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THE SOUND ENGINEERING MAGAZINE

JANUARY 1972 $1.00

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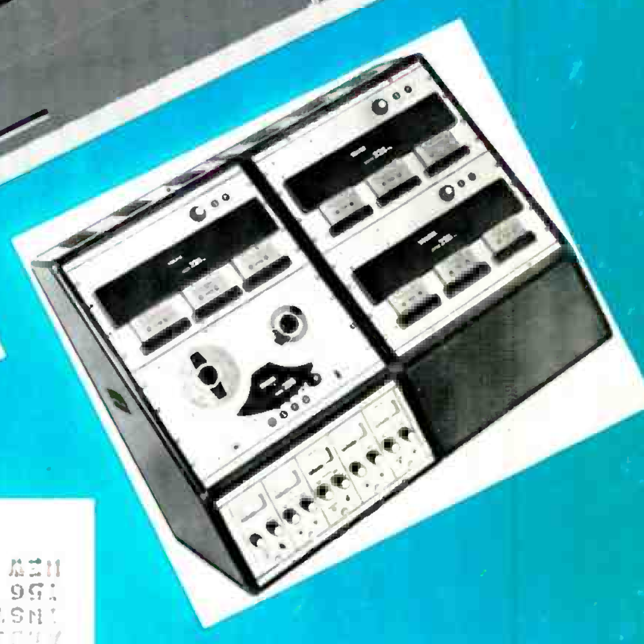

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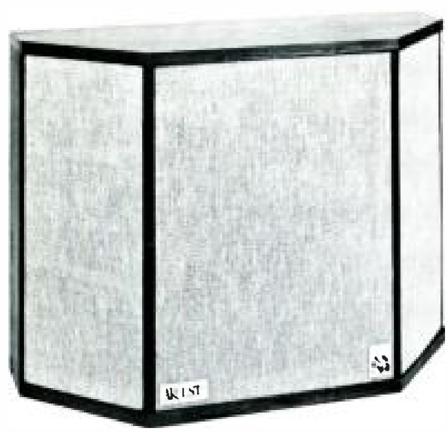

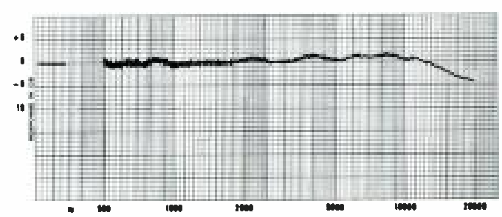

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COMING NEXT MONTH

• Robert Ehle has written an interesting article on experimenter's circuits for synthesizing multi-channel stereo. In it he covers basic circuits that can create two or even four channels out of mono—and your imagination might well take you from there.

In THE GAIN BRAIN, Paul Buff of Allison Research documents the reasons and uses to which his Gain Brain device can be used. If you use any kind of limiting, or find that you need this aid, this article will prove valuable.

The frequency counter is a tool of value to the audio professional that is not yet well known. Richard L. Lerner has prepared a report on these devices including a kit report on the building of a Heathkit version that is both of good quality and reasonably priced.

When you were younger and listening to radio, long before television, did you ever send away for a secret ring, or a code unscrambling device? Robert Hawkins certainly must have. You'll enjoy his nostalgic look in Old Radio Premiums—complete with photos that will bring fond memories back to many.

And there will be our regular columnists: George Alexandrovich, Norman H. Crowhurst, Martin Dickstein, and John Woram (Arnold Schwartz is on leave of absense.) Coming in **db**, The Sound Engineering Magazine.

ABOUT THE COVER

• The six duplicators on our cover all make copies of cassettes but Norman H. Crowhurst's survey of short-run duplicators looks at cartridge and open reel too. On the cover in clockwise fashion, starting at 12 o'clock, Pentagon, Infonics, Ampex, Telex, Rawdon-Smith, and Electro-Sound.

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JANUARY 1972 VOLUME 6, NUMBER 1

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letters

The Editor:
I have read with interest the article by Mr. Eric Small in your August 1971 issue, PROBLEMS OF MONO-STEREO BROADCASTING COMPATIBILITY."

The center channel build-up and loss problem which was discussed by Mr. Small is one that was solved by the CSG (Compatible Stereo Generator) that I invented and for which a patent will soon issue.

Mr. Small points up the problem of compatibility well. As a matter of fact. I believe I was the first to make Eric aware of this problem during the time he was working for MGM records. At that time MGM was already using one of my CSG Compatible Stereo Generators which they put into use early in 1968.

Further discussion with Mr. Small took place in May of 1970 when I was a member of an AES panel which discussed methods of creating compatible stereophonic program material which could be played and broadcast monophonically with exact aesthetic taste. For what it may be worth. CSG units have been available since 1968 and are now being sold to broadcasters and recording studios. Many are in use at this time. This is why so many compatible records have been produced.

The phase-shift technique for reduction of center channel build-up (and preservation of same) discussed by Eric is the heart of the CSG system and was the subject matter of a paper which I presented to the AES Convention in May 1970.

There were papers written by other authors prior to my technical presentation on CSG, but all of these authors whose remedies suggested phase-shift or quadrature either learned of the method by my direct disclosure, second-hand disclosure, or pure "hindsight".

It surprises me that my paper was not even noted in Small's bibliography.

Howard Holzer
Holzer Audio Eng. Corp.
Van Nuys, California 91401

MR. SMALL RESPONDS

The Editor:
Mr. Holzer's letter has several interesting points. He informs us of the fact that I learned of the application of 90-degree phase shift networks from him at MGM Records. His CSG purportedly solves the entire problem of center channel buildup with "exact aesthetic taste." He notes that I failed to include his AES paper in

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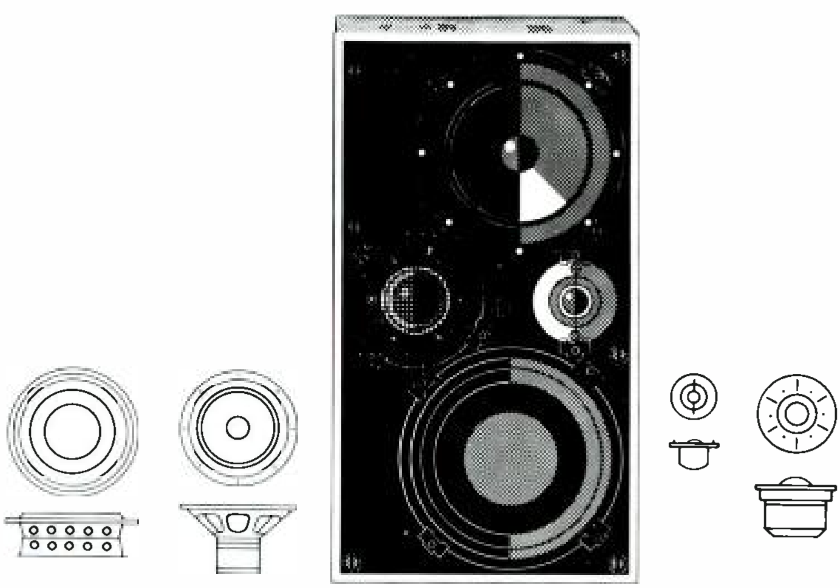

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my bibliography—an important point since Mr. Holzer considers himself to be the first worker to apply phase shift or quadrature to stereo signal processing.

In response to the first point: Mr. Holzer installed CSG at MGM Records as a magic black box. He was *extremely* secretive about the workings of CSG. In fact, the unit was soldered shut and sealed with dabs of red paint. To the best of my knowledge the above letter is the first time Mr. Holzer has admitted the principle of operation of CSG. In point of fact, I learned of phase shift networks and their application from a paper by John Eargle, "Stereo/Mono Disc Compatibility: A Survey of the Problems." It was delivered on October 22, 1968 at the New York AES Convention. The paper was issued as a pre-print and later published in the *Journal of the Audio Engineering Society*.

In his second point, Howard claims CSG solves the problem of center-channel buildup. In the section of my paper "Stereo Broadcasting" I discussed the application of a 90-degree phase shifter (CSG) as a stereo signal processing device where the signal would continue to be handled as stereo after being shifted. I opposed that use for reasons enumerated in the paper. The only application of a CSG type device I advocated was in the production of mono. That is, where a stereo signal would be mixed down to a mono using a 90-degree frequency independant phase shift network. Mr. Holzer has always advocated continuing to handle the signal as stereo following CSG.

Mr. Holzer makes quite an issue out of the fact that I did not reference his AES paper in my article. A query to the AES yielded the following: his paper, "The Compatible Stereo Generator and its application to All Stereo Media," was presented on May 4, 1970 at the west coast AES Convention. I was not present at that paper session. Mr. Holzer never submitted a manuscript, either prior to, or following his oral delivery on May 4th—*eighteen months* after Eargle's paper. I did extensive library research on the topic of compatibility and found no references to any published papers by Mr. Holzer pertaining to compatibility.

Howard's last point, that he is the original worker in the application of phase shift or quadrature to stereo signal processing, is apparently not true. Bauer, in his paper "Some Techniques Toward Better Stereophonic Perspective," first published in *IEEE Transactions on Audio AU-11, 88 (May-June 1963)* discusses the effects

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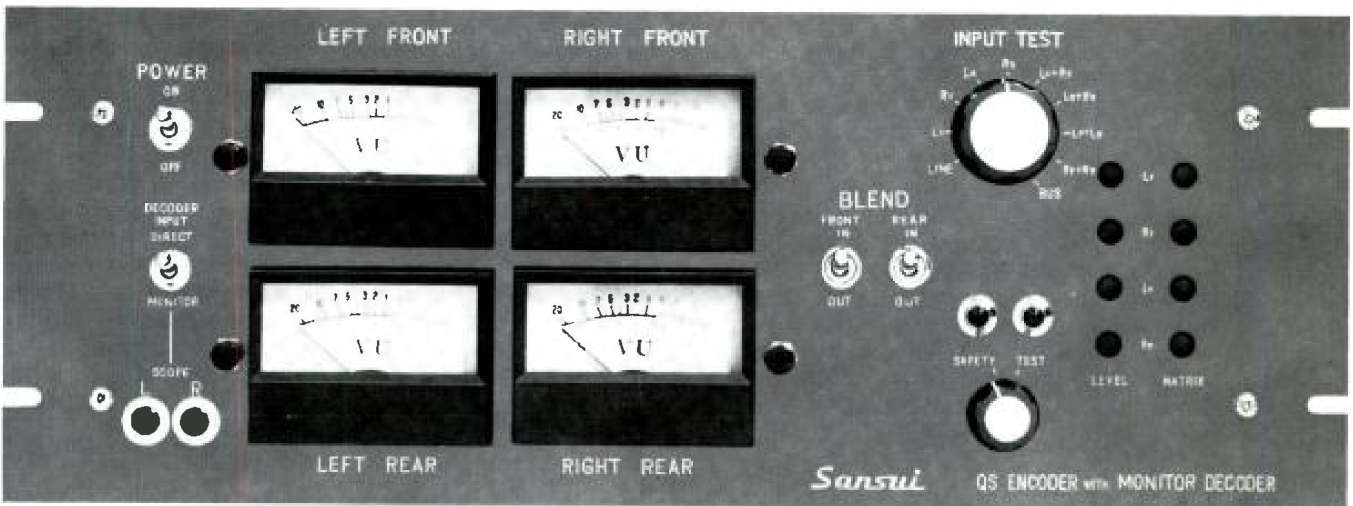

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of a 90-degree phase shift on the audio image position. An even more important document is a U.S. Patent recently issued to Benjamin Bauer called "Stereo Recording Systems With Quadrature Phase Relation." The patent deals rather extensively with the 90-degree phase shifter. The patent number is 3,564,162, recently JASA published the patent abstract. Additional patent references in this area are as follows: 3,059,065—10/1962 Tourtellot; 3,013,125—12/1961 Goldmark; 3,076,873—2/1963 Owen; 3,083,264—3/1963 Wintringham.

Eric Small
chief engineer
WOR-FM
New York, N.Y.

The Editor:
Robert C. Ehle's TECHNIQUE OF ELECTRONIC MUSIC in June and July was another interesting and welcome addition to audio literature. But I'm surprised that people are still confused about *tremolo* and *vibrato*.

On page 30 (June), Mr. Ehle says that tremolo is amplitude modulation, or a variation of amplitude or volume in a musical sound. What he's talking about is vibrato.

Tremolo is a quick reiteration of the same or different tones, as in the bowed tremolo of stringed instruments. *Vibrato* is a periodic pulsation of pitch, loudness or timbre.

Thomas R. Haskett
New York, N. Y.

The Editor:
In a recent "Letters to the Editor" column, David Hancock and Robert Orban have commented upon my recent writings on behalf of the Fairchild 641 Cutter system. Their arguments embody some of the shortcut thinking and logical non-sequiturism of which I complained in my original article, so I'd like to take this opportunity to shoot down several of their arguments in the interest of straight thinking in this field, representing as it does such a crucial link in the audio chain.

Orban begins by accusing me of failing "to recognize the difference between the sum of the *powers* in the left and right stereo channels and the sum of the *voltages* in these channels." My description of the operation of the 641 was confined to the *instantaneous displacements* which take place at the stylus tip when its operational mode is set for maximum vertical rolloff at the bass end. With its multiple class A amplifiers reading out through a hefty complement of ceramic tubes, added to the massive magnetic circuit which surrounds the armature, the 641 has more than enough capacity to deliver whatever power levels are required of it.

Hancock camplains bitterly of the mass of the 641 cutterhead, and says it can't be successfully mounted on any cutting lathe without using an advance ball. I have personally produced well over 25 LP albums which were mastered with a 641 cutter mounted on a Neumann lathe with variable depth control. Hancock exposes himself immediately as having dismissed the 641 on the basis of a hasty and superficial study of the problem; he compromises himself as a serious student of the art when he lectures us at length on how we mustn't "tailor response curves for the engineer's convenience," and in the same breath tells us he prefers a cutterhead the size of a pack of cigarettes because it's more convenient to use. Given the limitations of today's magnetic materials, no cutter of that size is going to be able to cut the levels that a large cutter like the Fairchild can handle. Nor does the "European finesse" of Hancock's cutter exceed that of the 641; the low effective mass of the 641 armature is one of its most shining features. On the subject of "convenience," by the way, let me point out that the vertical attenuation on the 641 cutter system is achieved by turning a selector switch. It is neither more nor less "convenient" for the recording engineer to have this switch in one position or the other. In neither position is there either more or less likelihood of Hancock's feared "groove discontinuities."

Hancock's next boner is his statement that I ascribe the stereo effect solely to directional factors. Wrong. I did not state in my article anything about my beliefs as to what elements add up to create the stereo phenomenon. For the record, I may say here that in addition to directional (intensity) effects, I recognize not only the considerable importance of phasing, but also different degrees of "presence," etc. However, my article dealt with the 641 and its operation, an operation which leaves untouched all elements of stereo performance except those having to do with directionality, and which, further, only touches upon directionality in the frequency range at which the human ear can't detect it. Therefore, there was no reason to discuss in that particular article anything *but* directionality.

Hancock and Orban share together

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the next bit of illogic, which goes as follows: during the matrixing of a left-right signal into a vertical-lateral signal a phase-shift error may occur which would result in an imperfect restoration of the original left-right signal at the re-matrixing stage: therefore the 641 system is a failure. Non-sequitur of all non-sequiturs! Everything we do in electronic manufacturing is accompanied by error. The great achievement of modern technology is that we have learned to keep these errors so small that their cumulative effect at the end of the audio chain is scarcely felt by the listening ear. These errors are embodied in manufacturing tolerances applied at every stage along the way. Any error of phase which the 641 matrixing circuitry may introduce is certainly miniscule, and, like other tolerances, very comfortably within a limit which no human ear will ever detect. We can perhaps excuse Hancock, who is apparently not experienced in design and manufacturing, but Orban is evidently a designer and manufacturer of a matrixing unit which, by the way, *purposely* shifts phase in the difference signal!

Hancock again errs when he hypothesizes a deterioration of phase relationships due to vertical attenuation at low frequencies—a deterioration which he is unable to demonstrate.

Hancock is also eager to dismiss the importance of limiting pointless vertical excursions of pickup cartridges. Such large excursions, occurring as they do in the relatively higher bass range amplitudes, sop up a large percentage of the operational capacity of the cartridge, leading to an inevitable compromise in overall sonic definition. If the sonic results of these vertical meanderings are not even detectable by the human ear, how can we justify using up so much of the performance capability of the cartridge for their slavish reproduction?

Orban dwells upon the subject of power, and manages to muddle the subject into a state of complete obfuscation. He leads off by repeating the classic error that a stereo groove cut with vertical bass rolloff produces a "loss of power". There is no loss of power. The cutterhead has power to burn. The groove modification merely needs to draw *less of it* than would be the case if the groove were unmodified. You don't need the algebra of complex numbers to reach that conclusion. You can see it by inspection.

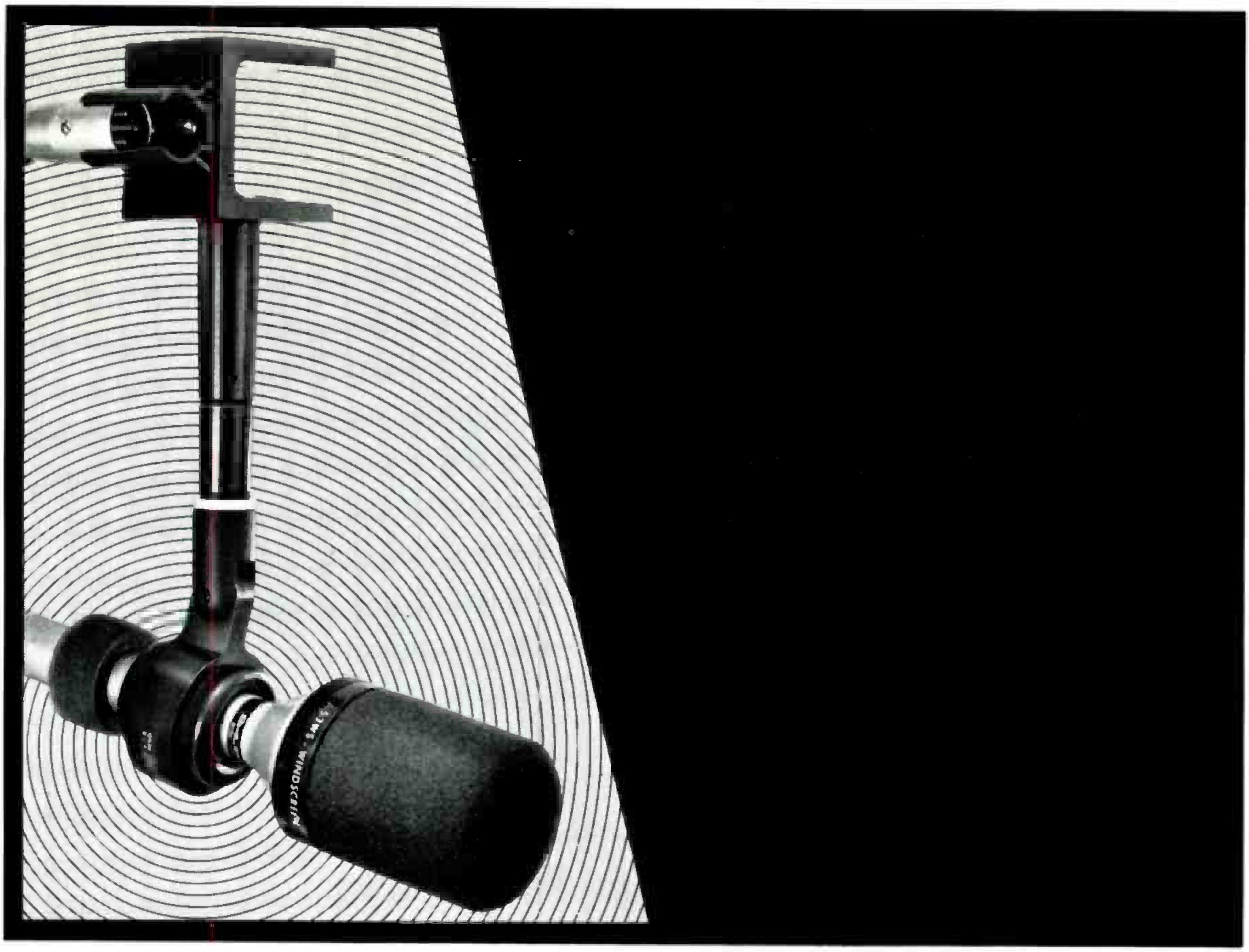
The energy in the difference channel is used only for the purpose of telling the two music channels how much and in what manner they should differ from one another in the distribution of the total musical program which lies in the summation channel. When we employ bass-end limiting in the difference channel we need less total power in the difference channel because we are purposely reducing the total extent to which the difference channel is directing the two music channels to differ from one another; i.e., we are using full energy to preserve the differences in those ranges where differences can be appreciated by music listeners, but we are reducing energy and minimizing differences in those ranges in which such differences are undetectable by music listeners. By an extension of this logic, a mono groove is a special case of a stereo groove, in which the difference channel has no energy in it because the two music channels are not being told to differ from each other in any respect.

If Orban and his colleagues will just apply themselves for a few minutes with pad and pencil, they'll soon be able to prove to themselves that we have no right to continue inferring the existence of an analogue between the aggregate power *drain* by the armature of the cutter and the aggregate power *delivered* by the stereo speakers at the end of the chain. The stylus displacements I showed in my article *will deliver* the corresponding displacements in the speaker cones, and the aggregate summation of the linear excursions of the total speaker cone area will be the same whether the cutter is or is not rolled off in the vertical plane at the low end. The distribution will be different but not the total volume of air displaced. Therefore, there *is no power loss* in the listening room.

Orban gives us several displays of notational prestidigitation leading to such conclusions as: "if we modify the frequency response of either the sum or difference channel, as Mr. Schulze proposed, then we will affect the stereo reproduction." Yes, we certainly will —in precisely the manner I described in my article and in a frequency range in which the effect will not be detectable by human listeners. Again: "the sum of the powers in the left and right channels is proportional to the sum of the powers in the sum and (unmodified) difference signals." Right on, Mr. Orban. Not only are the sums proportional, they are *identical*, as they arise from vector resolutions of the same resultant, as taken from different sets of axes.

C'mon, now, everybody. Sharpen up your pencils and do some real thinking about stereo cutting!

Richard Schulze
Philharmonic Standard Corporation
Acton, Massachusetts



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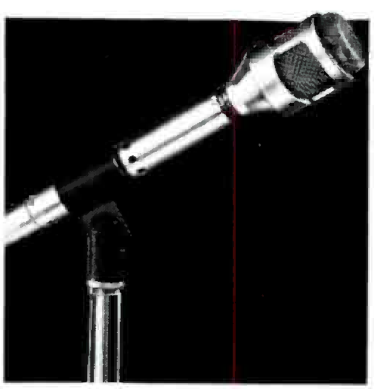

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Norman H. Crowhurst

THEORY AND PRACTICE

• Most of the textbooks that cover measurement deal quite effectively with the difficulties in measuring voltage on old-fashioned tube circuits, leading to the importance of *ohms per volt* under various circumstances. What has not been so effectively covered is the corresponding difficult in measuring currents, under equivalently critical conditions.

To set the stage for this little discussion, the point usually well covered is that voltage must be measured without disturbing the conditions in the circuit appreciably. And what *appreciably* means depends on the individual circuit being measured. Using the tube example, and supposing we want to measure plate voltage: if the plate current is, say 10 milliamps, and the meter used to measure voltage only takes 50 or 100 microamps for full scale reading, the current taken by the meter will not disturb the circuit worth mentioning. No commercial meter can tell the difference between 10 milliamps and 10.05 milliamps (assuming the meter goes to full-scale reading).

But if the plate current is, say 500 microamps, then the current taken by the meter used to read plate voltage will disturb the circuit appreciably, and the reading obtained will be falsified by this fact. The problem is even more difficult in the average working grid-to-cathode circuit of a tube (except for power output tubes). The d.c. resistance of the circuit is usually of the order of a megohm, and the voltage may be as low as 1 or 2 volts, and is unlikely to be much more than 10 volts.

To measure this with any accuracy, the instrument used must have an input resistance of at least 10 megohms, and be sensitive to measure whatever the voltage happens to be with some accuracy. The best moving-coil instruments require about 20 microamps to obtain full-scale reading, which means that they are rated at 50,000 ohms per volt of full-scale reading.

Suppose that a full-scale reading of 10 volts would provide a sufficiently accurate indication of the grid-to-cathode voltage, which is expected to be in the region of 1.5 volts. The best moving-coil voltmeter would have a resistance of only 500,000 ohms on the 0-10 volt scale. Assume that the d.c. resistance in the grid circuit is 1 megohm: then the total resistance now virtually shunted across the 1.5 volt source is 1.5 megohms, of which only 0.5 meg is in the meter. So the voltage the meter measures will not be 1.5 volts (assuming that voltage is there before the meter is connected) but 0.5 volt.

That could hardly be called a reliable measurement. About all the use it could serve is to show that *some* voltage is present from which you can conclude that it may very well be 1.5 volts, but you have no means of measuring it without disturbing it. You can probably observe other quantities in the circuit, from which to make deduction, such as the plate voltage and/or current.

The cathode-to-grid bias serves to hold down plate current. So applying the voltmeter reduces the bias to about one-third—that is assuming the 1.5 volts is there before you connect the meter to measure it. How much this change in bias affects plate current will depend on where the intended operating point is. If 1.5 volts has the tube biased almost to cut-off, then reducing this bias to one-third would multiply plate current far more than three times, and produce some corresponding change in plate voltage, depending on plate circuit values.

On the other hand, if the normal 1.5 volts bias only shifts the plate current a little below that at zero bias, the value at 0.5 volt bias would not be very different.

If you want to get a little more significant an idea of the bias that is actually there, before the meter is connected, you might combine plate measurements with grid measurements, as follows. Assume plate supply voltage is 250 (you check this) and that plate voltage, before you connected the grid voltage meter, is 180. This means 70 volts are dropped in the plate resistor, due to plate current. Now you connect the meter to measure grid voltage, leaving the plate voltage meter connected. As well as the grid voltage meter registering 0.5 volt (as closely as you can read, at the low end of the 0-10 volt scale), the plate voltage drops from 180 to 90 volts.

This means that the voltage in the plate resistor has risen from 70 to 160 volts—more than twice. Now short the voltmeter in the grid circuit momentarily—only just long enough to read the plate voltage change, because this condition may over-run the tube. Suppose the reading now drops to 50 volts. This means that the plate resistor is now dropping 200 volts.

Let us try to interpret that, as far as we can, assuming we have no more

We compared our new deluxe preamp to a 10¢ piece of wire.

First we ran a signal through a 10¢ length of shielded cable. What came out the other end was, of course, audibly identical to what went in. Then we ran the same signal through our new TA-2000F preamplifier, and ran an A-B comparison between its output and the wire's. Both were audibly identical. As we'd expected.

This is not to say that sufficiently precise instruments could not detect inaudible differences between our preamp's signal transmission and a wire's. Whereas a straight wire has no distortion whatsoever, we must admit to having some—three hundredths of one per cent harmonic, and five hundreths of one per cent intermodulation, maximum, at rated output. And whereas a wire theoretically does generate some noise, its signal-to-noise ratio is still somewhat better than the 73dB obtained through the TA-2000F's phono inputs, or even the 90dB obtained through our Aux, Tape and Tuner inputs.

But, as you'd expect, the big difference in price between our deluxe preamp and two feet of cable, buys a great deal more than just a pure, clean signal. As our preamp's 58 levers, switches, meters, knobs and jacks would indicate.

NEARLY 2,000 RESPONSE SETTINGS

Six of those controls are devoted to precise adjustment of frequency response. The calibrated, 2dB-per-step, bass and treble controls have switches that adjust their turnover frequencies, so you can choose how deeply the tone controls will affect —or not affect the midrange. Still another switch cuts the tone controls out of the circuit altogether. And a single knob controls the sharply-cutting, 12dB-per-octave,50Hz and 9kHz filters. Together, these six controls give you a choice of 1,935 *precisely repeatable* response settings including flat (10Hz-100kHz, +0, −2dB) response.

The facilities for tape recording are exceptional and unique; you can record on two tape decks at once, monitoring either (or your program source) at the flick of a switch. You can dub from one machine directly to the other, without external patching or connections. For straight microphone recordings, there's a mic input position on the function selector knob; for voice-over-music, there's a separate mic level control that diminishes all other input signals as it increases the microphone level.

And, of course, the two, front-panel VU meters, are as useful for testing as they are for monitoring record levels.

TOTAL INPUT AND OUTPUT FLEXIBILITY

The TA-2000F can feed two stereo amplifiers (and an additional monophonic or center-channel amp) at one time, at either a 1 volt or 300mV level. The second amplifier output could also be used for still another tape recorder, should you wish to use the ultra-versatile tone controls and filters in recording. The front-panel output jack feeds both high- and low-impedance headphones, or can be used as a tape output, by suitable adjustment of its independent level control; the same knob also controls the center-channel output.

Five of the 8 rear-panel stereo inputs have rear-panel level adjustments. A sixth—the Phono 1 input — has a switch that selects three separate input impedances at the normal 1.2mV sensitivity setting, and two more impedances at the 0.06mV setting that lets you use even the lowest-output cartridges.

96 TRANSISTORS VERSUS A SINGLE WIRE

But all these features merely make our TA-2000F more versatile than any wire. They don't explain how we can come so close to the wire's pure, unadulterated performance. That explanation will rest with our circuit designers, and with the 96 *high voltage*, and Field Effect transistors they used.

THE TA-3200F: AN AMPLIFIER TO TRULY COMPLEMENT OUR PREAMP

A preamplifier like the TA-2000F deserves, of course, its complement in a power amplifier. Not too surprisingly, we make one: the Sony TA-3200F. Its fully direct-coupled circuitry produces 200 watts continuous (RMS) at 8 ohms, with power bandwidth from 5 to 35,000Hz. IHF Dynamic Power is rated at 320 watts into 8 ohms (and fully 500 watts into a 4 ohm load). Its distortion, at a listening level of one half watt, matches the preamplifier's at 0.03%; at full rated output, it is still a mere 0.1%. And the signal-to-noise ratio is 110dB.

Our amplifier's facilities nearly match our preamp's. The 3200F has controls you've rarely, if ever, seen on power amps before: switch-selected stereo input pairs; a speaker selector switch; a power limiter (which holds output down to 25 or 50 watts, should you so desire), and a rear-panel switch that lets you limit bass response below 30Hz., instead of letting it extend to 10Hz.

For further information, see your Sony dealer, or write us. Or wire. Sony Corporation of America, 47-47 Van Dam Street, Long Island City, N.Y. 11101.

SONY®

Circle 27 on Reader Service Card

information available. The change from zero voltage to 0.5 volts, as measured by the meter, is 40 volts at the plate. The change from zero to the condition when the meter is removed is 130 volts at the plate. So the best guess that this information can give is that grid voltage without the meter connected is 130/40 x 0.5 = 1.6+ volts (it would not be safe to venture any closer figure than that).

But now you turn to the solid-state counterpart of the tube amplifier circuit—one of the many transistor circuits—and the picture changes. Now what controls collector (or emitter) current, is not so much base voltage as base current. This almost completely inverts the problem we have just discussed. That problem was one where the circuit impedance is very high, across which you want to measure a quite low voltage. In the solid-state counterpart, the circuit impedance (base input resistance) is usually quite low (and, to boot, quite variable) and you want to measure a quite low current value.

If you open the circuit and put any kind of current meter in series, you disturb the circuit voltage. The more usual procedure is to measure a voltage across a resistor that will tell the current through it, that happens to be the same as that going into the base terminal of the transistor. But since the resistor probably has a high value, and the current through it is quite low, the voltmeter connection may well add to the current flowing into the base, upsetting the circuit, in a similar, but different way, from the upset produced in measuring the grid-to-cathode voltage in the tube circuit.

In that instance, measuring the bias current may not be the easiest way to arrive at the operating condition. The voltage across the resistor that controls bias current may be easier to measure by a method that does not involve shunting it with a meter. If the "top end" of the resistor goes to supply point, and the bottom end to the base, with emitter at some potential not far from the other supply potential, measuring emitter voltage from the top end will come very close to measuring the voltage across the resistor in question.

The value of the resistor can be measured with the equipment off, and then the current through it can be calculated by ohms law. However, this may not be the same as the base current, especially if potentiometer biasing is used. In this case you need to know the value of the other resistor and the voltage across it, too. Then both currents can be calculated, and base current is the difference.

For example, if the top resistor is 100 k and the bottom one is 10 k and these values check out on a resistance measurement; then if supply is 12 volts, and the emitter voltage is 0.75 volt, base voltage will be a little higher than 0.75 volt. You could measure it, but the meter may disturb the base current, which in turn would affect collector-emitter current, invalidating the reading, because emitter voltage would change.

If the transistor is of a germanium type, it is safe to assume that base-emitter voltage is not more than 0.1 volt, making base voltage (that across the 10 k resistor) 0.85 volt. If it is a silicon type, the base-emitter voltage will be considerably more. Assume for the moment it is a germanium type. The 0.85 volt across 10 k will pass 85 microamps. Taking 0.85 from the 12 volt supply leaves 11.15 volts across the 100 k resistor, which will thus pass 111.5 microamps. The difference is base current 111.5 — 85 = 26.5 microamps.

Because the base current is, in this instance, a small part of the total current (i.e. much less than half) any error in calculation will seriously invalidate the value obtained. In a sense, it would be better to measure current directly. However, the only way to do this would be to insert a meter in series right at the base. And a meter sensitive enough to give a reliable indication of the order of 25 microamps will have an appreciable voltage drop across it—say 100 millivolts.

To see what effect this will have, first calculate the voltage in the absence of base current. The 100 k and 10 k in series will produce 1/11 of 12 volts across the 10 k resistor, or 1.09 volts. Assume the base current would be 25 microamps, without the meter in series. The source resistance, equivalent to 100 k and 10 k in parallel (by Thevenin's theorem) is 9.1 k, so 25 microamps will drop about 230 millivolts, to 1.09 — 0.23 = 0.86 volt.

Putting the meter in series will drop (assuming nothing else changes, which cannot be true) another 100 millivolts, making 330 total, and dropping base voltage from 0.86 to 0.76, which will probably change emitter current and thus the reflected base current. You do not know where you are.

This brief exploration should have shown the problems of getting reliable measurements, in solid-state circuits, that closely parallel the similar problems an earlier generation had measuring the corresponding quantities in tube circuits. In a later discussion we will get into a little more detail about measurements in circuits, and how they can be corrected for such difficulties. ■

total tape duplicating with "BUILDING BLOCK" simplicity

CASSETTE TO CASSETTE, REEL TO CASSETTE, REEL TO REEL

The Telex series 235-1 is more than just another tape duplicating system. It is a concept based on modular "building blocks" which complement each other and provide total flexibility for tape duplicating. It solves the problems of interfacing between open reels and cassettes. It is a system designed for future expansion. Engineered to make tapes of true, professional quality. And it's priced within your budget.

The Telex system consists of only five basic units.

1. Solid state modular electronics containing amplifiers, meters and controls. This unit works with any combination of ten cassette or reel slaves.
2. Cassette master play transport.
3. Open-reel master play transport.
4. Cassette slave record transport. Records three cassettes simultaneously.
5. Open-reel slave record transport.

The five units are totally compatible. Intermix cassette and open-reel master or slave transports to suit your duplicating requirements: cassette to cassette, reel to cassette, reel to reel, or even cassette to reel. All units fit into table top consoles of uniform size so when your requirements change, you just add more units. It's that simple. Telex series 235-1 is heavy duty equipment with hysteresis synchronous motor tape drives, momentary push button controls and time delay circuits for smooth, positive tape handling. Selected premium grade duplicator heads provide long life and excellent frequency response. And fail safe, automatic features enable non-technical personnel to operate the system efficiently. Telex "building blocks" make a totally flexible and complete duplicating system. It's the sensible approach, designed to meet your needs today, next month and in the years to come. Made in the U.S. to professional standards.

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Open Reel Slave, 7.5 - 15 IPS. Full track. Half track 1 or 2 channel. Quarter track 2 or 4 channel.

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Open Reel Master, 7.5 - 15 IPS. Full track. ~~Half track~~ 1 or 2 channel. Quarter track 2 or 4 channel.

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Circle 22 on Reader Service Card

John M. Woram

THE SYNC TRACK

● Perhaps more than any of the other recording tools, microphones are the greatest variable at the studio. Although the other equipment-console, speakers, tape recorders, remains the same from month to month, microphones have a way of getting moved about and replaced continually, between—as well as during—recording sessions.

In a large studio operation, you can often tell who the engineer is by observing what microphones are being used, and where they are placed. At the **db** FORUM ON MICROPHONES (*April 1971*) the panelists rarely agreed on anything having to do with selecting the right mic for a particular application.

Over the years, I've become particularly interested in experimenting with different microphones, leaving others to discuss the nuances of vented ports, infinite baffles, and acoustic suspension—all of which have something to do with loudspeakers. (Or at least I think they do.) I can easily bore any group to tears by considering aloud the advantages of omnidirectional polar patterns, or the merits of ribbons. When the discussion turns to wow and flutter, I usually remember something that needs doing in another room and leave before its my turn to be profound.

Of course, microphones are a very covenient thing to become interested in, since they are so easily manipulated during a session. When the producer complains about what he hears, you can hardly get up and change consoles. Even changing speakers will take too much time. However, you can go out and put up a different microphone. The new mic may be no better, but it will be different. "That's even worse," cries the voice over the talk-back, so you plug in still another. "Now you"ve gone too far the other way." Looking knowledgeable, you dash to the mic cabinet and return with the original mic. "That's it! Perfect!" shouts the producer. Returning to the control room, you tell him its a specially designed unit that you only use for special situations. He thinks you're a genius, you think he's an idiot, and everyone's happy.

Anyway, being interested in mics, it was only a matter of time before I met the Shure Brothers crew at one of the A.E.S. conventions, and got into a long discussion about their model 546, which I had been using on trumpets. Thus began an on-again, off-again chat that is now in its third year, I think.

Somewhere along the way, I prososed the idea of doing a recording session using *only* Shure microphones. The Shure crew expressed tentative interest. Not that they objected to anyone recording exclusively with their microphones, but, was it likely that a recording engineer would actually do such a thing in a typical studio situation? Probably not. I know I wouldn't. And no engineer in his right mind would tell a paying customer that only one manufacturer's microphones were available.

However, if we schedule a session whose primary purpose is to test microphones, we may all learn something in the process. By keeping the various microphones on separate tracks, we can later on analyze the tracks and perhaps reach some admittedly subjective conclusions about the microphones. Certainly, some tracks will sound better than others, and if we can come up with something that no one likes (for me, that's easy) maybe we can also figure out why, and what's to be done.

The project was still in the talking stage when the 1971 spring convention took place in California. I had just signed on at Vanguard Records. Among other little goodies, Vanguard uses Neve consoles, which meant that the project would be done through a Neve board, if and when. And there at the convention, right next to the Shure exhibit, was a Neve console. At once, the projejct took on a new dimension. If we could get the work done before the fall convention, what about bringing the 16-track master tape in and playing it back through the Neve console? The Convention visitor might be able to sit at the console and get some idea of what all the knobs and switches do, as he attempts a 16-to-2 mixdown. And, we could run lines to the Shure booth so that listeners there could audit each individual track and make their own evaluations of the various microphones used. Providing the comments did not take the form of hysterical laughter, they might prove a valuable addition to our own observations.

Next step—preparing for the re-

Figure 1. John Woram works at the Neve console as composer-arranger Lee Holdridge looks on.

cording session. Composer-arranger Lee Holdridge joined the planners and in a little while submitted the first movements of a ballet score he was working on. The arrangement would use rhythm section, strings, harp, woodwinds, brass, tenor soloist and chorus, and would make an ideal vehicle for exposing the microphones to a variety of instruments.

At the session, the rhythm section was recorded first, followed by the strings, harp and woodwinds, and still later by the brass. A few days later, the voices were added. I think the final tape turned out rather well, considering our self-imposed limitation—using only Shure mics. That's certainly a left-handed compliment to a company that has sent in a case of microphones and contributed a lot of engineering knowhow to the project. Yet, microphone quality being so subjective—and illusive—the probability is at best remote, that any recording engineer will find all his favorite microphones for every instrument within the catalog of just one manufacturer.

But, by being obliged (willingly, in this case) to confine my selection to one line, I made some interesting discoveries. After the session, some of my earlier favorites were discarded in favor of a Shure mic. Others were not. I still prefer Neumann and AKG condensers for many applications. And who could get along without the sensational Beyer M160, as well as their other ribbon mics? And the Electro-Voice 635A remains indispensible, as does the RE-20. And so on. Come to think of it, I haven't really discarded any mics, although I have done some reshuffling.

Conclusion

If I had to rate the final tape, I would say the rhythm section was excellent, the brass also quite good, although others will certainly look for a different sound. The strings and vocal parts

	Instrument	Mic
1	Fender Bass	A95P Transformer
2	Drums—Overhead Left	SM76 Omni
3	Drums—Floor Tom-Tom	SM53 Cardioid
4	Drums—Bass Drum	SM50 Omni
5	Drums—Snare	SM60 Omni
6	Drums—Overhead Right	SM76 Omni
7	Percussion—Bells, Tamborine	SM57 Cardioid
8	Percussion—Tympani	SM53 Cardioid
9	Organ	SM33 Ribbon, Cardioid
10	Piano	SM60 Omni
11	Guitar—Electric	SM57 Cardioid
12	Guitar—Acoustic	SM76 Omni
13	1st Violins	SM60 Omni
14	2nd Violins	SM60 Omni
15	Violas, Celli, Basses	SM53 Cardioid
16	Harp	SM76 Omni
17	Woodwinds	SM33 Ribbon, Cardioid
18	Strings—Overall Left	300 Ribbon, Figure 8
19	Strings—Overall Right	300 Ribbon, Figure 8
20	Trombones	SM53 Cardioid
21	French Horn	SM76 Omni
22	Trumpets	SM57 Cardioid
23	Brass—Overall Left	300 Ribbon, Figure 8
24	Brass—&Overall Right	300 Ribbon, Figure 8
25	Chorus and Soloist	SM53 Cardioid

The Shure mics used at the session

(continued from page 15)

were good although I would prefer a more open sound—by which I suppose I mean a condenser. In the FORUM ON MICROPHNONES, we discussed condenser sound, without coming to any provable conclusions. As usual, personal taste plays such an important part, even if we're not sure just what it is we like about the condenser sound.

When the tape was eventually brought to the fall 1971 convention, and played back at the Shure and Neve booths some listeners commented favorably on the string sound. And at least a few trained listeners didn't particularly care for some of the tracks that I thought were rather good. Once again, the personal taste factor.

So, where are we? We haven't really learned anything we didn't already know. I still would not want to be compelled to limit my choice of microphones to one manufacturer. Yet, this finished sixteen-track tape is really quite good, and we've gotten excellent results in the mixdown. No condenser microphones were used on the session, nor was any equalization added. Eq. galore is available on the Neve board, but we did not want to confuse the issue, which was to evaluate microphone performance.

Figure 3. Vanguard Records' main studio. The Shure mics are deployed. Out of sight at the right, the drum booth has its share of mics. Lee Holdridge is conducting this particular take at which just the brass section was present.

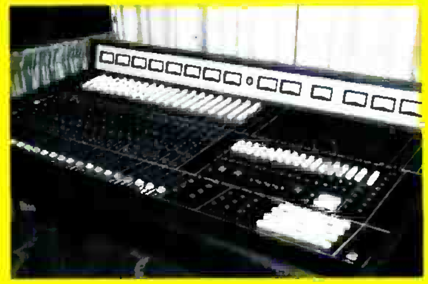
We all took extensive notes, which are now being studied and compared with the laboratory tests on each of the microphones that were used on the session. Trying to draw some conclusions from a comparison of lab tests with field tests is a precarious undertaking—I'm not sure if any conclusions can actually be made this way, but we shall try.

One conclusions comes to mind at this time. Multi-track recordings are usually made a few tracks at a time. A lot of time can be spent getting each track to sound just right all by itself, out of context with the complete recording. Some of this is unavoidable, since at the beginning of the session the complete recording is still a long way away. Yet, the adjustments that are made to a track heard out of context are rarely entirely suitable once that track is heart in its proper perspective. A lot of time can be wasted, getting each of sixteen tracks tailored so that it can stand on its own, something which it will never be called on to do. In our experiment, once each track sounded clean and reasonably accurate, we left it alone. At the mixdown session, we seemed to have more flexibility, and did not have to spend a lot of time trying to override settings that had sound good at the time they were recorded. The conclusion? Don't get over involved in echo, equalization, limiting and what not during the session. Remember a little goes a long way—usually in the wrong direction. No, this doesn't mean joining the "We'll fix it in the mix" school either. But when something doesn't sound just right as it's being recorded, think about changing a microphone or two before you reach for that eq. knob. Later on you can change the equalization, but they haven't built a computer yet that will allow you to change microphones during a mixdown. At least Shure Brothers hasn't. ■

NEW PRODUCTS AND SERVICES
Picture Gallery—N.Y. AES Convention

Automated Processes' console had 24 flexible inputs and sixteen outputs along with a built-in patch bay. Circle 99 on Reader Service Card.

The Fnörk, a sixteen input, two output stereo console that you can carry around in an attache case. Circle 52 on Reader Service Card.



This control board fron Spectra-Sonics provides twenty-channels in and sixteen channels out. Circle 69 on Reader Service Card.

Ready to use mixing desks, such as this solid-state modular unit are available from Norelco. Circle 79 on Reader Service Card.

Multi-Track Inc. showed a low cost but versatile console with twelve tracks in and eight out. Circle 59 on Reader Service Card.

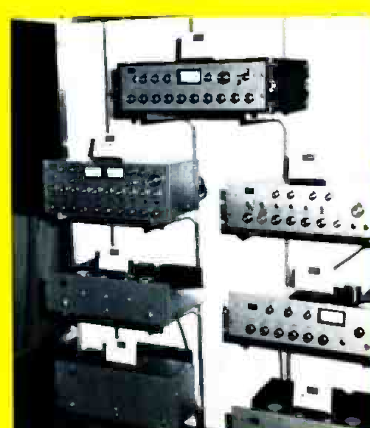
RCA showed a console that combined versatility with attractive visual appearance and useful function. Circle 84 on Reader Service Card.

Complete signal automation is achieved on this ten-channel broadcast console from CCA. Circle 62 on Reader Service Card.

Langevin specialized in customized small consoles for specialized purposes, such as these two. Circle 55 on Reader Service Card.

Audio Designs offers this mix-console especially for quad use as it has capability for 4-2-1 use. Circle 67 on Reader Service Card.

Bozak professional equipment includes amplifiers, mixers, and mixer-amplifiers for mono or stereo use. Circle 83 on Reader Service Card.



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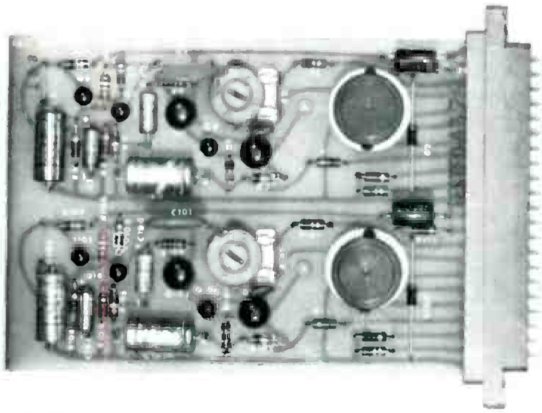
FAIRCHILD
SOUND EQUIPMENT CORP.
ENGINEERING DATA

AUTOMATIC ATTENUATORS, "AUTO-TEN" ®
Single Model 661TL (Integra I)
Double Model 692DAT (Integra II Card)

ROBINS INDUSTRIES CORP. SUBSIDIARY
15-58 127TH ST. FLUSHING, NEW YORK 11356 212 445-7200

Patent #3,281,706



Double Model 692DAT (Integra II Card)

Single Model 661TL (Integra I)

FAIRCHILD ENGINEERING DATA
AUTOMATIC ATTENUATORS, "AUTO-TEN" ®
Single Model 661TL
Double Model 692DAT

AUTOMATIC ATTENUATORS, "AUTO-TEN" ®

The Auto-Ten is a signal operated gate—soft switch designed to reject unwanted signals or noise below variable pre-set thresholds. It can be used for automatic and *noise free* switching, compression, expansion and equalization. All functions are carried out by means of light coupled components; plug-in incandescent bulbs drive solid state LDRs (light dependent resistors), providing smooth and fast response.

Auto-Ten is used for:

1. *Gating* of audio lines to eliminate unwanted low-level signals (noise, etc.) or changing the gain of the lines.

2. The Auto-Ten control circuit *acts as a variable resistor* in an audio circuit, and will perform the function automatically, its operation being triggered at variably pre-set levels by the same audio signal it is controlling, or by another audio channel, or vice versa.

3. *In Public Address Installations* Auto-Ten in each channel minimizes feedback from the always-open mike. If there is no useable signal, Auto-Ten automatically closes the channel, opening again only when there is sufficient signal level, thus providing effective feedback control and allowing higher average PA levels.

4. *With Compressors and Limiters* a major problem is the "breathing" effect, the build-up of noise when there is no information present to compress or limit. Auto-Ten can be set to close the channel in the "no information" mode, thereby eliminating noise buildup.

5. *Acoustic Control* when recording. With multiple microphone pickup, leakage of unwanted sounds into unused but "live" microphones detracts from the final recording. Also often isolation screens are used in an attempt to isolate sections of an orchestra. The Auto-Ten provides up to 10 db greater isolation than the conventional acoustic screens. Through the use or its variable threshold and release time, the Auto-Ten can also make apparent changes in acoustic conditions in a studio of hall.

6. *Automated Station and T.V. Audio Use.* The Auto-Ten can provide an automated signal switching system. In live TV pickups using multi-microphones, with an Auto-Ten in each channel, when there is no useable signal present in a particular set area, the microphone channels close and open automatically, resulting in a reduction of set noise pickup.

7. *Tape Editing & Mixing.* It is possible with the Auto-Ten to obtain noise reduction on several tracks coming into a mixing console rather than only on the final mixed channel. This provides the mixer with greater flexibility in governing the amount of noise reduction for each track mixed, and Auto-Ten eliminates the opening or closing of "pots" at the end of a loop or track. An Auto-Ten used in each channel will allow only useable program material to be recorded from each track, eliminating noise buildup from multitrack transfers.

8. *Tape and Film Noise Reduction:* In situations requiring reduction of noise, reduction of only 6 or 8 db is sometimes more desirable than total reduction, because total lack of noise sounds unnatural. The Auto-Ten can be adjusted to give anywhere from 3 to 60 db of noise reduction. With an Auto-Ten in the playback channel, low level print-through sounds can be eliminated. This is important in the production of tapes where there may be long pauses between words.

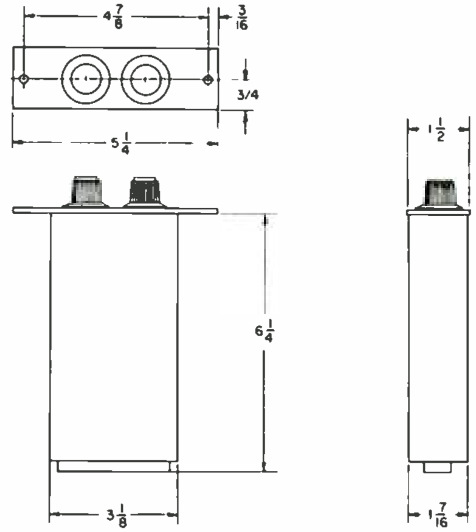
9. A *"Ducker"* for Automatic Mixing in paging Broadcast, Recording and Public Address Systems: The Auto-Ten handles two inputs—one program channel taking precedence, and "ducking" or fading the second channel, e.g., one channel may be background music and the other announcements. As the announce microphone is used, the music channel automatically fades 3 to 60 db (pre-set), and smoothly comes back to normal level after completion of the announcement.

OPERATION OF THE AUTO-TEN

A sensing amplifier, which continuously monitors an audio channel, controls the light output of a quick response incandescent bulb, which is light coupled to two independent cadmium sulfide light-dependent resistors (LDRs) which act as variable resistors in attenuation networks. Since the LDR is the only active component in the audio circuit, it introduces no distortion or frequency discriminaton. The sensing amplifier has two knob controls, threshold and release time. When monitored signal falls below threshold, information can be variab'_ attenuated from 3 to 60 db. Release time, being variable from 7 to 300 milliseconds, permits slow or rapid attenuation of the signal as desired. The amplifier triggers only on signals exceeding pre-set threshold, converting the audio signal into a light beam which shines on the LDRs. When the triggering signal falls below threshold, the light beam decays at the pre-set "release time" rate. The presence of two LDRs at each light source allows the units to perform two functions simultaneously, noise and distortion free. E.g., in "ducking" one LDR is used for expansion of mic channel, while the second cell is used for compressing a second channel. Since the sensing amplifier is isolated from the two LDR control circuits, triggering can be accomplished by an independent audio channel, while the unit controls two different independent audio channels. Signal levels as low as .01 volt are sufficient to trigger the sensing circuit.

Model 661TL (Integra I) See specifications chart

Requires 6.3 V AC or DC 70 ma power supply.



661TL MOUNTING DIMENSIONS

Model 692DAT (Integra II) Card

The 692DAT performs functionally the same as Model 661, except that:

1. It is a DOUBLE UNIT, containing two light sources and four LDRs.
2. It is housed on a 3 9/16" x 5" printed circuit board with provision for external REMOTE CONTROLS when required. The board has gold plated contacts and mating connector is supplied.
3. Uses GE377 plug-in bulbs.

MOUNTING INFORMATION

The 692DAT card can be rack mounted using Fairchild 692RM capable of accepting 16 Integra II cards. If single card is to be used, single card holder Model 692SCH in conjunction with 662RM will mount the card in the rack using 5¼ inches of vertical space and 1½ width.

The 692DAT card can be incorporated into any system which has power supply voltage of 6.3 or 24 volts. Any Fairchild power supply can power the card.

SPECIFICATIONS

	661TL	*692DAT*
Minimum input level:	—35 dbm	—40 dbm
Maximum input level:	+20 dbm	+20 dbm
Frequency response of sensing circuit:	20 Hz - 20 kHz	20 Hz - 20 kHz
Frequency response of CDS cells:	flat	flat
Distortion:	immeasurable	immeasurable
Response time:	3 mseconds	3 mseconds
Release time:	Variable 0.03 to 7 secs.	Variable 0.03 to 7 secs.
Power requirements:	6.3 at 70 ma V AC or DC	6.3 V or 24 V DC at 70 ma per section
Size:	1½" W x 5¼" H x 6½" D	3 9/16" W x 5" H
Bulbs:	GE-2114	GE-377(2)

ARCHITECTS & ENGINEERS SPECIFICATIONS: AUTOMATIC ATTENUATOR, (661TL)

An automatic attenuator shall be used to change the gain of the audio chain. The device shall be placed at the input or the output of the amplifier, and then strapped to attenuate up to 60 db from its normal operating level, depending on the action and setting of the controls.

The automatic attenuator shall accommodate input impedance up to 600 ohms and shall work into impedances from 150 ohms or higher. It shall be activated by input levels from —35 db to +20 dbm. It can operate into an inductive or resistive load.

The attack time of the automatic attentuator shall be 3 milliseconds. The attack time shall be defined as the time required for the unit to go "on" or open the gate. The automatic attenuator shall have variable release control that will determine the time required for the device to accomplish attenuation or reduction in gain of the amplifier or other equipment following the automatic attenuator. This time can be varied from 300 milliseconds to 7 seconds.

The automatic attenuator's front plate shall contain two controls: (1) threshold and (2) release time. The unit shall employ solid state design and components and shall not introduce distortion or noise due to its use in any circuit. The unit shall require 6.3V AC or DC at 70 ma for operation. It shall weigh less than 24 ozs.

The automatic attentuator shall be capable of automatic "ducking", e.g., the signal from one channel shall reduce the gain of another channel, both channels being controlled by the automatic attenuator. The range of automatic ducking shall be adjustable from 1 to 60 db by strapping it externally with resistor. The device shall contain an on-off switch so that it and its effect shall be instantly by-passed if desired. It shall also contain a visual means of montitoring auto-ten action.

The automatic attenuator shall be 1½' wide, 5¼" high and 6½" deep. The front panel shall be brushed and anodized, and operating nomenclature shall appear on the front, brushed aluminum anodized dressplate.

The automatic attenuator shall be FAIRCHILD Integra series Auto-Ten Model 661TL.

ARCHITECTS & ENGINEERS SPECIFICATIONS: DOUBLE AUTOMATIC ATTENUATOR, (692DAT)

The double automatic attenuator shall consist of two completely independent signal activated gates on one card and shall be used to change the gain of an Audio chain or line. When placed at the input or output of an amplifier, the automatic attenuator device will cause the gain of the amplifier following to be changed from 1 to 60 db from its normal opearting level, depending on the action and setting of the automatic attenuator.

Sensing inputs of the devices shall have an input impedance of 10,000 ohms, bridging, and shall be activated by input levels from —40 db to +20 dbm.

The attack time of the automtaic attenuators shall be 3 milliseconds. Three release time constants ranging from 0.3 seconds to 7 seconds may be obtained by proper strapping of connector terminals. The use of an external rheostat will enable the release time to be varied continuously over this range.

The double automatic attentuator shall be contained on a 3 9/16" x 5" epoxy glass PC plug-in board with dip-soldered connections. A mating connector socket shall be included. It shall operate from a power source of 6.3 V or 18-24 V DC.

The double automatic attenuator shall be FAIRCHILD Model 692DAT Auto-Ten.

Patent #3,281,706
1/72

FAIRCHILD
SOUND EQUIPMENT CORP.
ROBINS INDUSTRIES CORP. SUBSIDIARY
15-58 127th ST FLUSHING, NEW YORK 11356 212 445-7200

The newest baby is Allison Research's plug-in voltage controlled amplifier, UCA-1. Circle 57 on Reader Service Card.

Many options are offered by Quad-Eight for this sixteen input and sixteen output console. Circle 64 on Reader Service Card.

As an adjunct to their consoles, you can get this completely automated programmer from Olive. Circle 65 on Reader Service Card.

Fairchild Sound set up a board on which they displayed their new line of i.c. op amp audio cards. Circle 56 on Reader Service Card.

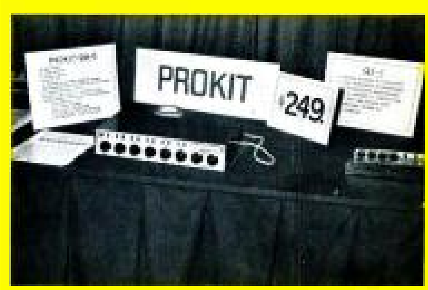
Extreme versatility was shown by this ARP systthesizer as guests made it make music. Circle 98 on Reader Service Card.

A variety of sound-reinforcement units can be had from DuKane. These Medallion Series are typical. Circle 78 on Reader Service Card.

Systron-Donner Model 7127 is a two tone audio testing generator with each channel tunable individually. Circle 81 on Reader Service Card.

Quad encoding and decoding was demonstrated from tape and disc by Sansui using their QS equipment. Circle 96 on Reader Service Card.

CBS-Columbia Records had a setup to demonstrate the encoding and decoding of their SQ quad discs. Circle 97 on Reader Service Card.



First in a line of do-it yourself kits from Gately is this six-channel stereo mixer. Circle 63 on Reader Service Card.

JAMES REISING

Q.C. For Cassette Duplication

The author is deeply involved in mass duplication of cassettes for the education field and is thus able to point to a principle rejection problem and its possibility of elimination.

When the cassette's internal friction rises above a certain level, the takeup reel will suddenly stop spooling tape . . .

THE CONVENIENCE and practicality of tape cassettes for instruction have helped to make our company one of the leading names in educational tapes. Although we continue to offer reel-to-reel tapes, they have been eclipsed by the popularity of cassettes and our production volume has risen to 3000 cassettes per shift.

Although our field experience has been good, we have had some returns, most due simply to jamming. When a tape will not move in the customer's machine, the cassette comes back to us. Jammed cassettes are easy to spot when checking through returned goods. Usually part of the tape will appear outside the cassette, or will be badly wrinkled. The takeup hub has stopped spooling tape for some reason, and the tape has wound around the capstan, pressure roller, or both. Some returns involve customer complaints of severe wow and flutter, normally an indication of excessive friction on the supply hub. In any event, these returns are my problem—my responsibilities include quality control.

My first step was to make heavy use of our WATS lines to talk with the teachers who returned the cassettes, and to call the salesmen and dealers involved to get all the information I could. I found that about 90 per cent of the cassette returns were due to high internal friction—there was more drag on the tape than the takeup drive could overcome when it was in the *play* mode.

Internal friction in a cassette originates in many areas. The edges of the tape packs rub against the slip sheets, the bearing surfaces between the packs and the cassette walls. Drag is created as tape passes over rollers and pressure pads, and the rotation of the hubs creates additional resistance.

When the cassette's internal friction rises above a certain level, the takeup reel will suddenly stop spooling tape —which is the time that a jam may occur. This could be due to excessive friction on the supply side, which the drive mechanism cannot overcome, or to stalling of the takeup drive while the capstan continues to feed tape. I measured the torque on the takeup hub in about fifty assorted cassette machines, and with that background I devised a method of measuring internal friction in cassettes. I took a drive with an adjustable clutch and calibrated it so that I could measure its winding torque. The torque range in machines I checked ranged from 40 to 84 gram-centimeters, and I set the clutch of the test unit at 63 so as to be in the middle of the range.

This drive has a pressure roller I can deactivate while it is in *play* mode. I prepared a group of test cassettes, loading a 31-minute program in one side of a C-60 tape—knowing that problems are more likely to appear when a small overload is present. When one of these cassettes stopped running before the end of tape, without the pressure roller in position, I knew I had a possible jam. Next, I would set the roller back in its normal position and time the remaining amount of tape to determine which cassettes stopped early and which ran most of their tape before stalling.

I felt that I was on the right track with this approach, and my belief was reinforced when a manufacturer with similar concerns introduced a new instrument specifically designed to perform the same type of test. Made by Information Terminals Corporation of Mountain View,

I felt I was on the right track with this approach . . . Each cassette is given four tests . . . we thus have checked both spools in full and empty condition.

James Reising is chief engineer of Imperial International Learning Corporation of Kankakee, Illinois.

Figure 1. The author performing a typical test on sample cassettes.

California, it is called the M-200 Torque Tester. It has a meter calibrated to display torque within a cassette, in gram-centimeters and ounce-inches. The user simply places a test cassette on the instrument's deck and presses the *start* button. An 8-gram-centimeter holdback torque can be switched in and out with a lever, in accordance with American National Standards Institute specifications. This holdback torque puts a small internal strain on the tape to simulate operating conditions inside the cassette.

Essentially, this torque tester duplicates the procedure I had devised, with such refinements as a numbered read-out—with two ranges of 30 and 60 gram-centimeters full scale. I purchased this instrument as soon as I learned of its availability, and it is in daily use. We run tests with the 31-minute program described earlier, keeping the hold-back torque switched on at all times.

Figure 2. A portion of the duplicating and loading area at Imperial International Learning. At the rear a ¼-inch bin loop duplicator made by Liberty U/A in conjunction with Magnefax. Other duplicators are Magnefax common mandrel machines. Loaders are Liberty U/A CW 15's equipped with Electro-Sound model 200 automatic splicers. One girl can load 900 cassettes per shift with this combination. Submasters are stored at the left.

Our test have included every make of cassette we could obtain, and we have learned a lot . . .

Each cassette is given four tests. Torque is recorded on the A side with a nearly-empty takeup reel, and the cassette is then turned over to get a B side reading with the takeup reel nearly full. The tape is then wound onto the other spool and another set of measurements is made for each side. We thus have checked both spools in full and empty condition.

Typical readings with an excellent cassette run around 12 gram-centimeters for a nearly-empty spool and 50 for a nearly-full spool. A poor cassette might read 25 empty and 78 full. We add all four readings from each test to arrive at an index number, and we have established 150 as the maximum allowable figure. If the meter hits the peg, I arbitrarily add another ten points to the index number for that test. The lowest number we have recorded to date has been 99, and the highest more than 200; checks of field returns show an average index figure of 190.

Our tests have included every make of cassette we could obtain, and we have learned a lot—particularly the advantage for us to load our tapes in high-quality cassettes. We now specify pin-and-roller construction and other design features which keep internal friction low, and we check production lots constantly to assure effective quality control. The cassette duplication field is young, and the state of the art is advancing rapidly. I consider instrumentation like this to be highly productive in solving a common cassette quality control problem. ■

NORMAN H. CROWHURST

Short-Run Cassette Duplicating

The duplicating of cassettes and tape reels in relatively small quantities has become big business, and more and more firms are becoming involved with it. Much equipment already exists, and more will be coming in the months and years ahead.

CASSETTES are an extremely rapidly growing market, a form of packaging for recorded material. This is probably because, as a source of recorded material, the tape cassette has several advantages over disc, particularly in the area of handling ease. For many applications, this makes the cassette a desirable replacement for the disc record. But the problems in production of various length runs in this medium are quite different from those by now well recognized in the disc record industry.

For the cassette counterpart of the kind of disc that sells a million copies (or even slightly less) the most economic process is to use a tape bin for transferring program endlessly onto large pancakes of 150-mil tape. This is later chopped up and put into cassettes by automated machines, making production of recorded cassettes in large quantity competitive with their disc counterpart (This was described in TAPE DUPLICATING—A STATUS REPORT, db, Nov. 1970.)

However, that process involves far too large a capital investment for the people who are only starting in the

. . . it is easier, simpler and less costly to produce small numbers of cassette copies by methods less elaborate than the large quantity process.

We still meet people who have never tried even listening to a cassette . . .

business, and the setup is too cumbersome to achieve the same economy on a short run. Just as a few discs can best be made without going through the whole mass-production process, so it is easier, simpler and less costly to produce small numbers of cassette copies by methods less elaborate than the full-scale, large quantity process. Many of these short-run alternatives duplicate the program content with the tape already in the cassette. This is the counterpart of using blank acetates for making one or two discs.

Tape, particularly in cassettes, has some attractive advantages in areas not suited for disc recording, *e.g.* for the roving reporter, with a cassette recorder slung over his shoulder, or for more formal interviewing, or even for just casual recording under "live" conditions, almost anywhere. The disc recorder requires a highly stable location in which to operate successfully, while the cassette tape recorder is at home anywhere. And it seems a natural to make copies by playing the original back and recording a copy in another cassette, using a blank like the one used earlier to make the original.

If you want to make only one extra copy, maybe you can use a couple of ordinary recorders, one to play back and the other to record, running both of them at normal speed. But as soon as you want to make even a few more copies, the time for making the transfer begins to seem interminable. This makes apparent the need for expedited in-cassette duplication. This article is about the new developments in this direction.

DIFFERENT APPROACHES

We still meet people who have never tried even listening to a cassette, who assert that they will never work, or will never produce quality recordings, because you need much more than 1⅞ in./sec. to get quality recording. A decade or so ago, their viewpoint would have seemed sane to the rest of us: running tape that much slower than the 7½ or 15 we were used to could only result in a sacrifice in quality.

At one place I visited while collecting information for this article, a new rep just learning about cassettes raised the question. "But isn't that still true? Isn't this relationship between tape speed and quality sort of basic?" To which the answer, as the people referred to in the previous paragraph will insist, is "yes."

What makes the difference is that modern tape materials and improved head design have changed the relative parameters, so that tape speeds formerly necessary for high fidelity are now capable of responding up into frequencies of utility only to the birds and the bees.

CHOICE OF CASSETTES

However, as this question elicited its answer, the same need for precision stil exists—is in fact amplified by the lower tape speeds. Cassettes can be made in various qualities, with appropriately corresponding costs, and the economics of producing and selling one's merchandise dictates to some degree where one puts one's money.

This choice in turn relates to relative quantity questions. What price to pay for the cassettes? The man who wants to make a few, high-quality copies may be content to pay a dollar or two more for the plastic case that holds his tape. But any duplicator who makes a dozen or more copies at a time finds the possibility of using the lowest-cost cassette that is feasibly usable much more attractive.

What price to pay for the cassettes?

The money saved can more profitably be invested in equipment for improving the quality of copies made in those cassettes.

That kind of decision extends throughout this discussion, and it is surprising at how many points there is more than one way to go. In itself, cassette-to-cassette duplication is essentially a step (and a rather large one, taken in aggregate) between making just one copy of one tape, and turning out copies by the million. Obviously, such a big transition can best be accommodated in several steps!

The high-quantity process is fast, but involves costly equipment. Speeds up to 240 in/sec. are used, and the endless tape bin for the master completely avoids costly time loss for rewinding, because on completion of one transfer, using however many slaves are coupled to the one master, the beginning of another can follow immediately with no time delay. Each slave can make a copy of a 30-minute tape every 14 seconds. So 14 slaves will achieve an output of 1 a second.

But to achieve such an output rate, a very large capital investment is involved. In addition to the costly master and slave units and the bin, there are many more units to complete the production chain. There must be an adequate number of tape leading machines to keep pace with the duplication rate and there should be various quality control checks. All these items involve more, relatively expensive equipment.

As blank, unrecorded tape is normally loaded into cassettes for use by people who want to make individual recordings, it seems logical that short-run duplication could be made much less expensive by utilizing such preloaded cassettes and performing the transfer with the tape already in the cassette. This means they are ready for

A readily transportable unit from Computerized Electronic Education (CEE). A copy maker in two models (DC-1542 for 2-track, DC-1544 for four track), it is capable of making from 4 to 20 copies (by using additional slaves. The reel master uses 15 in/sec for material recorded at 3¾; the cassette master runs at 7½. Cassettes copy at 7½.

shipment as soon as the transfer is completed, requiring no more expensive equipment to complete the process.

But utilizing this philosophy finds many of the same basic problems arising, with different obstacles to overcome. How fast can the transfer be made? Of course, the procedure of multiplying up the number of slaves recording from one master provides about the same advantage as in the other process.

SPEED QUESTIONS

The speed question leads to an interesting variety of possible solutions. At present, most duplicators work at 7.5 or 15 in/sec., which is 4 or 8 times normal playing speed, and seems very slow compared with the 240 in/sec. possible with open reel and the endless loop bin. But going merely 4 or 8 times as fast does enable a 30-minute tape to be transferred in 7.5 minutes or 3.75 minutes, which is a substantial saving, compared with going at normal playing speed and taking the full 30 minutes.

Cassettes come in a variety of designs and production qualities, somewhat related to price. Most, if not all, manufacturers now agree that it makes little sense to use a system that requires an expensive cassette to make good,

This completely self-contained unit is part of a large group of systems available from Infonics. These include reel and cassette masters as well as duplicators. This is the model 102 which makes two copies from a cassette master.

How fast can the transfer be made?

or adequate copies. If the user's recorder can handle the cassettes, with whatever limitations may be imposed by that cassette-machine interface, the duplicator should be capable of producing the best possible copy within that cassette, however "cheap." This means that the guides and transport mechanism built into the cassette must, to some degree at least, be a part of the recording mechanism.

This is what imposes the limit to duplicating speed. The highest speed achieved to date, in a system that keeps the tape inside the cassette, is 30 in/sec., which is 16 times normal playing speed, allowing a 30-minute tape to be transferred in 1⅞ minutes. Several maunfacturers have tried this, but most report that so far they find it not too reliable in quality and that it is much more dependent on cassette quality than the lower speeds.

RECORDING OUT OF CASSETTE

An alternative process is appearing on the scene. At the moment of writing, Ampex gives details of this, with machines just now available.

The method is to use a vacuum to suck the tape out of the cassette into an external transport mechanism, making the transport more independent of cassette quality. The Ampex machine (the CD-200) runs at 75 in/sec., which is 40 times normal playing speed, enabling it to run a 30-minute tape in ¾ minute. Time for rewinding the master makes the total time from start of one run to start of the next a little over a minute.

Another approach to solution, having some similarities and some differences with this philosophy, uses a common capstan for master and slave units, in one or other physical layout. This has the advantage of locking tape movement together mechanically, so flutter and wow, as well as speed variation, is less of a problem.

CHOICE OF TAPE

Before getting into other problems encountered and methods of solving them, one feature is common to all: selecting the quality of tape used. It *must* be of the smooth type known in the trade as calendared. This is because, at the low playing speed (1⅞ in/sec. good head contact is essential for high frequency response (even more so than at the earlier speeds). Only the fine-grain, highly polished tape makes this possible. And for transfer at the higher duplicating speed, the close contact is at least equally essential—and somewhat more difficult to achieve.

Also, however good the tape, there is some rub-off at the heads, as well as the abrasive tendency to wear the heads. This mans that frequent head cleaning is essential to good duplicating, and that heads need replacing at intervals, to maintain quality. Having dismissed those general questions, we will move to some of the details.

MORE SLAVES

The first in-cassette duplicators used one cassette as master, electronically coupled to one or more slaves on which the program contained in the master is recorded, at whatever speed proved possible in the design used. While this does step up production capability, as compared with recording

The highest speed achieved to date . . . is 30 in/sec . . . most report that so far they find it not too reliable . . . .

from one machine to another at normal playing speed, it is not long before this process in turn begins to seem too slow: it still takes a long while to copy a few dozen tapes.

INTERMEDIATE STEPS TO THE MASS METHOD

Once a facility is established, the pressure begins to rise for turning out more and more copies. This can be achieved, either by multiplying up the number of slaves running off one master, or by moving toward a faster system (or both). With the notion of making it easier to progress from slower to faster systems, as well as other possible intermixes, flexible systems have begun to appear: providing reel to cassette, cassette to reel, as well as cassette to cassette, and also recording on pancake—150-mil tape on a reel, which can be cut up and put into cassettes later.

The vacuum system, which extracts the tape from the cassette to use an external transport mechanism, involves a complete new system—it does not use any part of the simpler in-cassette duplicator system that the user may have had before. Even though transfer is faster, it still loses time on master rewind. Also, there is some appeal to using a system built of flexible units that can later be integrated into a system capable of a higher production rate.

Whichever in-cassette recording method (totally in cassette, or with vacuum extraction to use external transport consisting of capstan, guides and recording head) the cassette's tape feed and takeup mechanism are still part of the complete transport, and can interfere with smooth operation. A step that can help with this, whichever in-cassette recording method is used, is a controlled rewind of the blank tape before duplication.

TAPE MOVEMENT PROBLEMS

Smooth flow of the tape, particularly at higher speeds, but also to a degree at normal playing speed, depends on the inter-layer pressure of the tape on the feed spool of the cassette. To achieve optimum handling, the blank tape in the cassette is rewound at a steady rate, with precision-controlled drag on the feed spool that assures correct tension and inter-layer pressure, as the tape builds up on the takeup spool.

Before the advent of in-cassette duplication, a similar problem had been encountered in the bulk process. Occasionally a cassette would jam up in the user's tape player, because it had been poorly loaded. The remedy was found to be the use of controlled tension in feeding the tape into the cassette, which may be achieved, either in the initial loading of the recorded tape, or by controlled rewind after loading.

Some people who duplicate in cassette also use such a controlled rewind after duplication as precaution against this problem developing.

POSSIBLE MARKETS

Readers of **db** are drawn most from professional audio, and thus think in terms of duplication as a professional function, to be performed in a professional duplicating studio, tailored to cater for a particular market range. However, the nature of cassette recorders and the attendant advantages over previous media opens a whole field of potential applications, many of which include the need for duplication facilities at the user end, rather than as part of marketing something recorded.

The method is to use a vacuum to suck the tape out of the cassette into an external transport mechanism . . .

Magnetic Research Co.'s model 4002 is a cassette to cassette duplicator that puts the master and four copies to be made in the same drawer and drives them all from a common capstan, using 30 in/sec transfer speed. An end-of-tape sensor disengages the capstan at the end of recording.

Still within the sphere of professional audio is the use of cassette recorders by news and other reporters, who may want copies made, possibly with some editing in process, at shortest possible notice, to get the tapes out for transmission by cooperating or network stations while the news is still hot. Here the master comes in the form of a cassette, and the copies need to be either reel or cassette, because some radio stations are equipped only for reel, although there is growing reason for them to have a cassette input for this purpose.

Editing may be necessary to insert explanations of the content, or to tailor length to a predetermined available time slot. Cassettes themselves are inconvenient for editing, as compared with reel. So a simple flexible system that can transfer quickly from the original cassette to an editing master on reel and after editing has been accomplished can then make either reel or cassette copies (or both) is a boon to small radio stations and reporters that work with them.

A much larger potential field is the educational market, commonly known as *audio-visual, a-v* or *multi-media.* Cassettes are convenient and inexpensive means whereby a local school district can make its own material on the spot, either as straight audio tapes, possibly with provision for recording student responses on a blank track, or as part of a multi-media presentation, using slides or panel book for the visual part.

One wonders whether, in view of the immense amounts spent by some of the more prosperous school districts on equipment that quickly falls into disuse, the inexpensiveness of this feature will appeal. The convenience of being able to generate new materials at short notice, under their own roof, should appeal, and the inexpensive aspect may increase the market by making such facilities within the budget range of smaller, or less prosperous school districts that could never have looked at the more costly system.

A group of Pentagon units that provide flexibility: at left, an RM-1200 2-track reel master (RM-1400 for 4-track); center, C-120 cassette copier (2-track, 4-track available); and right, an S-1000 eight-cassette copier (2-track, or 4-track available).

. . . however good the tape, there is some rub-off at the heads, as well as the abrasive tendency to wear the heads.

SOME MECHANICAL PROBLEMS

Some of the problems that beset the short-run copier who operates professionally will also concern school and other non-professional users, although neither may anticipate the problems before they run into them. Two mechanical problems concern the length of lead-in provided, or to be provided, and the length of tape to be used for making a copy, or for the master to be copied.

A master, or original cassette tape, can be recorded with almost no lead-in. The cassette may have the tape tight at one end, and when the record button is pressed, it starts recording within an inch or so of this end position. The *auto-sensor* type cassette, which has a small piece of foil at the end of the tape that triggers a tone, emitted by the recorder when the end of a tape side is reached, is likely to record from about an inch of the beginning, clear off the end, on each side of the tape.

It is virtually impossible to copy such tapes from end to end, even at normal playing speed, unless the blank tape used for the copy is a little longer than the original master, and/or the original is fitted with lead-ins to facilitate copying. Performing duplication at higher than normal playing speed increases the problem, because then the run-up and stop times must allow a foot or so of tape, at least.

Once alerted to this situation, people who make the original recordings can easily be instructed to put a blank space at the start of the tape, before they start recording. Maybe the auto-sensor should not be used as a key to end the "side." True it is a useful device for purposes such as interview. The interviewer and interviewee are apprised by the beep that the recorder has run out of tape on that side. The interviewer flips that cassette out, either turns it over, or pops in another one, and the interview is resumed by backing up a little to repeat some of the dialog that may have been missed by the recorder when the beep started.

However, while that may be good for interviews, and the finish of a side can be appropriately edited in the course of copying, for a planned program that is not such a good idea. It would be better to plan on a time basis—most school presentations must have time limits anyway—so that the program will finish before the end of the tape is reached.

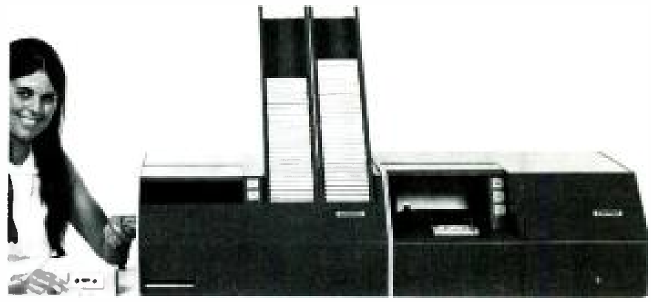
Closely related with this "filling to the ends" problem is the one of starting and stopping both master and slaves in such a way that the whole recording is transferred at duplicating speed, with minimum loss of active tape at the ends. Use of a common capstan is one way to overcome much of this problem in one step, or in the master-and-slave mechanism systems, the master can have additional leader at the ends, so it can be started a moment before the slaves and stopped a moment after they are.

One method of shortening start-up time is to have the capstan already running. Getting all the mass, necessary to achieve stability of speed *during* duplicating at the higher-than-normal speed, takes a considerable length of tape. By having the capstan already running and merely engaging the tape by means of the pressure roller when the tape is to start, the time taken (and corresponding footage, or "inchage") is considerably reduced.

But this method introduces another problem: the takeup motor, or drive must start virtually instantly, to match the

Master and slaves in this Telex reel-to-cassette system feature two-speed hysteresis synchronous motor drives. Electronics are of plug-in design so the system can be expanded to nine slave transports without additional electronics. Versions of the system are available in half-track one or two channel and quarter track two and four channel.

Ampex's CD-200 cassette-to-cassette duplicator is five times faster than in-cassette duplicators by virtue of its vacuum system that draws out the tape from the cassette so that it is run over guides and heads outside the cassette. The master unit on the right can drive up to five slave units. Note the automatic loader; the slave will also reject defective cassettes.



initial movement of the tape as it engages the capstan, without developing too much tape tension at any time, particularly during normal running.

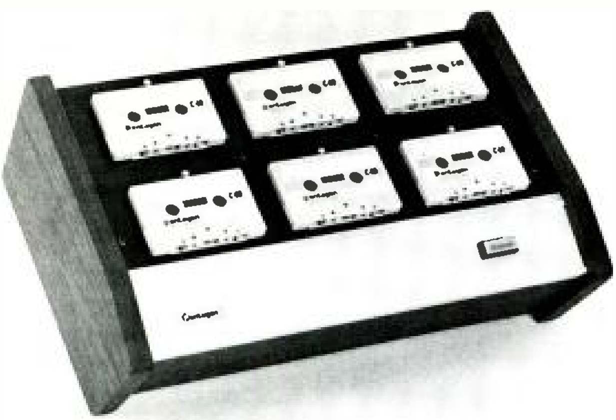
Another part of the same problem is that, not only must timing be correct, so the program starts at the beginning of the copy—not too early, not too late—but all tapes must be totally under control at all times, during starting and stopping operations particularly. So a good system needs some kind of *logic* or timing arrangement, to ensure that everything happens smoothly, in correct order, and timed for perfect control.

Such logic or timing can be achieved by a variety of combinations. Magnetic-type contact relays can be electrically sequenced with controlled delay times. Or the whole control circuit can be solid-state sequenced, with the necessary timing built in. Every action must be built to include the purely mechanical actions or reactions, due to inertia of the moving parts. Much design work has gone into this aspect of a well-designed unit.

TAPE LENGTH PROBLEMS

Copying still involves a little problem, which is being solved. Cassettes come with standard nominal lengths of blank tape loaded into them. Until recently, these lengths

A cassette winder, used either before or after recording, ensures that tape moves freely by being wound at the correct tension; this model winds six cassettes at a time.



were often more *nominal* than *standard*. The length could vary by ± 20 or 25 per cent from the designated. So the cassette whose playing time is nominally 30 minutes might contain tape that wil last anywhere from 24 to 36 minutes (taking the ± 20 per cent limits).

If the original had only 24 minutes worth of tape on it, there should be little problem: the copies will invariably have enough tape. But if the original happened to be a little full, copying could run into problems. Fortunately this problem is being helped by the availability of cassettes pre-loaded within guaranteed limits of tape length deviation.

So far, we have assumed that the material to be duplicated more or less fills both the master (original) and the copy cassettes, except for variable length leaders, as may occur due to different lengths of tape inserted. But there is another length problem. Sometimes program does not anywhere near fill the time available in the cassette, for one reason or another. A 30-minute cassette may have only 13 minutes recorded on it.

Does one record the 13 minutes' worth and cut the tape short, removing the extra so as to leave only adequate leader at each end? For the school type a-v use, a variety of answers can apply here, and the copier should be aware of these possibilities. First, how are the tapes to be used? Is the program going to be recorded and stored for an indefinite number of future uses, possibly never being erased and used over? If so, it makes sense to cut the tape short. In such cases, sometimes the practice is to record the same program on both sides of the copy, so the cassette never needs rewinding. After one student has used it, it is ready for the next student to use, playing it in the opposite direction.

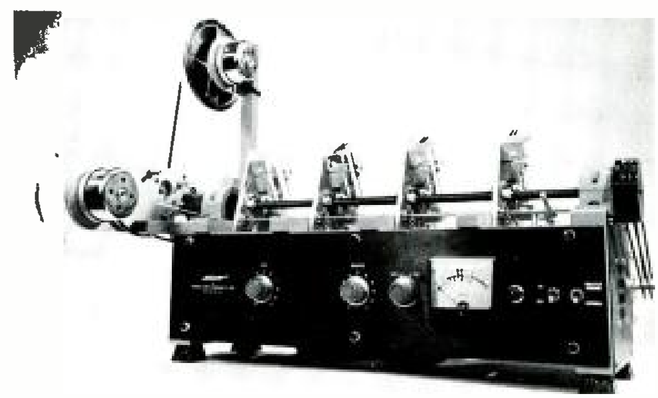
But the poorer school districts may not want to commit themselves to such a large investment in cassettes and storage for them as this approach would involve. They may prefer to erase and use over more often. In this case, cutting a 30-minute tape to 13 minutes would spoil that cassette for future use, when a longer recorded item may be desired.

This leaves the question as to how the tape shall be used, in both the original and the copy. If only one side is used on the original, with two sides on the copy (identical) then the question concerns only the copy, but the basic question is similar. You start recording with a 30-minute cassette of tape, and a suitable leader length to make it copiable, and you record, say 17 minutes' worth. Now what?

You have decided to keep the cassette's 30-minute length of tape, so you do not cut off the spare length of blank tape. But do you flip the cassette at the point where recording the first side ends, and record the second side so it finishes at the end of the tape? Or do you run the tape out on side 1, using fast forward (or fast rewind after flipping) so the other side also starts at the beginning of the tape on that side?

This question cannot be decided here. Different decisions will be made in individual instances, based on a variety of factors that we need not be concerned with. The important thing is to be aware of the question and its possible answers.

Once a facility is established, the pressure begins to rise for turning out more and more copies.



Multitape uses a common capstan system to go from open reel masters to the cassette slaves.

A torque guage is used to check the torque provided by the controlled tension device on the feed spool shaft.

COPYING PROBLEMS

Reverting to the copying of professional audio tapes, the program content can be 2-, 4- or 8-track and it can be mono or stereo. This creates a variety of possible track directions (as well as widths) on the tape. Precise positioning of the tracks is vital because, being so narrow and so closely spaced, very little lateral movement of the tape will move the head from one track to another.

The low speed used for playing and recording has already made azimuth critical to high frequency performance. Increasing the number of tracks and thus reducing individual width of track and spacing between them, complicates the transport mechanism problem of insuring that tracks are correctly located on the tape.

One step toward improving the performance of the in-cassette variety of duplicator (as compared with the variety that uses external transport with a vacuum extraction of the tape) is the use of extra guides, spaced further along the tape from the head, by utilizing additional apertures in the cassette for this purpose. This approach is being adopted by at least one company.

One master and two slaves in this Electro-Sound system. More slaves, up to a total of eight can be added to this cassette-to-cassette system.

Another somewhat minor complication, that can result in embarrassment unless care is taken, is the fact that the order of tracks on stereo reel to reel differs from that adopted for cassettes. On 4-track stereo, reel to reel, one direction uses tracks 1 and 3, while the reverse direction uses tracks 2 and 4 (which become 1 and 3 when the reels are flipped). On a 4-track cassette, one direction uses tracks 1 and 2, while the reverse direction uses tracks 3 and 4 (which become 1 and 2 when flipped).

Thus, if 4 tracks from a reel-to-reel tape are transferred to 4 tracks on a cassette, using the same track sequence, one channel of stereo is going to get paired with the other one from the opposite direction, playing backwards! The inside tracks need transposing. A convenient way to take care of this is with a switch that makes the change when the different medium is used.

Crowding more tracks onto the tape also creates another problem: the avoiding of crosstalk is more acute. For normal duplicating, time economy is effected by transferring both (or all) tracks at once. With 2-track tape, this means one track is duplicated forwards and one backwards, at the same time.

With multi-track crowding so many into such a small width makes electrical cross-talk much more difficult to avoid, because the windings and magnetic circuits on the heads are so close to one another. It is sometimes advantageous, to minimize this effect, to transfer tracks separately in opposite directions. But when this is done on a machine that has a full set of heads and accompanying electronics, it is important to kill the unused electronics by some means, so that they do not generate unwanted noise, deteriorating available dynamic range, as a price for reducing crosstalk. ■

Circle 23 on Reader Service Card

db Visits—Superscope Recorded Tapes

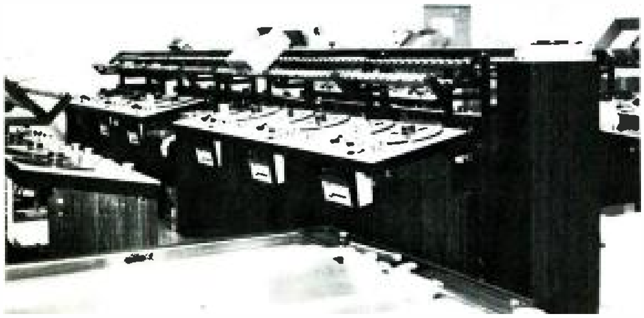
Superscope's custom mastering equipment includes Scully transports, Dolby noise-reduction units, Langevin Graphic and Audio Design equalization modules, Universal Audio limiters, and Allison Research Kepex modules.

It's a pleasant short trip from downtown Los Angeles to San Fernando where the Superscope plant is located. It is not too far from the other plants and offices of Superscope Inc. the parent firm. Superscope Recorded Tapes is a duplicating firm that has both its own label of recorded tapes, including open reel, cartridge, and cassette, and does custom work on both large and small scale for outside firms.

Our camera toured the plant and came up with a group of pictures that pretty much detail the operation. We wish to thank many at the company and in particular Murray Goldman for kindness and cooperation during our visit.

The short cassette duplicator bank, part of the 37-slave Gauss duplicator system. The historical data card system above follows the pancake throughout its life and provides control and quality feedback.

The Gauss loop bin and transport; this is one of five 1-inch, ½-inch, and Superscope-designed ¼-inch loop bins in the facility.

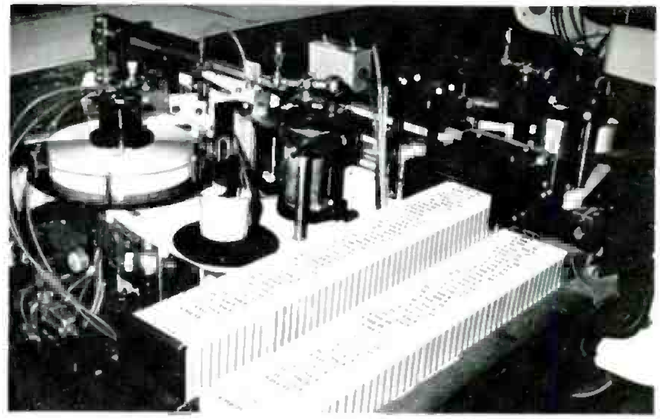


Part of the main duplicating room. You can see the conveyor system for raw materials and finished goods.

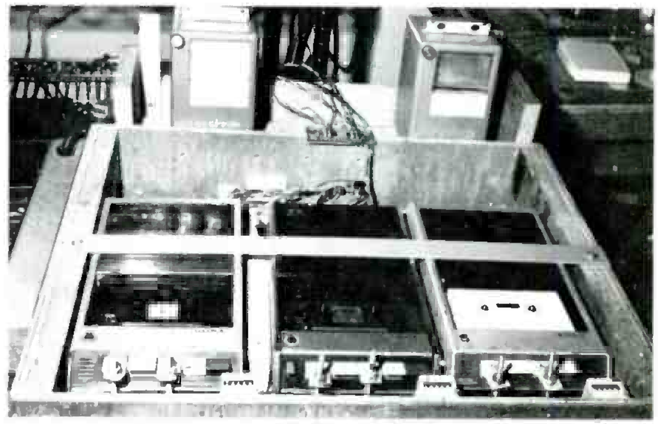
The young lady is doing an audio quality control checkout of a duplicated product.

Cassettes are loaded here. This is just a portion of the seventy stations in the production assembly area.

This machine uses pressure sensitive labels that are automatically applied to the finished cassette.



Process quality control station for mechanical checks of loaded cassettes and eight-track tape cartridges.



This life test bank is use to shuttle a finished tape back and forth as part of the company's environmental testing.

Martin Dickstein

SOUND WITH IMAGES

SMPTE Technical Conference

● Back in October, the Society of Motion Picture and Television Engineers held its 110th Technical Conference and Equipment Exhiibt. The meeting took place in Montreal, Canada, ran a full week, and provided visitors to the sessions with many technical hardware demonstrations as well as talk and panel conferences.

The SMPTE, well known to most, if not all, of the people associated with the audio-visual field, is a non-profit organization and one of its many aims is "to foster the advancement of engineering technology and to sponsor lectures, exhibitions and conferences designed to advance the theory and practice of engineering within the scope of the Society."

At this session, some of the exhibitors provided technical papers on their exhibited equipment and the range of hardware covered the field from lenses to film processors, from cordless cameras to sophisticated audio-visual sound mixers and projectors. Among the exhibitors were Amega Research Corp. of Newark, N.J., manufacturer of specialized sound equipment for the recording and editing of film sound tracks; Bell & Howell; Canon; DuKane; GE; Hollywood Film Co.; among others from the U.S.A.; and Braun Electric; Central Dynamics; Clean Air Inc.; and MacKenzie Equipment Co.; of Canada. This is only a random selection, listed in alphabetical order only for convenience, and by no means is intended to show favoritism in any way. All exhibits were most satifactory.

Some of the topics covered in the talk and panel sessions included subjects such as laboratory practices (film, processing, techniques and equipment); television systems (t.v. studios, facilities, technology, transmission and distribution); Film for t.v. (concepts, equipment, production techniques); projection and theater design (rear, front, large screen and multi-screen ideas and installations); and photo-instrumentation (technology and systems for high speed photography and flow measurements). Also covered, in a two-day symposium, was the video cartridge/cassette/disc field, and it is to this portion of the proceedings we will devote our coverage at this time.

The intent here is to take excerpts from several of the talks to indicate the feelings of the expert speaking. There is no intention of editing for editorializing or for personal comment or review. The excerpted portion is complete as shown and no direct or indirect comparison of viewpoints of the speakers is meant in the portions selected. The talks will be given in order of number and it should be understood that not all of the many papers given in this subject could be covered no matter how brief the individual portions quoted. However, no slight or comment is intended toward the papers not selected for excerpting.

In the "Perspective Session", under the heading of "Video Cassettes, Boom or Bust?", Mr. Gordon Thompson of Bell-Northern Research Labs., Ottawa, said at the beginning of his talk: "In order to set the analysis that follows in perspective, let us divide the field of video cassettes, etc. into three classes: the pre-recorded sort of thing that emulates today's phonograph and audio cassette business, the do-it-yourself kind of business that is typified by the Port-a-Pac video tape recorder and resembles the present day audio tape recorder, and finally an electronic delivery system."

In summing up his discussion of the first of the above classes, Mr. Thompson says: "In review, I am concerned about the content of the pre-recorded video cassette being adequately suited to generate a mass market because of our present low level, but rapidly increasing level, of visual literacy and our culture's tendency to accept television-like presentations as figure rather than ground. (*Ed. note*: *The Gestalt theory was introduced and explained briefly at the beginning of his talk to explain the use of figure and ground references.*) I am not too concerned by the high prices of the material in the first place and suggest this may in fact cause the conventional sort of material to be re-examined."

In his discussion of the distribution of pre-recorded cassettes, Mr. Thompson concluded this part of the talk with: "Certainly the issue as to whether cassettes are a boom or bust will not be a simple binary one. The probable future lies somewhere in between. Educational and training markets alone can sustain a fairly large industry. The mass entertainment market may, however, be far more complex than that which motivates the phonograph record business. Whether or not the technology can be developed to permit the development of interactive video systems that would stimulate a really new business remains to be seen as does the cost of such a system."

Mr. Thompson's conclusion, after discussions on the other two classes introduced at the beginning of the talk, was: "Video cassettes, boom or bust? Not really either, but rather a step along the way to more complex, rather than complicated, systems of the future. Systems that seem to have some intelligence, and appear concerned about the satisfaction they are giving to the individual users. I believe we still have a long way to go, and that all three classes of these presently emerging video systems will play their parts as components of an even greater synthesis."

In a technical session on video cassettes, one of the speakers, Mr. J. Bernhart, of the French National Television Office of Paris had this to say: (*Ed. note: this talk was given by Mr. Hans Wohlrab for Mr. Bernhart and is being quoted from a rough translation.*)

"To wish to settle at the moment on a definitive standardization would mean in large part to freeze design possibilities and block highly desirable broad systems studies.

"To speak of standardization is to fix common techniques within the framework of a given family of users.

"When applied, these principles lead not to a similarity of players (not to say an industrial monopoly) but to their adaptation to a standard for recording and playback. This is fundamental to a coherent plan for the production and distribution of software.

"The problem of standardization exists at all steps in the manufacture of hardware and software."

After mentioning the various methods and media presently in use and under consideration, and an in-depth discussion of the variations in each of the systems, Mr. Bernharts's conclusion is: "We may accept that imposition of a standard from this moment on would risk discouraging all of the development that is highly suitable for the systems as a whole.

"On the other hand, permitting each manufacturer without reservations to commercialize a different model, incompatible with the norms used by his competitors, would be in defiance of good sense. We would then be participating in the creation of a 'gadget for the rich', in the words of Mr. Guber.

"Already we are suffering from the disparity in standards in color and in scanning.

"Within a given family only one standard should prevail.

"I earnestly hope that, concerning the suggestion made right here of the creation of a permanent commission, under the aegis of Billboard VIDCA, that it will be set up, and that the manufacturers will subscribe to it, if not with enthusiasm, at least with *reason*.

"Is not the interest joint between the users and the manufacturers?"

* * *

For your future reference, mark your calendar for the next SMPTE Winter Television Conference in the Sheraton-Dallas Hotel on February 4 and 5, and the SMPTE Technical Conference at the N. Y. Hilton Hotel, April 30 through May 5. Both of these sessions will include papers on the use of video tape, film, and equipment of all kinds for application in t.v. production and distribution. For details and information as well as membership the Society can be reached easily by phone or mail at its New York offices. ■

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PEOPLE, PLACES, HAPPENINGS

• Election of **George Alexandrovich, Sr.,** as a vice president of **Robins Industries Corp.,** College Point, N.Y., has been announced by **Herman D. Post,** president. Mr. Alexandrovich is also vice president of **Fairchild Sound Equipment Corporation,** a Robins subsidiary. The Fairchild unit, which Mr. Alexandrovich joined in 1956, specializes in standard and custom components and systems for broadcasters and the professional audio industry. Robins is known for its magnetic and perforator tapes, cassettes, tape cartridges and accessories for consumer electronics and data processing. As a corporate vice president, Mr. Alexandrovich will be deeply involved in all technical aspects of the company, Mr. Post said. Mr. Alexandrovich has written widely on audio engineering subjects, in addition to his regular **db** column and holds a number of patents on related products.

• **David Neve,** genreal manager of **Rupert Neve, Incorporated,** announces the appointment of **Rodney D. Titcomb** as marketing manager. Mr. Titcomb, formerly with **Westinghouse Electric Corporation,** will be responsible for the marketing activities of both Rupert Neve, Incorporated, and Rupert Neve of Canada, Ltd. An electrical engineering graduate, he brings 13 years of marketing experience to his new assignment.

• Fire on Thanksgiving Day caused an estimated $1 million or more damages at **Crown International** of Elkhart, Indiana manufacturers of professional tape recorders and quality high-fidelity products. **Clarence C. Moore,** president, estimated that 60 per cent of the facility was completely destroyed despite the efforts of eight fire departments called to battle the blaze. There were no reports of injuries as the plant was closed for the holiday. Two firemen suffered from smoke inhalation and were hospitalized but are now recovering. Employees reported for work as usual Friday, November 26, 1971, and began to repair the remaining facilities for occupancy Monday for business as usual. Arrangements have been made for temporary production facilities in the area according to **Clyde W. Moore,** vice president marketing.

• **Nortronics Company, Inc.** has announced its entry into the Japanese market through a joint venture with **Alps Electric Co., Ltd.** of Japan, the largest manufacturer of electronic components in Japan. **Alps-Nortronics Company, Inc.,** to be located in Yokahama, will be owned equally by Nortronics and Alps and will manufacture and sell mini-digital and digital type magnetic recording heads. The joint venture was formed to manufacture and sell to the expanding Japanese and Southeast Asia industrial, computer and mini-computer markets.

"Two separate licensing agreements have been signed," said **John Yngve,** president of Nortronics. Nortronics Company, Inc., has licensed the joint venture (Alps-Nortronics Company, Inc.) to use the techniques and advanced technology developed by Nortronics, and also has signed a similar licensing agreement with the Magnetic Head Division of Alps Electronic Co., Ltd. As a third aspect of the agreement, the joint venture company will take over the marketing and servicing in Japan and Southeast Asia of Nortronics products which are manufactured in Minnesota.

• **RCA** has announced it is phasing out its magnetic products business, which includes computer tapes and disc packs as well as audio and video recording tape. The company said this action is being taken as part of RCA's withdrawal from the general purpose computer field. Prior to undertaking the phase out, discussions were initiated with various firms regarding the possible sale of the magnetic products business. RCA said the estimated costs associated with the phase out of its magnetic products business are included in the $250 million extraordinary charge related to the company's withdrawal from the general purpose computer business.

• **William G. Eagle** has been named manager of indirect sales at **Philips Broadcast Equipment Corp.,** it is announced by **James L. Wilson, vice president of marketing.** Mr. Eagle will direct the efforts of the company's national network of distributors handling Norelco commercial video, or closed circuit television systems. Philips Broadcast is a subsidiary of North American Philips Corporation. Prior to joining Philips Broadcast, Mr. Eagle was vice president of **Joseph Plasencia, Inc.,** exclusive export agent for a number of U.S. manufacturers of systems and equipment for the broadcast, closed circuit, cable television and two-way radio fields. Before that, he was with **General Electric Company,** first as western regional representative for microwave sales, and subsequently as Latin American area manager for broadcast and c.c.t.v. systems. Earlier, Mr. Eagle served in various managerial positions in the international operations of **Collins Radio Company.**

• **David Sarnoff,** honorary chairman of **RCA** and one of the dominant figures in the world of communications for more than 50 years, died December 12, 1971 in his home in New York City after a lengthy illness. He was 80 years old. Born on February 27, 1891, in the small village of Uzlian, near the city of Minsk, Russia, he was brought to the United States by his parents in 1900.

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