usually, sometimes 16. I usually keep some tracks open but a couple of times I couldn't. I put Mr. Sinatra in the center of the stage and put a baffle on each side of him, high flats, soft side to him. I used a Neumann U-67 on a boom, and used a Teletronix peak limiter with about 5 dB of limiting, which allowed me to record pretty flat through the system and get rid of all the unwanted extraneous sounds and get some pretty good tracks. The U-67's we used are really classy mikes, they've been rebuilt and they're pretty flat. And we recorded Mr. Sinatra that way, flat, the whole band was actually recorded flat; no equalization, no reverberation, nothing. The natural room acoustics were about, I would say, 3 seconds reverb time, and it lent a marvelous kind of ring to everything.

Re/p: Did you close-mike the orchestra?

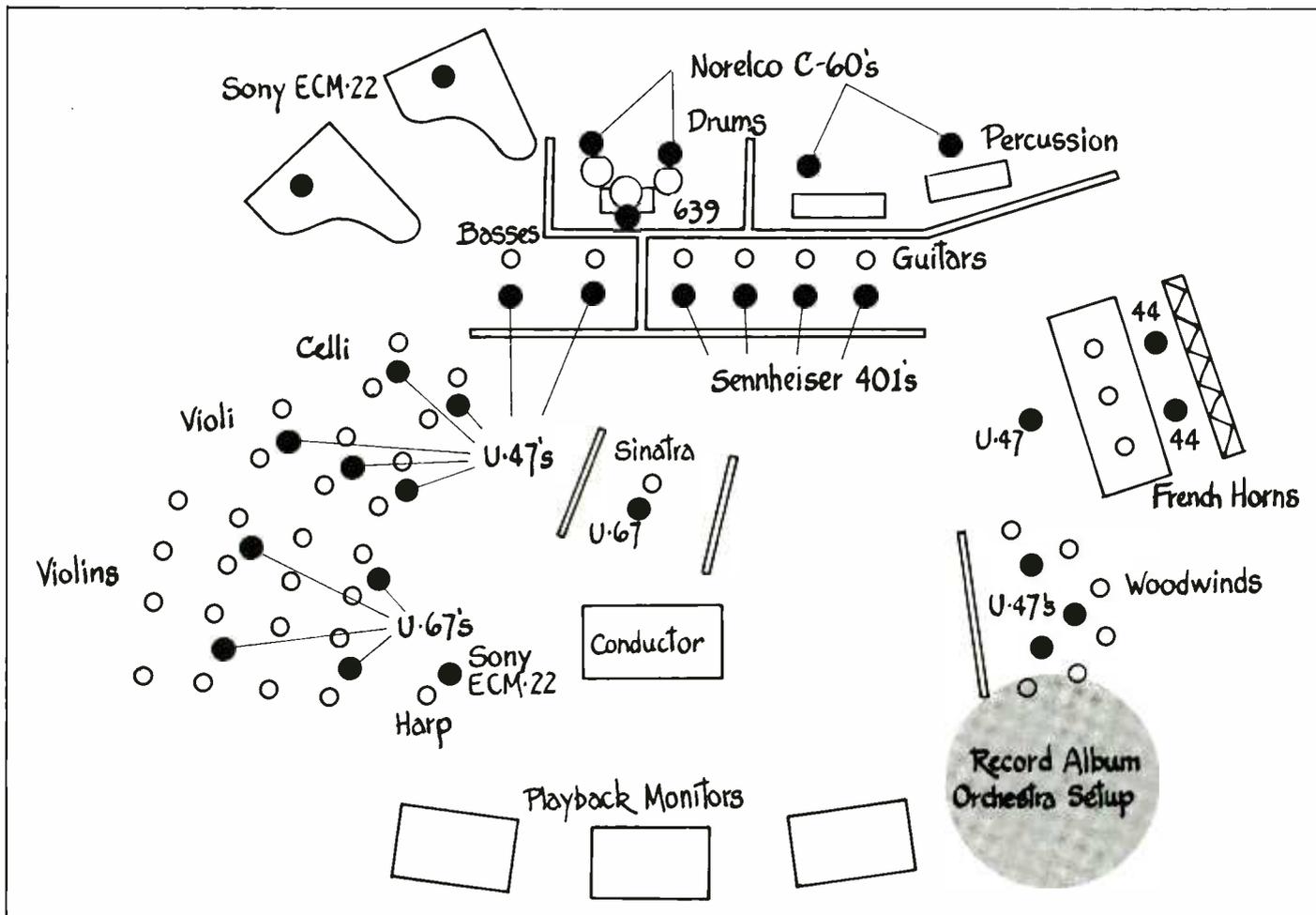
DON MACDOUGALL: The sections we-

re close-miked. The french horn section had a hard surfaced accordion-shaped baffle in back, and we mike those horns two ways, front and back. In back I used a pair of RCA 44's and a Telefunken U-47 with a "Church" capsule in front. The orchestra was on the floor except for the horns. There was a wooden baffle in front of the woodwinds. I had a U-shaped baffle around the drummer using the old Norelco C-60 microphones on him, with an Altec 639 on the bass drum. Don Costa lent me his patio umbrella to cover the drummer. I used more Norelco's in the percussion section, and on tympani. In another booth I had a Telefunken "Church" on Fender and string basses, and next to that the guitars in another booth each miked with Sennheiser 401's. The two pianos had Sony mikes, ECM 22's. That little condenser mike is the best thing I've found for piano.

Most of our stuff is very old, its not really considered to be "state of the art", at least in the recording industry.

Re/p: What are the characteristics of the Telefunken "Church" mike?

DON MACDOUGALL: I would say it has a very rich low end, close to about 40 cycles. It has very smooth response between about 40 to ten thousand. On



one of the sessions, we had a solo trumpet which used an RCA 77.

R-e/p: Did you use any overall mikes for ambience?

DON MACDOUGALL: I had them available to me but I didn't use them. We picked up plenty of the room sound even though we were fairly close-miked. Its a fantastic sound in this room.

R-e/p: Who specified that room for the session?

DON MACDOUGALL: I don't know, I imagine Mr. Sinatra. I guess he's the one who said he wanted to record here. Its kind of nice that he did, especially when you think of all the great studios there are in town. The room is really sort of miraculous in that its difficult to do anything wrong in it acoustically. I've found in working there over the years its sound is really consistently good. We have to cheat a lot with baffling. We do a lot of television shows: "Cannon", "Streets of San Francisco", "Barnaby Jones", and you have to baffle sections to bring down the reverb time of the room. But for this particular session I think the thing that really made it sound so good is that in playing for Frank Sinatra the string players, the whole orchestra, everyone played a little more in tune, a little more enthusiastically. In that environment no one laid back at all.

R-e/p: Did the whole string section come up on one track?

DON MACDOUGALL: No it was divided; violins, violi, celli, and basses on separate tracks.

R-e/p: What were the characteristics of the accordion baffle behind the horns?

DON MACDOUGALL: All that really does is send the french horn back to the front, where I usually have an overall section mike, and this way I have an opportunity to get the balance of the horn section with a little reverb time included. If you record them directly you get sort of a pointed sound. The accordion-shaped baffle seems to sound better than a flat baffle, and the horn players also seem to have an affinity for playing in front of it, they say they sound better to themselves. There was no trumpet section, although Conte Candoli did a solo on one number. He was with the horn section, on a separate mike.

R-e/p: Was there a PA or monitor system so that Mr. Sinatra could hear himself more in balance with the orchestra?
DON MACDOUGALL: He had headphones available, but he didn't use them. No one in the orchestra used them either.

R-e/p: What kind of sound were you looking for?

DON MACDOUGALL: The recording supervisor was Don Costa, Sinatra's conductor on the road. He wanted a very live, real sound for the session, he didn't want any gimmicks. If we had EQ in the system I'm sure he would have used it in the monitors just for his own ears, so he could hear things a little more pointedly. I had to tell him there were some things he wasn't going to hear on playback, at least on the stage. Most film studios are really not with the recording state of the art. Of all the film studios in the recording field, at least as we consider the recording field, Warner Brothers (The Burbank Studios), has done a great deal to update their equipment. They've gone to a marvelous new board, and spent alot of money on new equipment. We've done the samething here at Samuel Goldwyn Studios, but in a different area, in the area of re-recording. In the state of the motion picture art, we feel re-recording is really the most important place to put your' bucks. We've up-dated our equipment to the point where I'd say its the finest dubbing facility in the world. Warner Brothers can't compete with us in dubbing, but they've got the finest equipment on the scoring stages. On the other hand, we've got this recording room that acoustically is second to none. So we have to fool with the equipment a little. When you hear the results of the album, and what we've done with old stuff and what guys like Dick Hornung, or maintenance engineer, Allen Holly my stage man, and recordist Bill Schlegel; guys who make this stuff work for you, well, it's nice to think it can still be done. Especially when you hear it back on marvelous equipment like Ed Greene has there at MGM.

R-e/p: Is yours a tube or solid state board?

DON MACDOUGALL: Its a tube board. It's an oldy.

R-e/p: What did you think of the mix-down?

DON MACDOUGALL: I couldn't believe what Ed did. I went over one night after a long date here and he played a song from "A Little Night Music" "Clowns" and I'll tell you it wasn't to be believed. Of course I couldn't hear it on playback here, and when I heard it there I was dumbfounded.

R-e/p: Did you use any noise reduction equipment?

DON MACDOUGALL: None at all. The only thing that was used at all was just a little Teletronix limiting to account for the lows and highs in Mr. Sinatra's voice, in volume only; sometimes he would sing very very softly. And the monitoring was a problem too, I couldn't

really listen to him with that big an orchestra coming through the monitors I had. I wasn't guessing really, but I was straining to hear the clarity I knew was there and that was what I finally heard on the dub-down.

R-e/p: Have you heard the record on the radio?

DON MACDOUGALL: Yes, I think its sensational, one of the best things he's ever done. Even on AM radio, it sounds well balanced, all the values are still there. All Ed really did, I think, in a couple of cases was add just a little bit of chamber to Mr. Sinatra, and just a little refinement; sometimes we had a 60 cycle in a guitar amplifier which he got rid of. Outside of that I don't think he had to do much.

I can't remember ever hearing a badly mixed Sinatra record. I believe a music mixer ought to be a musician, or should have pretty good ears and know what music's about. It's pretty important. I also feel that there aren't enough young guys coming up that have really paid their dues enough to get into it.

R-e/p: How many sessions were required to do the album?

DON MACDOUGALL: We had several sessions, about four get-togethers, and they went from 7 o'clock to around midnight. Generally, everything was very relaxed. On the first night of recording, on the very first song, there was no percussion on this song and the drummer, Johnny Guerin, decided to come into the booth. He walked in right in the middle of a take and kicked out the master AC plug. Everything went dead. I had to tell Mr. Sinatra we'd have to start over again. "You're a new kid," he said, "and that's ONE."

R-e/p: Had you used only 2 or 3 mikes overall, with maybe a vocal mike on Sinatra, do you think the results might have been better?

DON MACDOUGALL: It would have sounded pretty good, but I don't think it would have sounded better. Otherwise we would have done it that way. But it would've still sounded pretty good, with maybe more of a cathedral quality. Of course, in the old days, that's the way they did it. Once we started making takes we just kind of let him go. He has such a phenomenal knowledge of how to relate to a microphone. P's, for example, have a tendency to pop alot if a performer doesn't know how to treat a microphone. But he's a master. He could hear himself and if he popped he would stop and not pop the next time. It was a monumental session. I was thrilled and flattered to have an opportunity to work with him, after all the years of growing up to his music.

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MASTERING FOR TAPE DUPLICATION

by PETER BUTT, Chief Engineer
SUPERSCOPE RECORDED TAPES

I would like to begin this article by extending my compliments to Messrs. Kulka, MacLeod, and Malo on their fruitful collaboration on disc mastering appearing in R-e/p's last issue. I recommend it to all as a relatively compact statement of what is widely referred to throughout the audio industry as "standard practice". I am aware of no other literature where all of the information given in that piece can be found assembled under one title. It is my purpose to add to what those gentlemen have already presented.

Tape duplication differs from disc mastering primarily in that no electro-mechanical conversion of the audio signal need occur. Absolute chastity with regard to proper net channel signal phase relationships, therefore, is not strictly required. If one has some serious compulsion to mix his stereo program out of

phase, that program could be duplicated quite well in cassette and/or 8-track cartridge form with minimal difficulty. If such a thing were to be presented to any self-respecting tape duplicator, the out-of-phase situation would either be corrected internally or questioned by the duplicator.

I have always been led to believe that one of the guiding principles of most professions, audio included, is that doing a job right the first time is generally to be regarded with favor. In the spirit of that ideal, let us pursue a rough format for stereo music masters that will not only be a boon to tape duplicators and disc masterers alike, but should help minimize the misunderstandings that seem to persist between studio personnel and producers and those, like myself, who are frequent recipients of their work.

First of all, a complete alignment of the tape machines to be used in generation of the source master tape should have been completed shortly prior to beginning the mastering process. Obviously, this applies to all machines utilized in the process. I say this because the playback machine alignment is sometimes neglected as being of minor importance compared with that of the record machine. As an aid toward this end, I would like to urge that more studios install phase scopes in the monitoring outputs of their consoles so that the phase characteristics of the signal being monitored can be continuously observed. Such a scope is also very useful in multi-track tape machine alignment and can serve as a tool to observe and localize faults such as clipping and can be used to indicate compression in a more meaningful way than a simple gain-reduction meter. I am more-or-less accustomed to not finding phase scopes in the control rooms of most studios of my acquaintance. The value of a relatively cheap oscilloscope has been proven in my experience many times. In my intellectual parochialism I marvel that others have not come to rely upon them as I have. With a little outboarding, an X-Y scope can even yield some pretty significant information regarding phasing and balance of quadrasonic program material.¹

Having aligned his equipment, the master tape preparer should record a series of 30-second tones at the head-end of the program material. I think that the frequencies of 700, 10,000, and 100 Hz are generally considered to yield an accurate indication of the condition of the recorder/reproducer in question. It is important to emphasize that the tones be recorded in such a way as to appear to the originator of the material to be flat within the ± 2 dB tolerance for professional tape equipment. Just to eliminate any misunderstanding subsequent to this process, the tones should be included, by frequency and observed playback level, along with the music title listing that should be a part of every mastering effort. The observed playback levels should be logged with candor usually reserved for the confessional. If you see a 1 or 2 dB hump at 10 kHz in playback, for a constant input level, please note it. I, for one, will not relay that information to your competitors. Your secret will be safe with me, and we'll both gain a better end-product for it. Honesty is, indeed, the best policy. Without these tones and the written description of them, variations not only in equipment calibration, but in standard

alignment tape characteristics cannot be prevented from coloring the program quality. It may appear that the points I have brought up so far are so elementary that they usually go unmentioned. I am mentioning them for precisely that reason. Unless the recipient of the master tape can set his playback system to duplicate the levels and azimuth observed by the originator of that tape, he must presume that his local standards are equally applicable to the recorder on which the master was generated. After having had occasion to examine alignment tapes from several sources, I must confess that this is a somewhat shaky presumption. A recorder, after all, can't be aligned more accurately than the limits determined by the alignment tape used to determine the machine's playback characteristic. Alignment tapes often disagree between manufacturers not only to the extent of high-frequency boost but also as to the value of flux supposedly representative of the 185 nano Weber/meter defined as N.A.B. zero. Aging alone can account for a couple or so dB along the high end of an alignment tape. As far as who's right, or least wrong in the alignment tape business, I don't care to venture, but it appears that magnetic flux standards do vary from standard to standard.

I think it's also well to mention that, in the past, I have noted a distinct scarcity of master tapes prepared at established studios across the country that include these tones and the information necessary to maximize their usefulness. While we're on the subject of tones, any noise reduction equipment to be used during the program transfer should be bypassed during this operation. It's the recording machine characteristic we're after. Not that of the machine coupled with whatever peripheral equipment that may be in the program chain.

In passing, although it is beyond the scope of this article, inclusion of the tone set at the head end of $\frac{1}{2}$ ", 1" and 2" masters should also be a standard practice as well. In all cases the tones should be leadered to facilitate their location and to separate them from the program itself.

Now then, the program material should be transferred with due attention paid to the points made by the aforementioned Kulka, MacLeod and Malo. Further, a clear listing of the program material by title and clock time, in chronological order of appearance from the head of the tape, should be included with the master more often than it seems to be. This is especially important in the case of purely instrumental selections and foreign language material.

Further, and very important, if any noise reduction system has been used in processing your master tape, note the fact on your cue sheet and specify

whether it's been Dolby'd, DBX'd, or Burwen'd or whatever. This may strike some as a rather self-evident practice, but more than one source tape in my experience has had some unspecified system of noise reduction applied to it with no obvious indication as to what type was used. In fact I've even seen a couple that had processed and unprocessed segments within the same tape, again with no indication as to what had been done, noise reduction systems are no more invariant than tape machine alignments.

With regard to flat spectrum or other extremely bright program material for duplication in tape format, keep in mind that although cutting stylus velocity is not a factor, the high-speed duplicator record pre-emphasis curve often rises to greater than 15 dB above a 500 Hz reference level and therefore may be responsible for saturation of the cassette or 8-track tape during duplication. The pre-emphasis curves used for the 15 and 30 ips professional machines have much less high-end boost, permitting recording of zero-level signals to beyond 15 kHz, without danger of tape saturation. If saturation is to be avoided on 8-track cartridge and cassette copy, the audio spectrum in the 10 kHz to 15 kHz region should generally be down 10 to 15 dB from a 500 Hz reference. The point of all this is that excessively bright material is as much of a problem to tape duplicators as it is to disc cutters. Both disc and tape media are limited rather strictly in the peak signal amplitudes they are capable of successfully reproducing. The total flux representing an audio signal existent on a piece of tape is the algebraic sum of the components of that signal within the band-pass of that signal, with pre-emphasis added, just as the groove excursions on a disc represent the algebraic sum of those same components, with pre-emphasis added. The point is that there is a maximum level over a given bandwidth that can be accommodated on a piece of consumer priced tape just as there is on a stereo disc. For this reason the mixer should be aware that his program material will fit within some rather inflexible limits, regardless of what form the ultimate duplicated product may take. Very high levels of high frequency information should be restricted in the multi-track mixing process rather than in the tape duplicators' running master generation. Additionally, the mixer should realize that an excessively high low frequency component can result in saturation of high frequency energy riding on top of it. The high end of the spectrum is not the sole source of trouble for either disc or tape media. Suppose, now we turn our attention to

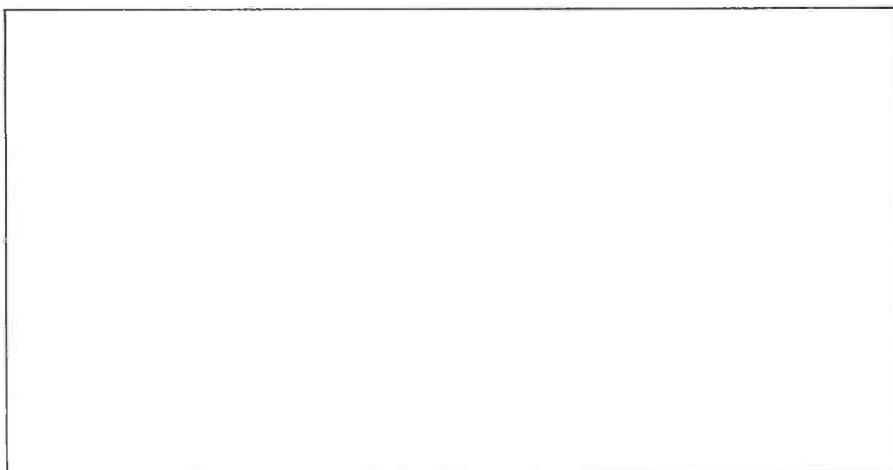
1. D.L. Patton, *QUADRAPHONIC DISPLAY TECHNIQUE*, *Journal of the A.E.S.* Vol. 20 No. 6

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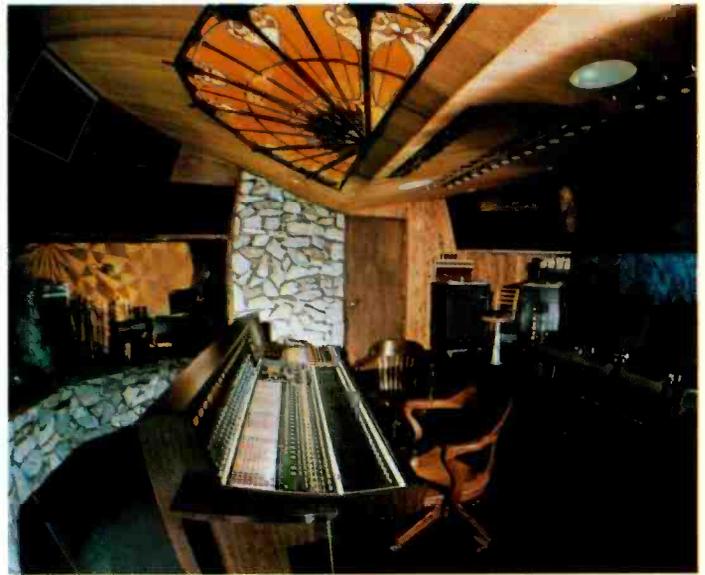
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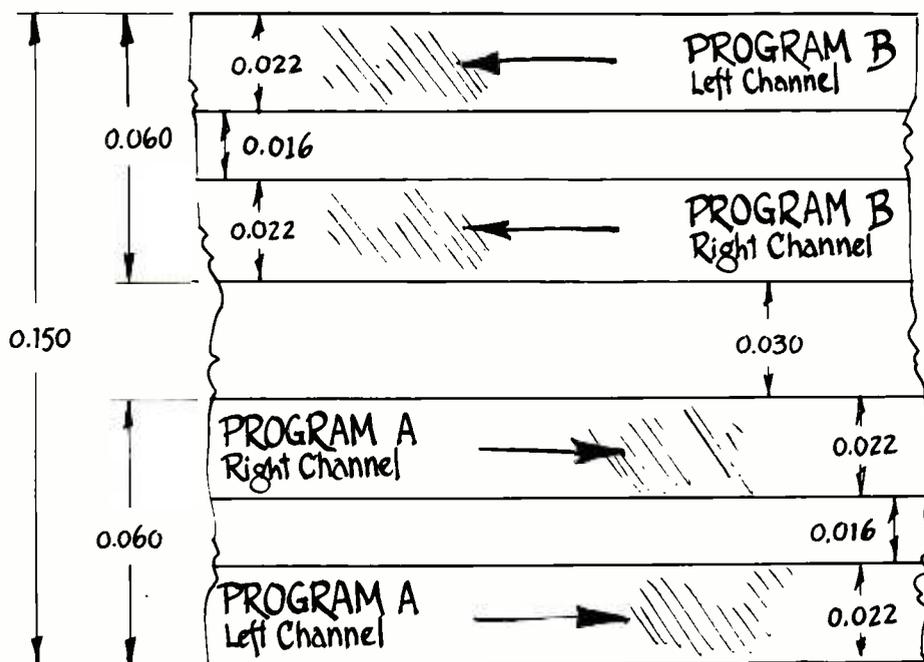
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Cassette Tape Dimensions and Track Geometry

Figure 1

some of the restrictions upon the stereo program material peculiar to the tape format, most notably cassette and 8-track cartridge. Let us now consider the stereo cassette.

As we all know, this little beastie consists of a roughly symmetrical set of plastic shells welded or glued together to form a protective case containing a pair of tape spools, tape guiding devices of varied kind, and means for access to the tape by the cassette machine playback head and tape transport system consisting of a pinch-roller and capstan mechanism. There are a bunch of other goodies within your basic cassette, too, but it is not our purpose to dwell upon them here.

Inspection of a typical sample of the species will reveal that the tape contained in one of these little jewels differs in at least a couple of ways from your ordinary, garden variety of magnetic tape. Reference to Figure 1 will serve to define many of the dimensional characteristics peculiar to cassette tape and the cassette stereo track format. Of course, just about everyone throughout creation, with the exception of mothers-in-law, are thoroughly aware of all this, but here it is anyway. For those of us who have not already chosen to avert our eyes, the drawing is intended to show the cassette tape as it would appear when viewed in the cassette with stereo program A in the process of being played. That is, oxide out, tape motion from left to right. The arrows point to the head end of their

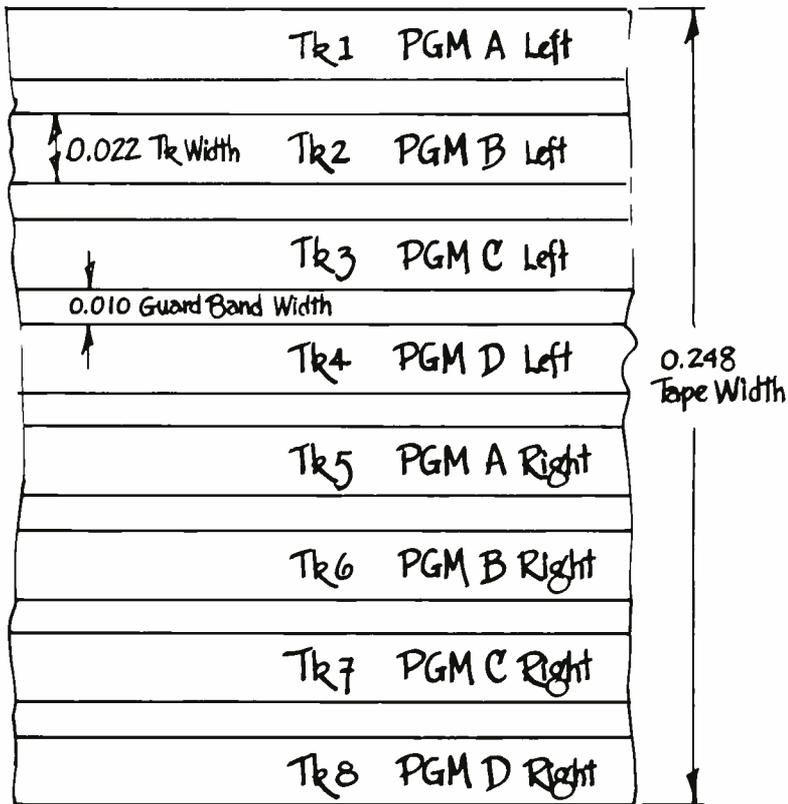
respective programs A and B. Widely accepted dimensions are given as design centers with tolerances omitted for clarity. The tape itself is about 0.150 inches wide with a thickness of about 0.8 thousandths for C-60 tape and about 0.5 thousandths for C-90.

A word or two of clarification regarding the significance of the C-60 and C-90 designations may be in order. The "C" may be taken to stand for some obscure nomenclature of which I am not fully aware, (Cassette, possibly?) and the subsequent digits refer to the total playing time, in minutes, available on the cassette, for both sides. By way of illustration, a C-90 cassette could be expected to play for 45 minutes in each direction, a C-60, for 30 minutes, etc. The standard playing speed for audio cassettes is, of course, nominally 1 7/8 inches per second. I insert the modifying adjective owing to the scarcity of cassette players of my acquaintance that do, in fact, operate at the 1 7/8 I.P.S. speed. The majority seem to run as much as 5% faster than the naive would initially expect them to. The implications of this, regarding tonal pitch and actual program playing time, I think, are obvious and may be inferred by the reader. This description of the cassette itself is presented primarily as a guide to be kept in mind in the preparation of a master source tape whose program material will eventually be contained within each of a presumably large number of the little wonders.

The stereo cassette track format is set out the way it is to permit a certain amount of compatibility between mono and stereo cassette players and mono and stereo cassettes. This has been done by arranging the sixty-thousandths wide mono cassette tracks for programs A and B so that the single mono track covers the left and right stereo tracks of the program of interest, including the guard band between them. The energy from the left and right channels is then combined within the mono playback head as the well known L + R monophonic sum of the stereo channels. Obviously, phase cancellation and addition will occur between channels of a stereo program when played back in a mono player. Improprieties regarding the phase relationships of program components during the mix-down can have some rather jarring repercussions when observed through the mono cassette playback head. Although a given stereo program may sound just great in a stereo player, that's no guarantee that the cassette will sound ok in a mono player.

As far as the arrangement of the sequence of selections for duplication is concerned, the reader is urged to consider that programs are contained on the same piece of tape, side-by-side. I'm sure, by this time, no one will flinch at this idea, but I mention it to emphasize that it is important to arrange a given sequence of selections in such a way as to split the first and second halves of the program as nearly equally as possible between sides of the cassette. Unlike the 45 and 33 1/3 R.P.M. disc, the length of side A of the cassette is exactly the same length as side B. Since the longer of the two programs will determine the actual playing time of the cassette, several benefits may be realized by making the lengths of programs A and B very nearly equal. One of these is that the length of tape necessary to contain the entire program will be minimized and, also, there will be a minimum of blank tape to be plodded through by the listener of the finished product. One side being very much longer than the other will result in an annoyingly long portion of blank tape at the end of one program or the other. Casual reflection will reveal that there is very little either edifying or entertaining about a long period of silence at the beginning or end of parts of a cassette.

Now for the good old 8-track Lear tape cartridge. The Lear cartridge is a plastic case containing a rotating hub on which the tape containing the program has been wound, oxide out. Access to the tape, as it passes from the center of the rotating hub, over the tape pack and across the front of the cartridge, is gained by a playback head protruding from the cartridge player through openings in the



8 Track Lear-Type Tape Cartridge Track Format

Figure 2

cartridge plastic case. The tape is drawn across the head by a capstan within the player that is positioned opposite a pinch roller contained within the cartridge body. The tape passes over the pinch roller so that it is engaged between the player capstan and the cartridge pinch roller. Engagement of the pinch roller with the capstan then pulls the tape across the player head. The tape is held in contact with the reproduce head by a pressure pad and a system of tape guides internal to the cartridge. From the capstan, the tape is routed back to the outside of the pack on the rotating hub assembly. The tape is spliced together so that it forms an endless loop with a conductive foil splice retaining the two ends of the tape. Tape circulation on the rotating platform is facilitated by the lubrication of the tape itself with a graphite compound coating the tape backing. The purpose of the conductive foil is to indicate the end of the program cycle and either switch the player off or cause the reproduce head to step to the next pair of tracks in the program sequence as the tape loop completes an entire circuit. Got that?

Now, let's take a look at the track format for these specimens. Figure 2 shows an approximate drawing of the

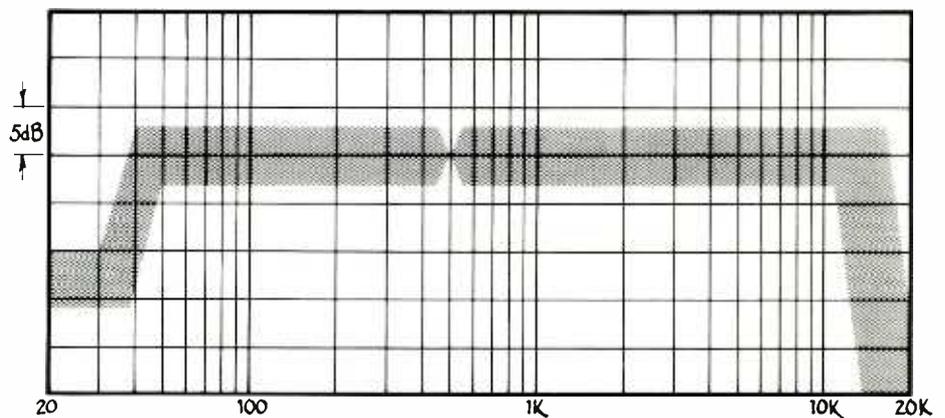
dimensions of the tracks, guard bands and track assignments for the standard 1/4-inch 8-track tape. Note that the track widths are just about the same as they are for stereo cassette tracks. The guard bands are a little smaller than in the cassette format.

I'm sure that very few of us would indicate surprise at the fact that there are four stereo pairs available on the

tape. A stereo program, to be contained on an 8-track cartridge, must be divided into four very nearly equal length segments and the segments arranged so that they will be played as programs A through D in alphabetical sequence. Even though up to about 90 minutes of playing time is available in the 8-track format, a break in the program continuity must be tolerated at the point where the tape completes its cycle and the reproduce head must be switched to the subsequent pair of tracks to continue playing the program. This seemingly minor technical detail, like other minor details, is only important when it is not considered. The "click-thunk" interrupting 8-track program segments may be thought objectionable enough to take some pains, when arranging the time sequence of program selections, to avoid having one selection begin at the end of one program segment and conclude on another. Most importantly, such a case must not occur with program D and program A.

Sometimes, try as we might, there's just no other remedy for fitting a program on an 8-track other than to allow a gross disparity between segment lengths or to tolerate the interruption of a selection. 8-track programming can be somewhat of a knotty problem in the case of a program sequence that must preserve a certain sequential order. Solutions to this sort of situation can be difficult indeed if the freedom to rearrange selection order is restricted.

In closing, I think a brief discussion of the sound quality capabilities of duplicated tape products is in order. The question of the viability of tape recordings as opposed to the stereo disc has occurred to more than one audio professional. Almost everyone seems to know that tapes just don't sound anywhere near as good as records and cassettes are a waste of time to even



Typical Limits of Playback Frequency Response of a Philips Type Stereo Cassette Duplicated at 32 Times Playback Speed

Figure 3

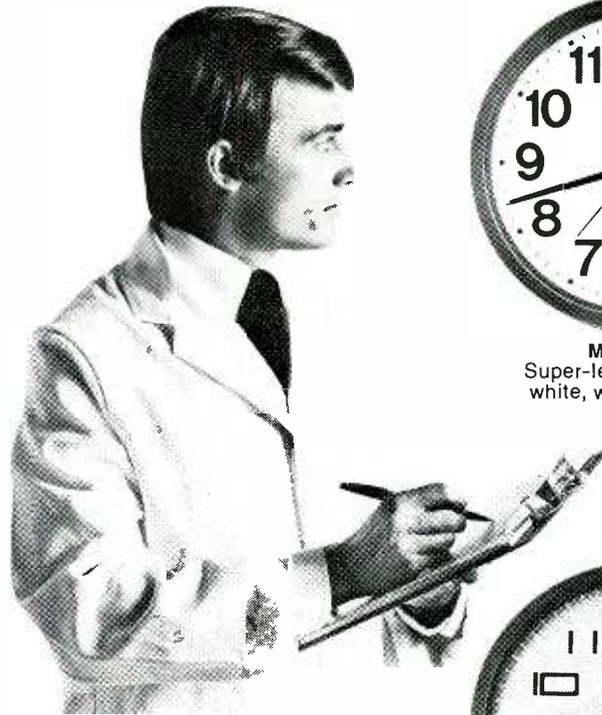
consider as a quality consumer sound medium.

Why even issue tape product in the form of cassettes at all, when everybody knows that 8-track cartridge sales exceed cassettes by about 5 to 1? Not only that, cassettes with their skinny little tracks and slow tape speed are the low riders of the retail music industry. Everybody knows that. Right?

Well, almost. I don't know that. In fact, the results that we at Superscope have been able to achieve in the form of stereo cassette product has been rather pleasantly surprising in terms of quality. The sound quality of cassettes of my recent experience has been at least as good as the product we produce in any other tape format, and often exceeds results realizable in 8-track cartridge. Peak signal-to-noise ratios of about 50 dB are generally achievable in stereo cassette and 8-track format. Frequency response variations observed in playback measurements taken from six slaves fall within the limits shown in Figure 3. Subjective results of duplicated music comparisons in 8-track and cassette formats generally indicate that the lowly cassette does not suffer relative to other tape formats or even by very much when compared to disc recordings.

Once more, I would like to underscore the importance of supplying program material of the very highest quality possible to any duplicator. Most duplication establishments are intimately aware of the capabilities and limitations of their respective facilities and tape formats. Obviously, your material can't very well emerge from the high-speed duplication process very much better than it was when it went in. Degradation of quality will occur in any duplication process whatever so we may as well start out as well as we can in the first place. The importance of an accurate, complete master tape cue sheet should not be discounted.

It is difficult to argue that cassettes are the key to the high volume tape market. I do, however, believe that the cassette is too often ruled out of many marketing plans because it is generally believed that it is incapable of yielding results consistent with other recorded music formats. I think that general realization of the capabilities and limitations of consumer tape formats would enable the industry to make more judicious choices in marketing strategy. The availability of high quality music in the lower-cost cassette form should yield benefits to the industry and to the consumer. I only ascend to the soap box to rebut an indictment of the cassette that I have heard from both layman and professional alike. Evidently, very few of us realize how good a pre-recorded tape can sound.



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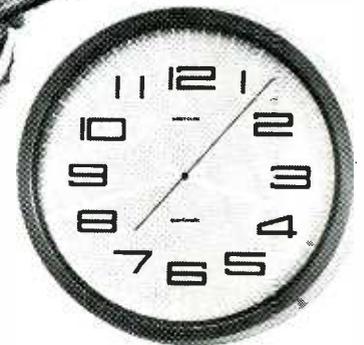
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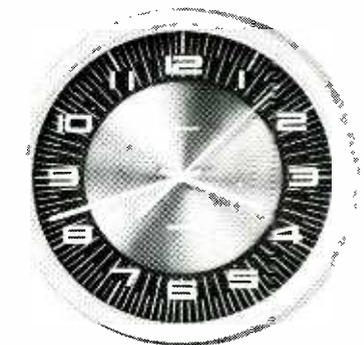
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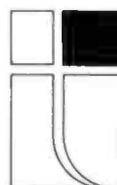
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TUBES vs TRANSISTORS

by RUSSELL O. HAMM
SEAR SOUND
NEW YORK

Ask a recording engineer what makes one studio sound different from another and he'll tell you . . . "acoustics." Why? Because there are a lot of articles about building studios with technical looking stuff like sound absorption coefficients. Supposedly these things affect the sound. How about electronics, does the console affect the sound? "Oh no." Why? "Cause the specs say so. Just look at an ad for a good console and you'll see the frequency response, noise and distortion all look good."

With this premise in mind I spent a couple of years trying to improve the sound of a bad studio. I literally rebuilt the whole studio acoustically. The place still sounded abominable. Then one day I had a bright idea. I plugged the mikes directly into a small mixer instead of the regular console. Wow! what a difference. From that day on acoustics were out the window in my book. All the acoustic changes I had made had never come close to the change in sound made

electronically.

About this same time I had an interesting discussion with a guitar player who was searching for the best amp he could get. He told me, "You know, there is a night and day difference between amps, especially tubes and transistors." I asked him if he'd looked into the specs on the different amps to see what they had to say. His reply: "I just go by my ear, I can't read them specs, man."

So I posed the question to a lot of people: what about this tube sound vs. transistor sound business? Is there a difference? Musicians, engineers, hi-fi bugs everyone could talk about it. "Really, it's a very hot topic," is the one point that came across very clearly though everyone had opinions but no facts. Here are a few examples.

An electrical engineer, one who designs recording consoles, absolutely proved to me that there was nothing to the argument. He did this by getting out his data sheets and quoting some figures

which were visually very impressive. It's true, according to the parameters being measured there should be no difference in the sound of equivalent tube and transistor amplifiers. My question was, are some important parameters not being measured? Said another engineer, "You just have to get used to the nice clean sound of transistors. What you've been listening to on tubes is a lot of distortion." Well that could be too, but have you looked at the hi-fi ads recently? Seems now that unless you buy a super high power amp, you're going to get clipping distortion. I guess those nice clean old amps weren't so clean afterall . . .

I asked a few musicians and producers to tell me what they heard as the difference between tubes and transistors. "Tube amps have more bass . . . The bass actually sounds an octave lower," said one guitarist. A couple of different people pointed out that there was a big difference in the mid range sound. Tubes seemed clear while transistors were

* This article was derived from a paper presented at the 43rd convention of the AES, New York.

cloudy, "Transistor records are very clean but they lack the 'air' of a good tube recording."

I showed a transistor to one older musician and his immediate reaction was: "no wonder they don't have any 'air' in the sound, there ain't enough room in 'em!" Different people told me that they heard a lot of buzzing or white noise on transistor recordings especially on the attack of notes. Of course I heard several theories that tubes overload gently so they don't cause distortion on attacks. One producer told me he liked transistors because they had better highs and lows but they didn't have the 'punch' of tubes. "Sometimes transistors sound like they're under a blanket."

I started a collection of records grouping them according to their sound. Quite surprisingly they did seem to fall into three general categories. Comparing records with one another is a bit of a problem since the musical selections and instrumentation is different on every one. Still, a general sound quality or electronic cast prevails over each record regardless of musical content. The records in category one had a 'closed' sound, they were brilliant yet they seemed to have a 'covered' quality. Within the sound texture the instruments seemed masked so determining just what was playing was difficult. Played loud the records were 'buzzy' and rather annoying, at normal levels they were fine. Category two's predominant trait was loudness. These records were so loud compared to others it seemed like they were at the breaking point. One more dB and the record would shatter. They were distorted somewhat but the sound still seemed clearer than the first category. Instruments were defineable within the sound but they did not sound real or live. Category three was very different. Realism prevailed. If the records were played at a 'live' sound level they actually sounded like the band was sitting in the room. Each instrument was very clear; distortion seemed almost nonexistent. The loudness was nowhere near category two and as the playback level was reduced on the phonograph the sound became thin with the highs very overbalanced. This characteristic was not so dominant in either of the other categories.

It took quite a bit of time to do all of this listening and categorizing which I have so briefly described here. The next step was to track down some of the studios or engineers who had made these recordings and find out what sort of equipment they had used. Needless to say this too was a big project. All of this is, of course, a psychoacoustical study where there is bound to be error and indeed there was. But, in general, the main factor in each category was the

type of amplifiers used in the recording console. Category one was transistors, two was vacuum tubes and three was operational amplifiers. Electronics was again the predominant cause of sound coloration. With this premise in mind I decided to look into amplifier distortion characteristics.

As the new hi-fi ads tell us most amplifiers clip on peak program material. Here, I thought, might be where the sound coloration is coming from but first I decided to check up on this clipping business. To get an idea of the kind of levels mike preamplifiers have to handle under actual studio operating conditions, I built some special test equipment. A peak reading meter allowed me to read the instantaneous level of signal transients while a special log amplifier showed the whole signal on the scope. This way I could get an idea of how significant the peaks were relative to the actual signal level. I hooked this rig up to the console and monitored different mike lines during regular sessions. The results were amazing. Sure I expected to get loud signals, especially from the drums with close miking, but not this loud. Table No. 1 gives a few good examples.

If you get a manufacturer's data sheet for one of the mikes listed in the table you'll notice they give the sensitivity of the mike at some standard sound pressure level. My calculations, based upon that data, indicate that sound pressures in excess of 130 dB are common. While the latest console amplifiers have less noise, less distortion and more knobs

than ever before they are not designed to handle this kind of level. Most commercially available preamplifiers operate at 40 dB gain and overload at an input level of about - 20 dBm. From the table you'll note that the U-87 mike puts out a peak of - 1 dBm from the large floor tom. Amplification of this by 40 dB gives severe amplifier overload and logically causes lots of distortion.

The high level mike signal problem is curable of course. Most consoles today have pads on the microphone inputs which can attenuate these signals to a range where the preamplifier can handle them. The use of pads however raises two unresolved problems. One, pads were not used 10 years ago on tube type consoles. In fact they weren't even common on the first generation of transistor consoles either. Yet, I have popular recordings made back then that don't sound severely distorted. Secondly, how much padding do you add? Too much and you don't have any range on your fader or too little and the peaks clip.

I set up three commercially available preamplifiers in the studio. One transistor type, one IC and one vacuum tube. I adjusted them to a gain of exactly 40 dB and I regulated their operating voltages so they would overload at the same output level, + 18 dBm. Each amp was connected to the console monitoring network. As the test signal I used the U-87 microphone over a large floor tom. The mike fed into a variable pad and then to a switch which could select each preamp. I got together a few studio

Table 1 - PEAK MICROPHONE OUTPUT LEVELS FOR PERCUSSIVE SOUNDS

Instrument	Distance	Microphone output level open circuit 0dB = .775				
		U-87	U-47	77-DX	C-28	666
Bass Drum (single head)	6"	0	-6	-9	-15	-1
Large Tom Tom	12"	-1	-6	-9	-10	-5
Small Tom Tom	12"	-1	-5	-7	-9	-1
Piano (single note)	6"	-25	-29	-38	-35	-32
Piano (chord)	6"	-23	-27	-36	-33	-33
Orchestra Bells	18"	-16	-25	-33	-33	-30
Cow Bell	12"	-10	-12	-29	-19	-15
Loud Yell	4"	0	-11	-	-10	-10

* U-87 and U-47 made by Neumann, 77DX made by RCA, C-28 made by AKG, 666 made by Electro-Voice.

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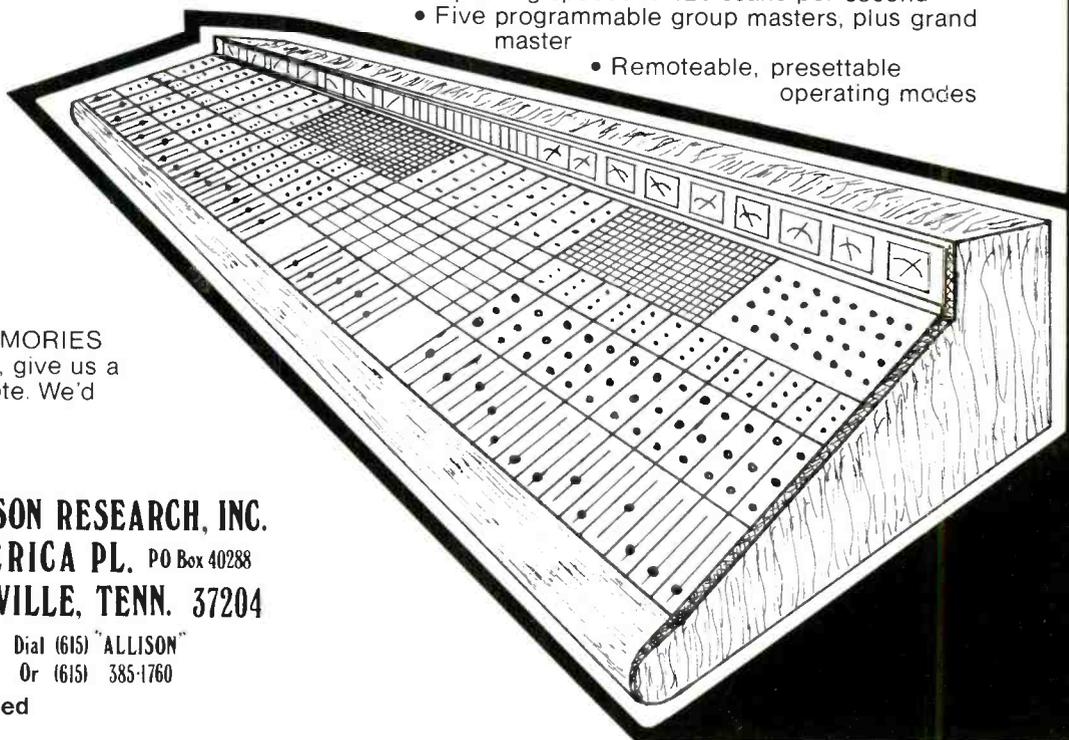
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people and we listened to the output of each amp as a strong armed drummer beat away.

The transistor amp was a push pull silicon design. Its output signal sounded very distorted. I adjusted the pad until everyone agreed that the distortion had disappeared. I did this adjustment several times so I could get a range of attenuation settings. It turned out that 10 to 15 dB padding did the trick.

The second amp was one of those cast epoxy operational amplifier designs. Again the output was very distorted without padding. It turned out that 20 dB of attenuation was necessary and

the margin of error we had with the transistor amp almost disappeared. A 2 dB change in pad made the difference between no distortion and very audible distortion.

Amp three was a push pull triode tube design. Quite surprisingly this amp didn't need any padding. Its output was quite clean.

Just to make sure the amplifiers were operating ok I inserted 25 dB of attenuation and switched the mike signal to each of them. Everyone agreed they all sounded the same, clean.

These listening tests quite clearly indicate that the overload margin varies

widely between different types of amplifiers. It's well known that when an amplifier operates in its overload region it introduces distortion. Any amplifier design for audio use has a total harmonic distortion specification at some particular signal level. These tests illustrate however that all the amplifiers could be driven beyond this point without the distortion being too noticeable. Obviously this is not the kind of distortion the ear normally associates with electronic overload yet the amplifier is distorting. Distortion is the addition of harmonics to the signal. Harmonics are what gives a sound it's character. Adding harmonics changes a sound. Therefore it must be in this region of inaudible overload where the sound coloration is added by the amplifier causing the difference between transistors, tubes and ICs.

Using a conventional THD (total harmonic distortion) analyzer, I checked out approximately 50 different amplifier designs. I plotted a curve of THD against input level as each amplifier was driven into its distortion region. The results were very disappointing, all the curves came out about the same as figure No. 1 shows. These particular examples were chosen because they are representative of the family of devices. A quick glance will show you that tubes do not overload more gently than transistors; another popular myth laid to rest!

THD is actually a measurement of the sum of the individual distortion components. In other words you can determine it by adding up the contribution of each harmonic. Here is an area for problems however since THD tells absolutely nothing about which harmonics are causing how much of the distortion. For several of the amps I repeated the overload tests but this time I examined the output signal, on a spectrum analyzer. After a bit of testing it seemed that measuring the first seven harmonics was enough to see how most of the prominent distortion components behaved. The harmonics higher than the seventh were quite low in amplitude and very hard to measure accurately.

This time the results were very revealing. Figure No. 2 is a good example of the distortion from a triode tube amplifier. The distortion is composed of strong 2nd and 3rd harmonics with the higher ones in diminishing order of importance. Look at the output waveform, notice that the top is flattened but the bottom is still rounded like the sine wave input. The next amplifier, figure No. 3, is a push pull, silicon transistor type. The 3rd harmonic is very strong while the 2nd is about the same magnitude as the higher ones. Now it becomes clearer where THD measurements can be misleading. Figure No. 1 indicates that the THD for both these amps is about the

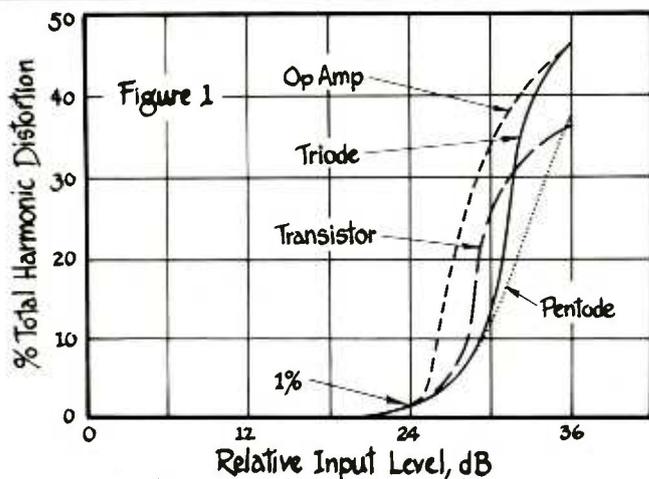


Figure 1
Multistage amplifier comparison of Total Harmonic Distortion

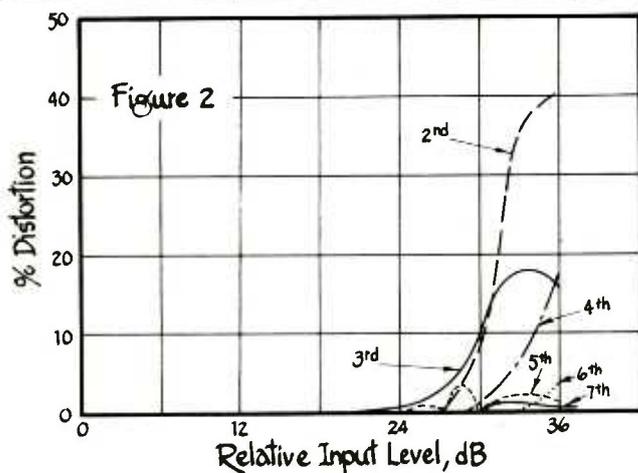
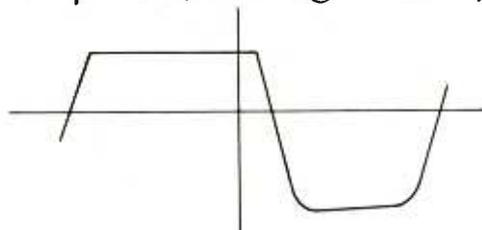


Figure 2
Distortion Components for Two Stage Triode Amplifier



Waveform for triode amplifier at 12 dB Overload

At last, a studio mastering tape that's better than the one everybody's been using.

A while ago, someone came along with a new tape that, admittedly, was a better mousetrap. But it was not the ultimate mousetrap.

There were problems with that tape, good as it was. Problems which we at Audio Devices have been able to solve.

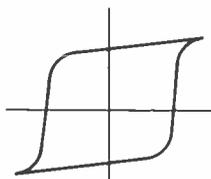
First problem:

How do you get even more energy out of each particle?

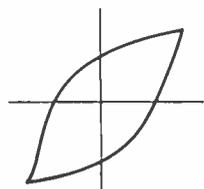
Solution:

By improving the dispersion.

Poorly dispersed particles clump together causing magnetic losses due to interaction and energy cancellations. The new Audiotape HOLN has higher output and lower noise than the tape you switched to years ago. The new Audio tape iron-oxide particles deliver more energy.



Hysteresis loop of Audiotape HOLN.



Hysteresis loop of poorly dispersed tape.

Second problem:

How do you reduce print-through?

Solution:

Uniform particle size and dispersion are part of the solution.



Audio's secret processes are the other part. The results aren't secret, though: Audiotape HOLN has reduced print through by at least 2 dB, and typically 3 dB over the tape you switched to a few years ago.

Third problem:

How do you reduce headwear?

Solution:

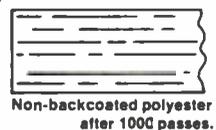
Use a smooth coating surface with a built-in permanent lubricant. That'll reduce your headwear.

Fourth problem:

How do you improve handling and storage reliability?

Solution:

Use a backcoating that's super-durable. Cushion-Aire™ backcoating, with its controlled surface texture, improves high-speed handling and winding, and eliminates the causes of cinching, spoking, and other pack deformities.



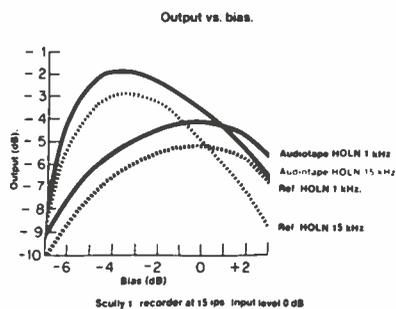
Non-backcoated polyester after 1000 passes.



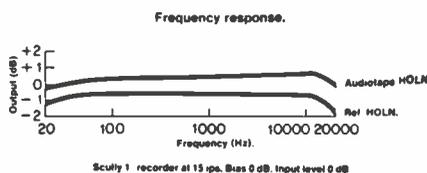
Cushion-Aire backcoating after 1000 passes.

Another problem is maintaining consistency of product. We've solved that too. By having a superior degree of quality control.

For a complete discussion of the improvements Audiotape features over the leading backcoated tape, send for our detailed literature.



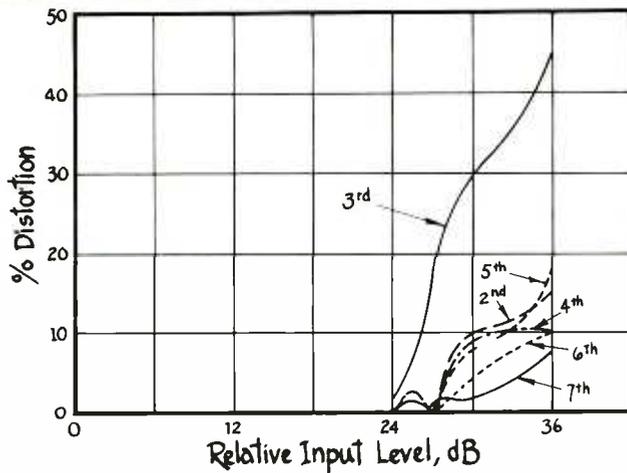
Scully 1 recorder at 15 ips. Input level 0 dB



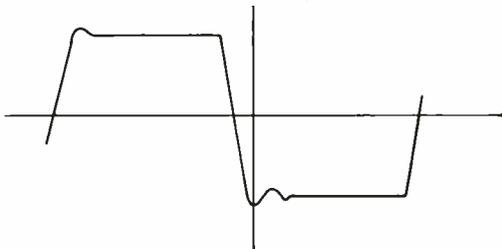
Scully 1 recorder at 15 ips. Bias 0 dB. Input level 0 dB

audiotape™

Audio Devices, Inc., A Capitol Industries Company, 100 Research Drive, Glenbrook, Conn. 06906

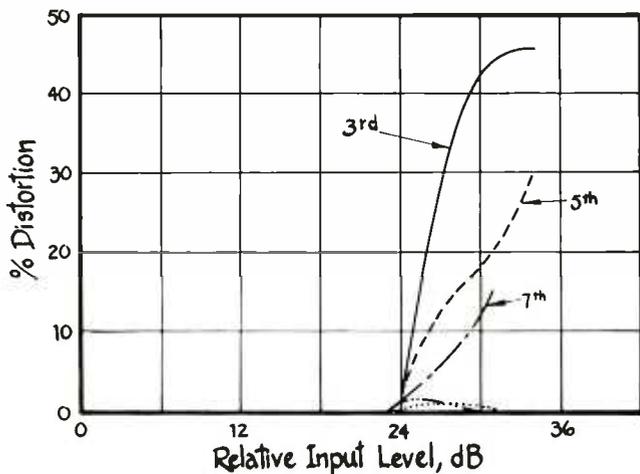


Distortion Components for Multistage, Transformer Coupled, Transistor Amplifier

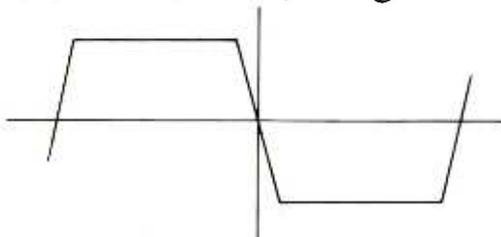


Waveform for transistor amplifier at 12dB overload

Figure 3



Distortion Components for Monolithic Operational Amplifier with Hybrid Output Stage



Waveform for operational amplifier at 12dB overload

Figure 4

same. But, from figures No. 1 and No. 2 we see that the actual distortion components are quite different. Look at the waveform for the transistor amplifier, it is almost a square wave, quite different from the tube. Next, in figure No. 4, is the distortion for an IC amplifier. Here again the 3rd harmonic is the strongest but, there are two more very different characteristics. One, there are no even numbered harmonics present. Second, the 5th and 7th harmonics are very strong. Look at the output waveform, with sharp and symmetrical clipping.

From these spectrum plots of distortion we have found out then that each type of amplifier is generating different harmonics as it goes into overload. From our listening tests we know that the audibility of this distortion varies from one amplifier to another. With this in mind we decided to check out the effect of various harmonics on our musical hearing. Fortunately there is quite a bit of published information in this area. It seems that instrument builders and physicists have been working on mechanically varying harmonic structure of sounds for centuries. What makes a trumpet sound different from an oboe has a great deal of relevance to what makes a tube sound different from a transistor. Basically harmonics can be broken into two parts. Odd harmonics like the 3rd and the 5th produce a 'stopped' or covered sound. Even harmonics like the 2nd and 4th produce a 'choral' or open sound. In combinations the 2nd, 3rd, 4th and 5th produce instrument sounds particularly the 'brassy' type. This is quite basic and needless to say no where near the whole story for the lower harmonics. For our purposes it will do nicely. Next, the upper harmonics like the 7th and higher actually get out of tune musically with our Westernized ear, they are not musical. As these high harmonics begin to appear they sound grating and very noticeable. The musicians and physicists have called this effect 'edge'. It's the bite of the sound. Actually engineers are familiar with this in the form of the 'presence' equalizer. Studies have been done which show that the edge is a strong ear clue for loudness. A trumpet playing loud or soft maintains the same balance of fundamental on lower harmonics, its the balance of the edge to the fundamental which actually clues the ear that it is playing louder, not nearer.

Now, to apply what we've learned to the problem at hand: tubes versus transistors. From the electrical tests we see that transistor amplifiers generate strong 3rd harmonic distortion when they overload. The instrument theory says that 3rd harmonic generates a 'covered' sound. Hence when the producer I spoke to said that transistor records sounded like they were under a blanket he didn't

realize just how good a distortion analyzer he was. IC's, too, generate this strong 3rd harmonic but here there is the factor of 'edge' to take into account. Besides the 3rd the IC generates strong 5th and 7th which sounds awful. Right away you hear it and correct the overloading. This agrees with the listening tests where the amp went into audible distortion with a couple dB over the overload point. IC's actually have an audible warning system which prevents generating the 3rd harmonic which is responsible for 'covered' sound. With IC's then you stay pretty much in the linear range and get very clean sound. Now, if you don't notice the distortion especially on short transients you get that 'shattered glass' effect. Exactly the sound that some of the musicians said they heard. It comes from too much edge on the attacks.

Tubes are quite a different story from the solid state amplifiers. When the tube amp overloads it adds all the lower harmonics. You get the 'brassy' sound on overload instead of the 'covered' sound. The higher harmonics don't add appreciable edge until the amp is quite away into distortion and very brassy. This point, according to the listening tests can be 15 to 20 dB into distortion. Is this bad? It depends upon what you are looking for in your finished recording. The reason why the tube records seemed to jump out of the speaker is because every input signal is being compressed and equalized (distorted). You hear more bass because the higher harmonics are enhanced and cause a 'synthetic bass' effect. You get the clarity of mid range at low volume again because of the compression, you are recording the signal at a higher level relative to the normal 'real' level. You cannot get these effects with transistor amplifiers. Neither can you get them with tube amplifiers if they are not operating in the right distortion range. How do you know if it's the right range? You take your chances.

My point is not to start a revival of tube amplifiers but rather to shed some scientific light upon a controversy which has been long on answers and short on fact. Perhaps the real question we should all be thinking about is: are records supposed to be a recreation of the 'real' acoustic event or are they a manufactured product tailored to make record players sound good? Either way we have a long way to go.

As a non-technical friend asked me a while ago, "Why is recorded music sometimes so soft I have to turn up the volume and the next minute it's so loud it's blasting? Why can't you record it so the entire record comes out at the same loudness?" To think we spend so much time and money on a 70 dB dynamic range!!!

Listen to the Sound of Dependability

STL test tapes maintain a reputation as the most dependable and accurate tapes you can buy because of the consistently high standards produced on the finest precision equipment.

In addition, they are available in more sizes than that offered by any other manufacturer in the world.

Listen to the sound of dependability . . . and accuracy. Order STL test tapes and find out where your system really is.

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Tennessee distributors: Auditronics, Inc., Studio Supply Company

Circle No. 120

YES, YOU CAN PAY LESS when you need a completely self-contained **PROFESSIONAL MIXER SYSTEM.**

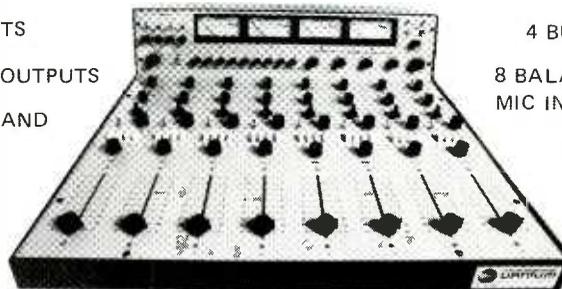
The QM-8 contains all the features and functions of a full-size console.

8 LINE INPUTS

4 MONITOR OUTPUTS

ECHO SEND AND
RECEIVE

LOW NOISE



4 BUSS OUTPUTS

8 BALANCED LOW-Z
MIC INPUTS

HEADPHONE
CUE SYSTEM

2 POS HIGH AND LOW FREQUENCY EQUALIZERS

MONITOR MIX SYSTEM STEREO OR QUAD

XL INPUT AND OUTPUT CONNECTORS

LARGE ILLUMINATED VU METERS

PATCH POINT PREAMP OUT-EQ IN

QUAD PAN POTS ON EACH INPUT

The QM-8 mixer system is ideally suited for recording, production or sound reinforcement. It's small size (19"x19"x7") and light weight (37 lbs) make the QM-8 equally at home as permanently installed console or portable remote unit.

PRICE \$1995.00

Circle No. 121



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Telex tape duplicating equipment...you start with what you need, but you're never likely to outgrow it.

Every possible thought has been given in the design of the Telex tape duplicating system to make it a modular, step-by-step expandable system with the highest degree of flexibility we know of.

You can have cassette-to-cassette, reel to cassette, reel-to-reel or even cassette to reel duplicating. All this with true professional studio quality and all the commonly required head configurations available.

Simple, push button operation assures consistent top quality reproduction even with non-technical operating personnel.

Plug-in componentry makes the Telex system easily expandable in true "building-block" fashion.

Your Telex dealer can show you exactly what equipment you need and how economically he can satisfy that need.

Write Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420.

PRODUCTS OF SOUND RESEARCH
TELEX[®]
COMMUNICATIONS, INC.

7302

NEW PRODUCT NEWS

MEMORIES LITTLE HELPER AUTOMATED MIXDOWN SYSTEM

Allison Research Inc. of Nashville has introduced their "MEMORIES LITTLE HELPER" system of Automated Mixdown.

Memories Little Helper is unique in the respect that it allows existing control boards to be easily converted to automated operation without extensive down time or mechanical alterations.

In a typical installation, the wires to each channel fader are brought out to a special multi-pin connector, which serves as an interface point for the Memories Little Helper unit. When a dummy plug is inserted, normal non-automated console operation is restored.

When the automation system is connected, however, the audio is routed through voltage controlled amplifiers contained in the Memories Little Helper package, while a source of 5 vdc is fed through the faders. Installation time for most consoles is said to be 4 to 6 hours.

Once installed in this manner, Memories Little Helper allows automated mixing on the console faders themselves, rather than on a relatively awkward external fader bank, or controller. (The company does, however, have available a compact external fader bank for applications where console modification is undesirable, such as demo rental and other un-committed purposes.)

Another side advantage claimed for the quick disconnect, wired in console approach is that it allows studios with more than one console to easily move the system from room to room while still maintaining "on the console" automated mixing. Along these same lines, it is interesting to note that several console manufacturers are currently considering the inclusion of Memories Little Helper "quick connect plugs" on their non-automated consoles.

THE PACKAGE:

A complete 16 track unit measures only 8 3/4" x 19" x 9" and can be rack mounted, pedestal mounted or set on a table or producers desk.

Contained in the package are the programmer, 16 voltage controlled amplifiers (VCA2-1), all operating controls, level-match and over-range indicators and all associated circuitry.

NEW MICMIX REVERBERATION UNIT

The MICMIX MR-II Master-Room is a professional, studio-quality unit and is one of a series of economical designs which permit application of exactly the right amount and type of reverberation to individual tracks or to any type of mixdown. The Master-Room series is avail-



THE CONTROLS:

As seen in the close detail photo, each of the individual channel modules contains the following operating controls or indicators:

Read, write and update controls (momentary, illuminated buttons with electronic latching. Used for selection of individual track operating modes.)

Level-match null indicators (LEDs used for locating relative fader to programmer relationship, when switching from read to write modes. These LEDs also serve as overrange indicators.)

Group master selector which allows sub groups (i.e. rhythm, horns, voices) to be assigned to one of five grouping sub-masters, whereby they are controlled in blocks, while maintaining echo and panning perspectives. The effect of the group master may be programmed or non-programmed.

MASTER CONTROL MODULE:

A seventeenth module in the package contains controls for simultaneously placing all modules in "read" "write" or "update" modes, as well as data track change-over selector and group master status selector.

All controls, individual and master, may be remote controlled. A pre-set control module is also in development.

THE PROGRAMMER:

The programmer in the Memories Little Helper system is, of course, the

Allison Research / Automated Processes unit, and is the same device used in automated consoles currently being delivered by Automated Processes Inc.

Its unique multi-level digital code is claimed to offer larger capacity, higher update speeds and greater inherent protection from dropouts and splices than more conventional bi phase digital systems. It is readily expandable to up to 256 variable automation functions (2048 equivalent bit functions) via plug-in cards. The physical space allotted in the Memories Little Helper system, however, allows expansion to only 128 variable functions.

SYSTEM SPECIFICATIONS:

Functions automated, individual track level, master level, 5 grouping sub-masters. Linear range of controls, 100 dB. Update speed, to 125 scans per second. Accuracy-resolution, .5 dB (first 50 dB attenuation), 2 dB (last 50 dB attenuation), (not affected by multiple passes). Signal to noise ratio, 111 dB typical. Distortion, under .05% typical. Max attenuation (kill), 130 dB. Storage medium, master or slave tape machine, (2 tracks required).

Complete 16 track system \$9,250.00. Complete 24 track system \$13,500.00. Available November 1973.

ALLISON RESEARCH, INC., 2817 ERICA PL., BOX 40288, NASHVILLE, TN. 37204

Circle No. 123

able in equivalent room volumes from 4000 to over a million cubic feet. The MR-II model is the 4K cubic foot equivalent and has a nominal decay time of 2 seconds, which is most applicable to both speech and music. The larger equivalent room volumes are more useful with strings and similar instruments. Since a

reverb is 'captured' by the most predominant sound applied, individual-track reverbs are becoming highly desirable and Master-Room's cost allows the best type and amount to be applied to a particular type of sound.

Master-Room incorporates a patent-pending design which eliminates the need

Who would want to own...an 80dB dynamic range record?

You would, once you heard one.

Examples of records selling because of superb sound, alone, are becoming more numerous. And small wonder!

For, in a recent survey of customers who already own high-quality, home sound systems, over 80% of those who responded to a request for suggested improvements said, "Do something to get better sounding records, tapes and FM."

How can records of 80dB dynamic



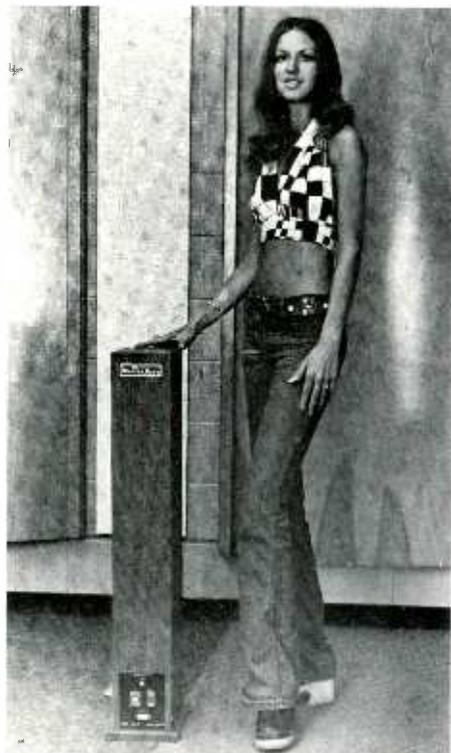
range be produced? The fact is that only the Burwen Noise Eliminator makes such recording possible . . . and it's expensive! You will be convinced, as we are, that it can boost your record sales 10% to 20% . . . and decide that it is more than worth the investment.

To get complete facts on the Burwen Noise Eliminator, Model 2000 . . . just call or write:

 **Burwen**
LABORATORIES, INC.

209 MIDDLESEX TURNPIKE, BURLINGTON, MA. 01803/TEL. (617) 273-1488

for any tape-delay mechanism as well as the 'twang' and flutter-echo effects generally found in other moderately priced reverbs. Each Master-Room includes a Brilliance control to adjust the character of the Room to fit the type of sound being processed. Featuring monaural drive and stereo-perspective outputs, input impedance on the standard model is a bridging 10K ohms, with 600 ohm balanced input units also available. Standard output impedance is 150 ohms on each channel which is enough to drive loads of up to 500 ohms at rated output. 600 ohm balanced outputs are also available in the Master-Room series.



Standard input level is set for +4 VU, but almost any other design level is readily obtainable. Standard output level is also +4 VU. Saturation level on the Master-Room series is at +18 dBm peak and noise is rated at -66 dB. An acoustic susceptibility level of 100 dB SPL permits use of the Master-Room in the monitor area without feedback problems, while its small size and weight (the MR-II is only 38 inches high and weighs 22 pounds) allows it to be placed almost anywhere. XLR connections are featured for both input and output with mating connectors supplied, and the unit is housed in an attractive walnut finish wood cabinet. The unit is self-contained and operates on 115 volts, 50/60 Hz power.

Price: \$985 (Standard Model MR-II), and up.
MICMIX AUDIO PRODUCTS, INC., PO BOX 9691, DALLAS, TEXAS 75214

Circle No. 126

DUAL CHANNEL FREQUENCY SELECTIVE LIMITER FROM AUDIO/TEK

Audio/Tek's Model 500 Frequency Selective Limiter is designed to limit high frequency energy below a fixed value. With this capability, recording studios,

tape mastering and duplicating facilities, and FM broadcasters can eliminate objectionable high frequency distortion or carrier modulation.



The Model 400 operates much like a standard program limiter except that it does not cover the full audio band width. Only the high frequency components are controlled.

It is particularly effective in cassette duplication. Masters processed using the Model 400 Limiter significantly reduce high frequency distortion, such as sibilant sound, on the duplicated tapes.

The Model 400 Limiter is compatible with standard studio grade equipment. With an internal power supply, it is totally self-contained. A single knob controls primary power and limits in/out functions. Front panel lamps provide visual indication of limiter modes.

Price, \$1050.
AUDIO/TEK INC., P.O. BOX 5012, SAN JOSE, CA. 95150

Circle No. 127

FERROGRAPH SUPER SEVEN TAPE RECORDER FROM ELPA MARKETING INDUSTRIES

The Ferrograph Super-Seven, a 3-speed 10 1/2" reel recorder, offers 2 and 4 track stereo and mono models with or without integrated power amplifier and speakers. With 3-speeds (7 1/2, 3 3/4, 1 7/8 ips), Super-Seven is the only reel-to-reel machine offering 1 7/8 ips and only Ferrograph offers this speed with Dolby "B" noise reduction.

An optional high speed unit operates at 15, 7 1/2 and 3 3/4 ips and is available at no additional cost. (Dolby "B" noise reduction system is also available at all speeds except 15 ips. Dolby is not available at 15 ips on any 10 1/2" machine).

A host of thirty-five features includes instant slur-free starts on record and playback, bias adjustment on front deck, variable speed wind/rewind for fast editing, push button tape source comparison for each channel, professional electronic editing, push button bias readings, push

button tape track transfer, mike-line signal mixing and automatic demagnetization of tape heads.



Solid state with FET front end, Super-Seven is a product of the Ferrograph Company, Ltd., Great Britain's leading producer of quality tape recorders.
ELPA MARKETING INDUSTRIES, INC. NEW HYDE PARK, N.Y. 11040 AND SCOTTSDALE, AZ. 85260

Circle No. 128

NEW ANNIS COMPANY KIT PROVIDES EVERYTHING NEEDED TO MEASURE AND ELIMINATE MAGNETISM FROM AUDIO AND VIDEO TAPE RECORDER COMPONENTS



Known as the Han-D-Kit, the kit provides everything needed to measure and eliminate damaging magnetism. Included is a pocket magnetometer to measure residual magnetism, a clip-on extension probe to reach recessed components,



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Circle No. 129

Re/p 45

dual-purpose Han-D-Mag demagnetizer, experimental test strips, and complete instructions. Han-D-Mag has a demagnetizing field strength of over 350 oersteds at ¼" distance from end of probe, compared to 70-80 oersteds on demagnetizers formerly available.

Complete measurement and demagnetizing of an average recorder takes only a few minutes. In operation, the Han-D-Mag plugs into any 115 VAC circuit. Its plastic jacketed probe is shaped to demagnetize hard-to-reach components. The opposite, flush pole end, measures over 800 oersteds, so powerful it can be used for limited bulk demagnetizing of tapes up to ¼" wide if regular bulk tape eraser is not available.

Two kits are offered by Annis. Economy kit 20/B5 at \$29.75 includes the standard magnetometer, while Deluxe kit 25/S5 at \$51.00 features a jewelled magnetometer with greater stability and accuracy. Above prices are postpaid in U.S. A.

Special export model kits are available with 230-volt 50/60 Hz Han-D-Mag at \$4.50 extra, plus export shipping charges.

R.B. ANNIS COMPANY, 1101 NORTH DELAWARE ST., INDIANAPOLIS, IND. 46202

Circle No. 130

PERFORMERS' MODEL 671 SINGLE-D MICROPHONE

Buchanan, Michigan, September 12, 1973 - The Electro-Voice Model 671 is a new "ball type" single-D cardioid microphone which emphasizes low frequencies when used "close up." Its carefully shaped response is ideal for the exacting needs of high quality sound reinforcement, public address, and recording.



A new head design and an exclusive hologram designed Volumetric™ diaphragm provide exceptionally wide, linear response at all angles of incidence for high gain-before-feedback in sound reinforcement applications. Off-axis coloration is virtually eliminated. The head subassembly is user replaceable. As part of this assembly, a newly designed and extremely effective shock absorber iso-

lates the transducer assembly from mechanical noises. An internal Acoustifoam™ filter allows close talking without excessive "P-popping" and prevents dirt and magnetic particles from accumulating on the diaphragm.

The 671 uses the broadcast standard A3M-type connector and the matching tapered cable plug becomes a part of the microphone's shapely silhouette. This "ball type" microphone's more beautifully detailed styling is indicative of its outstanding performance.

The microphone is equipped with a locking device to keep the switch in the "on" position when desired. Impedance is selectable Hi-Z or Lo-Z at the connector.

Suggested resale net price of \$54.75 for the Model 671. Also available are Models 671P, with phone plug at end of cable at \$57 net, and the 671PC with plug and in handsome carrying case priced at \$60 net.

ELECTRO-VOICE, INC., 600 CECIL STREET, BUCHANAN, MI. 49107

Circle No. 132

MCI ANNOUNCES TAPE TRANSPORT, RECORDING CONSOLE PRODUCT LINE UPDATES:

MCI JH-100 SERVO DRIVEN TAPE TRANSPORT

The MCI JH-100 transport replaces the JH-10 transport in MCI's JH-16 and JH-24, 8, 16, and 24 track recorders. The JH-100 combines state of the art electronically controlled tape handling and the following unique features:

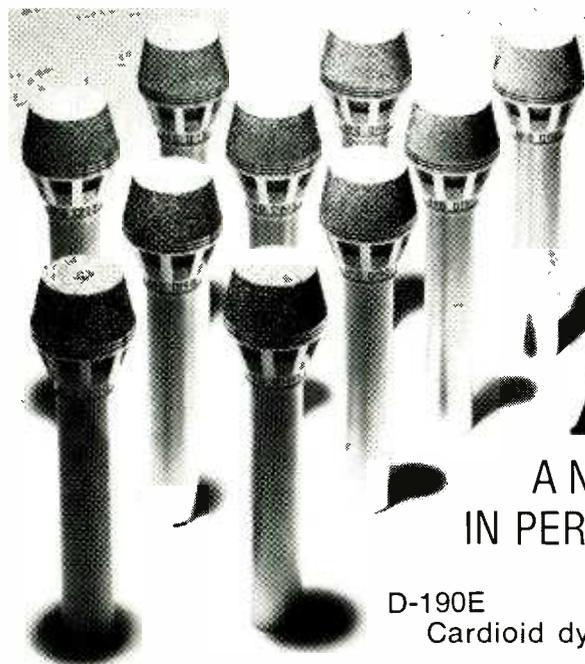
D.C. capstan servo drive. Super accurate crystal controlled. Fixed tape speeds, 15-30-ips (7.5 ips available).

Stable variable speed operation from front panel for special effects and speed corrections.



Wide range external speed programming for inter-machine sync, audio/video or audio/audio remote speed control, special effects.

"Piano Proof" flutter; typically .04% 15 ips Din weighted, .06% 15 ips Din unweighted.



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Cardioid dynamic microphone.

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AKG CANADA • DIVISION OF DOUBLE DIAMOND ELECTRONICS • SCARBOROUGH, ONTARIO

AKG 35

All mode reel tension control system, constant tape tension, high speed accuracy anywhere in reel, consistent tape packing.

Full manual velocity programming for cueing, editing, special effects.

Totally "Relay-Less" design with full TTL deck logic.

New "Mark II" auto locator, full bidirectional operation, key board entry, readout and operation in real time, no over shoot-controlled approach speed.

New decor and trim.

MCI, 4007 N.E. 6th AVENUE, FT. LAUDERDALE, FLORIDA 33308

Circle No. 133

MCI JH-416 'STOCK' RECORDING CONSOLES



In response to input from the 65 owners of the MCI JH-416 recording console the following features have been added to the MCI 'Stock' board:

Improved conductive plastic faders by Penny and Giles Ltd with improved illumination.

Illuminated mute switch with channel number.

Full reciprocal midrange equalization-boost or cut of 14dB.

EQ in/out switch.

Mike input pad and new higher gain

preamp to accommodate the full range of professional microphones (I.M. distortion @ ODBM input less than .15%).

Monitor mute switching and echo return muting.

Full quad panning - both L-R and F-B for 360° quad positioning on all input modules and echo returns.

48 additional tie - lines and jacks on patch bay.

MCI, 4007 N.E. SIXTH AVENUE, FT. LAUDERDALE, FLORIDA 33308

Circle No. 134

NEW ECONOMICAL PROFESSIONAL SOUND LEVEL METER FROM SCOTT INSTRUMENTS

Scott Instruments announces its new portable 451C professional sound level meter with "C" weighting for flat response. Designed for use by the audio professional and the advanced enthusiast alike, the 451C instrument is pocket sized, yet gives readings which meet or exceed ANSI type S3C accuracy.



Its range of 45 to 130 dBC sound pressure level permits measurements of ambient and background noise as well as

the signals of interest. Its large, easy-to-read meter reads directly in dBC without interpolation or computation. The 451C is housed in a rugged, all metal case and uses a single transistor radio battery giving over 200 hours operation. The 451C is priced at \$98.00 and is available from professional audio dealers or the factory. For full product information and list of dealers contact the manufacturer. SCOTT INSTRUMENT LABORATORIES, 30 CROSS STREET, CAMBRIDGE, MASSACHUSETTS 02139.

Circle No. 135

NEW UREI "ACTIVE" CROSSOVER NETWORK FOR BI-AMP AND TRI-AMP OF TWO-WAY AND THREE-WAY SPEAKER SYSTEMS

A radically different concept in Electronic Crossover Systems is employed ahead of power amplifiers to increase efficiency and performance of loudspeaker systems. Two plug in cards, the 521L (for two-way) and 521H (for mid and high in three-way) make the crossover frequencies continuously tunable: 200 Hz to 2 kHz for 521L and 1 kHz to 10 kHz for 521H. No changing of fixed components to establish optimum crossover frequencies for any two-way or three-way speaker system. All inputs and outputs are transformer isolated but may be bypassed if desired. Filter characteristic is 2 pole Butterworth, yielding 12 dB per octave or 40 dB per decade attenuation rate with essentially perfect frequency flatness within the passband. Available with or without internal power supply. One card (521L) is required for each two-way system; two cards (521L and 521H) provide three-way outputs for tri-amplification.

Model 521P housing holds four cards and has its own power supply; Model

The time has come when digital delay for both the recording studio and sound contractor is no longer a luxury but a necessity. Pandora Systems has developed a unit which fulfills the needs of both, and has flexibility and technical excellence that surpasses any comparable device available on the market today.

High resolution 12 bit digital encoding produces a full 72db dynamic range naturally, making the use of signal altering noise reduction unnecessary. Coupled with less than .1% distortion (measured at full output 400 HZ) the Time Line literally is a black box that

**DON'T
DELAY...
TIME LINE
IS NOW!**

generates time delays without any alteration to the signal.

By using modular construction the unit can be expanded at any time. The main frame holds 449 ms. of delay and 5 outputs. Inter-connecting frames are available for longer delays.

Delay times are variable in 3 ms. steps by simple front panel patching or internal strapping for permanent installations.

Tie this all together with the lowest basic price in the industry, the Time Line becomes the ultimate time machine. Pricing starts at \$2,500. Dealer and contractor inquiries invited.

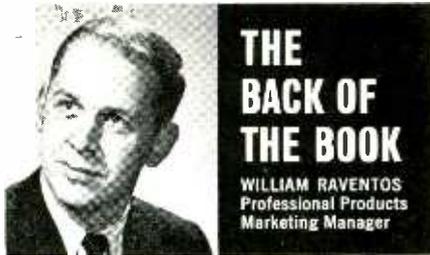


(615) 320-0623 P. O. BOX 964, **PANDORA** NASHVILLE, TENN. 37202

Circle No. 136

Re/p 47

One of a series of brief discussions
by Electro-Voice engineers



THE BACK OF THE BOOK

WILLIAM RAVENTOS
Professional Products
Marketing Manager

Part of the fun of reading any microphone catalog is looking at the new models designed to solve old problems. While most manufacturers, ourselves included, put their greatest emphasis on microphone design, the area of accessories can often be vitally important to the operating engineer.

Several items soon to be seen in the E-V catalog deserve special notice. New line matching transformers that convert 150 ohms to Hi-Z have been introduced. Not only are they smaller and more convenient (with plugs already installed, for instance) but performance has been upgraded as well, the result of superior transformer design.

The Model 380 Mike Line Attenuator is a simple device (you can easily build your own from our information) but when packaged with plugs installed in a small tube, the convenience of controlling pre-amp overload by simply plugging in a 380 cannot be overlooked.

The Model 513A High-Pass Filter is an improved version of this useful tool. Cost has been cut 1/3, and weight by even more. Connectors are now integral and the switch has been eliminated. Getting rid of rumble, low-frequency wind noise, and other problems is now a simple plug-in operation.

A novel answer to stage sound pickup needs is the "Mike Mouse". It's a molded Acousti-foam TM support that permits locating a microphone inconspicuously on the stage floor surface. Our original discussion of stage pickup methods tell how and why this simple bit of foam worked so well. Write for Sound Techniques, Vol. 3, No. 1.

There are times when you may wish to use a professional microphone with an On-Off switch and stud mount. Enter the Model 342 Stud Adapter. It can be added to any 3/4" mike with XL-style connector. An Allen screw firmly clamps the mike without marring the case, and the unit can be freed from the stud adapter whenever desired.

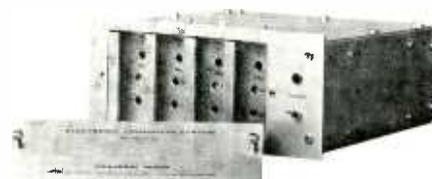
Theft of microphones is a common, and seemingly increasing problem. The E-V Model 340 Security Clamp is designed to thwart the thieves. Two Allen screws can be used to hold the mike. One squeezes a shoe that clamps the microphone firmly without marring. The other can actually bite into the case of the mike, making unauthorized removal a major problem. It is generally agreed that if the microphone can't be stolen in the first 15-20 seconds, the likelihood of loss is greatly reduced. This security clamp should sharply cut your losses.

E-V is continually on the lookout for new ideas from the field that can increase the utility and effectiveness of our microphones. The accessories in the back of our catalogs are our response to your need for greater flexibility in meeting today's sound challenges.

For reprints of other discussions in this series,
or technical data on any E-V product, write:
ELECTRO-VOICE, INC., Dept. 1033J
623 Cecil St., Buchanan, Michigan 49107



Circle No. 137



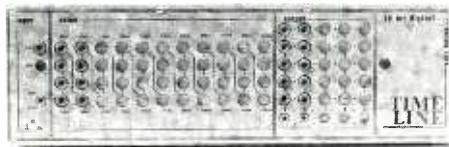
521E holds four cards and has no power supply, but can be powered from the 521P. Up to eleven cards can be mounted in a 19" rack (3½" high) for large installations, using a standard card cage and external ± 15 to 24 vdc supply.

Send for complete technical information.

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

Circle No. 138

PANDORA DIGITAL DELAY LINE TIME LINE - a high quality digital delay line specifically designed for professional audio. High resolution 12 bit encoding produces a full 72 dB dynamic range naturally, making the use of signal altering noise reduction systems unnecessary.



The main frame is expandable to 5 outputs and 449 ms of delay. Larger units are available. The delay time switching is accomplished by simple patching in 1 ms. steps. The basic frame is 89 ms. 1 output.

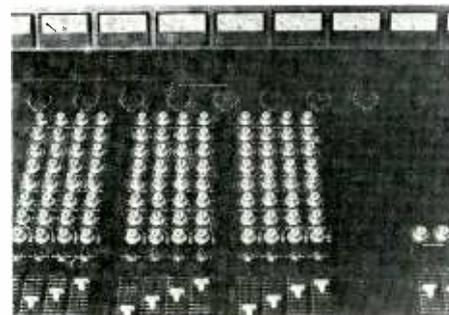
Price - \$2,500.00.

PANDORA SYSTEMS, P.O. BOX 964, NASHVILLE, TN. 37202

Circle No. 139

MULTI-TRACK SERIES "B" MIXING CONSOLES

Multi-Track of Hollywood California announces the addition of the Series "B" modular mixing console system to their product line. This mixing system was designed by the same engineers who developed the vari-band sweep equalizer. Channel features include 9 frequency equalization, solo-mute, dry channel pan, echo pan, monitor mix, earphone mix, echo send, line-mic switch, input gain



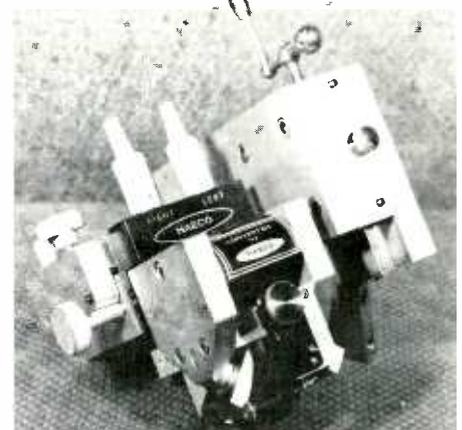
trim, bus selector, and in line fader. Amplification is plug in operational amplifier and all signal switching is solid state MOS analog switch. All circuits are designed to 1% tolerances and are made from 100% American components. This series according to Multi-Track is priced half-way between the low cost import consoles and the twenty thousand dollar low cost super consoles.

MULTI-TRACK, P. O. BOX 3187, HOLLYWOOD, CA. 90028

Circle No. 140

HAECO IMPROVED SUSPENSION ADAPTER FOR WESTREX / CUTTERHEADS ANNOUNCED

HAECO introduces a new suspension for use with Westrex heads mounted to Scully lathes. The suspension helps significantly in the reduction of advance ball pressure, thereby reducing the sometimes troublesome scoring problem. The HAECO CS-1 suspension can be directly retrofitted to any existing Scully lathe and includes within its structure the facility for automatic headlift, automatic heated stylus control, and built-in dash pot.



Besides effectively lowering the mass of the cutterhead, one of the most important features of the suspension is the ease of removal and re-insertion without disturbing the absolute diametric relationship of the cutting stylus.

HOLZER AUDIO ENG. CORP., 14110 AETNA ST., VAN NUYS, CA. 91401

Circle No. 141

MODEL DL42, LONG REACH MICROPHONE

The Cardiline Model DL42 is said to represent the newest state-of-the-art generation in highly directional microphones, utilizing a combination of characteristics of hypercardioid and distributed front opening designs. The hyper-cardioid action gives the microphone essentially uniform characteristics at frequencies up to 500 Hz. At this point, the distributed front opening takes over for the balance of the range to which it responds.

Benefits derived from this new design include wider range response, better con-

trol of polar response, plus high level and greater directivity. These features make possible a working distance which is two, three, or four times that of conventional directional microphones.



In deriving the polar pattern (off axis response) of the microphone, specific considerations were made to achieve the lowest possible directivity index at all frequencies (highest possible directionality). The directivity index even down to 100 Hz approaches the theoretical. Maximum attenuation of off-axis energy occurs to the sides of the microphone where such rejection is often most useful.

An entirely new shock-mount design greatly reduces susceptibility to mechanical shock transference. Also, tailored low-frequency response allows accurate reproduction of input material, while greatly reducing wind noise problems in the low-frequency area.

To prevent wind noise during outdoor use or for rapid panning in the studio, the DL42 is equipped with an Acoustifoam™ windscreen. Shaped low-frequency response also greatly reduces wind noise problems.

Ideal for boom use, fish pole use, or handheld applications where added working distance is required, the DL42 offers wide-range response in a comparatively small size, plus greatly increased directivity and working distance.

The suggested net professional price: \$300.00.

ELECTRO-VOICE, INC., 600 CECIL ST., BUCHANAN, MI. 49107

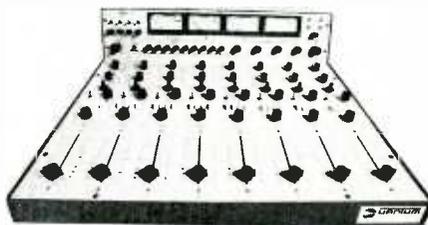
Circle No. 142

NEW QUANTUM QM-8 MIXER SYSTEMS

Torrance Ca. . . The QM-8 Mixer System is ideally suited for recording, production or sound reinforcement. It's small size (19"x19"x7") and light weight (37 pounds) make the new QM-8 console equally at home as a permanently installed console or as a portable remote unit. The unit is said to contain all the features and functions of a full size console. All inputs are XL type female connectors. Mic inputs are 200 ohms balanced, line inputs 10K ohms unbalanced. Buss outputs are XL type male

connectors. Monitor outputs on ¼ inch phone jacks. The electronics in QM-8 were designed and evaluated over a 2 year period before being placed in production.

Designed for stereo or quad operation, the 8x4 console includes monitoring and headphone cue systems. The input module contains high and low frequency selector switches and high and low frequency boost-cut controls. An input selector switch selects the signal for the module and controls microphone pre-amp gain. A pan selector switch that switches pan pot operation to front or rear. Buss assignment switches an echo send control, and a slide pot module level control.



Low frequency equalization at ±12DB max at 50HZ or 200HZ. High frequency equalization at ±12DB at 3KHZ or 10 KHZ. Output at ±18DBM before clipping. S/N ratio is 70DB. Response ±1DB 20-20,000 HZ.

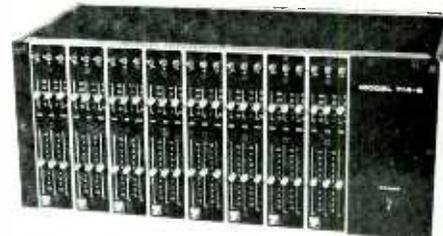
Priced under \$2000.

QUANTUM AUDIO LABS, 1310 SARTORI AVE., TORRANCE, CA. 90501

Circle No. 143

CLOVER MODEL 714 EQUALIZER

Clover systems announces the introduction of the Model 714 equalizer. This unit offers many unique and valuable features and is described as a plug-in fifteen frequency active equalizer incorporating linear motion slide controls and high performance integrated circuitry to provide a new advance in useability and performance.



Low frequencies are 50, 100, 250, 350, and 500 HZ. Midrange frequencies are 500, 1100, 1700, 2500, and 3500 Hz. High frequencies are 2500, 5000, 7000, 10000, and 12000 Hz. In addition, there are separate high and low-pass filters with cutoff frequencies of 85 Hz and 11 kHz respectively. An in/out switch is provided to defeat the equalizer without changing the control settings. The unit has unity gain, and can be operated either balanced or unbalanced.

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tion at fifteen frequencies in three ranges, continuous boost and attenuate controls, independent high and low-pass filters.

The unique layout of the controls is the result of user-oriented design program, and results in a tremendous improvement in speed and useability since the control settings can be observed with peripheral vision from any angle or distance. EQ changes are completely free of pops and clicks.

Clover is also offering this equalizer in self-powered units of 4 or 8, designated Model 714-4 and 714-8 respectively, which are ideal for upgrading or expanding existing installations.

CLOVER SYSTEMS, 6232 SANTA MONICA BLVD., HOLLYWOOD, CA.90038

Circle No. 145

3M MINCOM INTRODUCES TEST SET FOR AUDIO TAPE RECORDERS

A test set that shows at a glance if tape recorders and other audio systems are operating correctly has been introduced by 3M Company, Mincom Division.

The 3M brand Model 6500 Recorder Test Set was designed to simplify the testing process for the recorder manufacturer, user and serviceman. 3M says special skills are not required to operate the Model 6500. The instrument's "quick look" meter has calibrated color bands to indicate acceptable, marginal or unacceptable performance of the device being tested.

The lightweight, portable unit's meter reads a composite signal for testing input and output levels, frequency response, harmonic distortion, signal-to-noise ratio and tape transport flutter for a wide cross section of audio tape recorders and systems, 3M says.

For example, the flutter and harmonic distortion levels can be measured up to 3 percent maximum and signal-to-noise ratios from 20 to 50 decibels.

By the flick of a switch, the operator can select any of three individually calibrated sets of test parameters to cover different quality recorders - from those

of relatively low performance to those of professional quality.

For operator convenience, a step-by-step test procedure is provided under a transparent cover on top of the unit. A self-test feature also is provided to verify proper operation of each of the test functions.



Potential uses include production testing, in-service calibration and repair testing of audio tape recorders, audio multiplex systems, audio power amplifiers and voice logging tape recorders. Other uses include a daily confidence check of audio recorders in offices and schools, rapid quality assurance testing by manufacturers, and recorder production line test stations.

The unit, which measures 10-3/4 inches wide, 12 inches deep and 5-1/2 inches high, weighs less than 10 pounds and uses either AC power or six standard "D" cell batteries.

The Model 6500 is priced at \$1,595. Availability is scheduled for early 1974. FROM: 3M COMPANY, ST. PAUL, MN. 55133

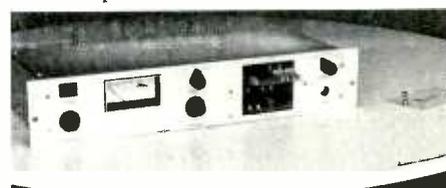
Circle No. 146

NEW TAPE ELECTRONICS UP-GRADES SINGLE-CHANNEL RECORDERS

Inovonics' Model 360 Tape Recording Electronics replaces tube-type electronics in older single-channel professional recorders.

It is designed as a plug-for-plug replacement package for Ampex 300, 350/351, and 354 tape transports and will perform with original heads. The Model 360 Electronics are also adaptable to most other single-channel tape transport and head assemblies.

The 360 is completely self-contained and highly reliable. The internal power supply is fully regulated to assure stable operation despite wide variations in line voltage. Plug-in circuit cards and solid-state design simplify maintenance and increase performance.



All adjustments are accessible from the front. Panel controls include Record Gain and Repro Gain with preset CAL positions, and solid-state Monitor and Equalization switching to eliminate contact noise and to permit remote control of both these functions. The 360 is housed in a standard rack size cabinet.

Price: \$645.

INOVONICS INC., 1630 DELL AVE., CAMPBELL, CA. 95008

Circle No. 147

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continued from page 13

Fairly long iron or steel members which may be oriented somewhat parallel with the direction of the earth's magnetic field, will become magnetized due to the fact that their high magnetic "conductivity" tends to concentrate the earth's magnetic field in that area. Rather strong magnetic poles will appear at the ends of such iron or steel members. Steel components brought near such poles will, in turn, become magnetized, the same as when exposed to any other magnetic field source. Very little consideration is usually given to such a possibility. In other words, don't place your recorder too close to the ends of steel pipes, bars or structures oriented either vertically or in a generally north and south direction. It is also well to be alert to the possibility of picking up magnetism from a myriad of electro-magnetic or permanent magnet devices that may have extensive stray fields. For instance, some meter type photometers and many transistor radios contain very strong unshielded permanent magnets.

An instrument known as a pocket magnetometer can be used to discover or determine the magnitude and polarity of such disturbing magnetic fields or residuals. The calibrated magnetometer is quick and handy to use, giving an instant indication of any dangerous levels of

magnetism that may be present in components.

It is indeed fortunate that magnetic residuals can be removed from steel components in several different ways. In other words, they can be demagnetized.

One very effective method is to heat the steel red hot then slowly cool in a low magnetic field area. This, however, is obviously not a very practical method for most requirements. A second method is to expose the steel to a carefully controlled magnetic field of opposite polarity, but oriented in exactly the same direction as the original magnetizing field. The intensity of this oppositely polarized field must be an accurately determined fraction of the original magnetizing field. This fraction will vary depending on the type of steel, its heat treatment or work hardening, etc. Determination of such a precise fraction is practically a laboratory procedure and therefore is not a very suitable process either.

A third, relatively simple demagnetizing method is to expose the steel to a magnetic field of cyclically reversing polarity which must have an initial intensity higher than the fraction mentioned in the above described laboratory procedure. This cyclically reversing field is then reduced in intensity so that each succeeding half-cycle, of opposite polarity, is slightly less than the preceding half-cycle but more than the critical minimum "fraction" as dictated by the type of steel involved.

The intensity of such a cyclically alternating demagnetizing field can be reduced to near zero by means of a rheostat or a variable transformer, or much more simply by progressively separating the steel and the source of alternating demagnetizing field to such a distance that the field induced in the steel is essentially zero. This is not difficult, nor is the separation distance involved too great because such induced magnetism very nearly follows the inverse square law, where doubling the distance apart will reduce induction to one quarter the initial amount and doubling again, to one sixteenth, etc.

One of the most important points to remember in cyclical demagnetizing is that actual demagnetizing is accomplished only during the incremental reduction of successive half-cycles of the demagnetizing field, or only during that time when the work and the demagnetizer are being separated. Leaving steel to "cook" in an alternating demagnetizing field is of little value unless one might consider the secondary effect of heat being generated in the work due to losses from induced eddy currents.

*part two will appear in the
Nov/Dec issue*

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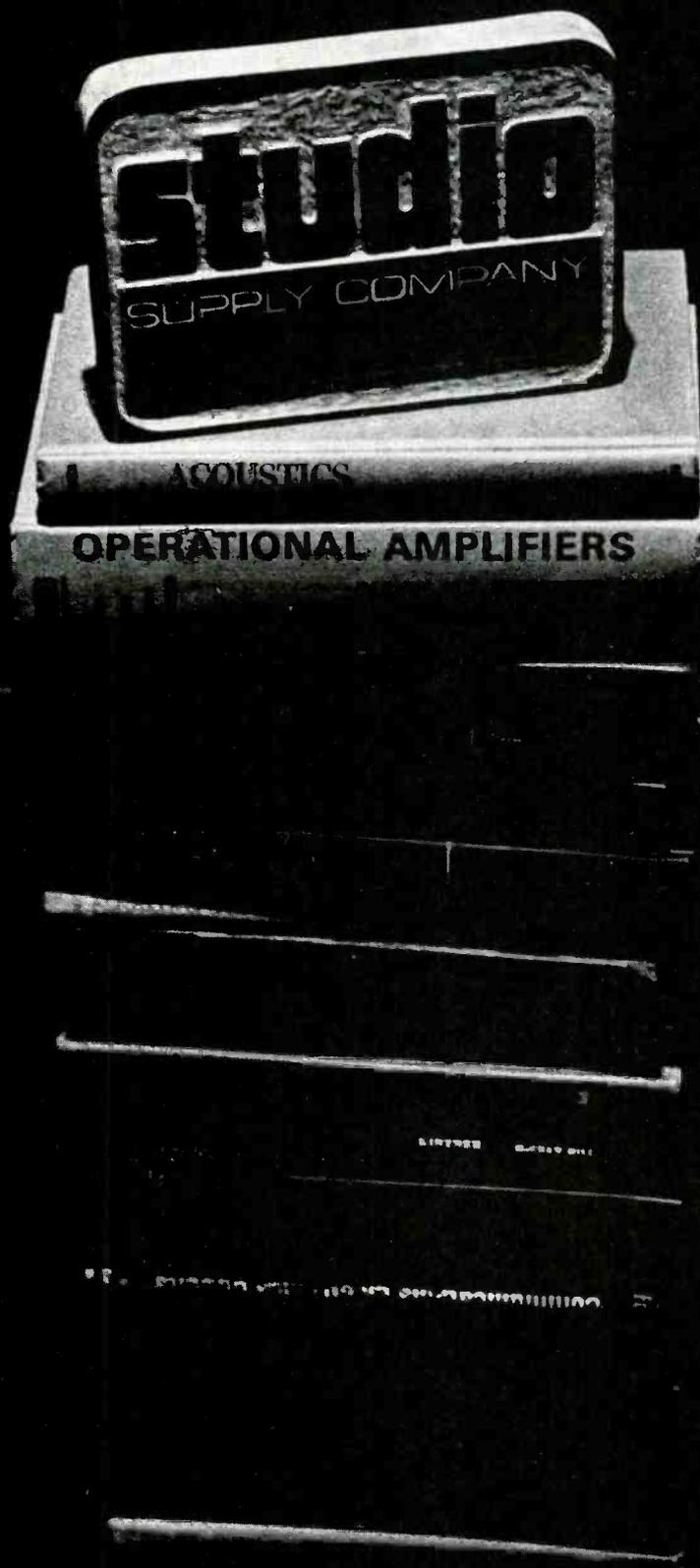
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