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JUNE, 1961
50¢

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THE "DARK HEATER"

From RCA—which in recent months has brought you the revolutionary nuvistor tube, the dramatic Novar receiving tube, new super-strength metallized ceramics, the vacuum-melted cathode, and S-311 high-dissipation plate material—now comes the latest in a proud list of contributions to tube making: "DARK HEATER".

The "DARK HEATER" is a key to greatly extended life and improved performance of receiving tubes.

The "DARK HEATER" operates at greatly reduced temperatures—as much as 350°K below the 1500 to 1700°K of the "White" heater. The unique dark surface radiates heat more efficiently and improves the transfer of heat to the cathode. Thus the required cathode temperature is attained with the heater operating temperature lowered to approximately 1350°K.

For more information on what this dramatic advance in heater design can mean to you in your equipment, see your RCA Field Representative.

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CONSTANT HEATER CURRENT—The "DARK HEATER" exhibits an exceptionally stable current characteristic throughout its life. This feature is especially desirable in maintaining a constant cathode temperature.

REDUCED HEATER-CATHODE LEAKAGE AND HUM—AC leakage and hum are significantly reduced through the use of the "DARK HEATER". This improvement is most startling because it eliminates "spike" or pulse leakage currents sometimes present in other heaters. In addition, the reduction of heater temperature serves to reduce both AC and DC leakage from heater to cathode, and heater emission to other tube electrodes.

IMPROVED MECHANICAL STABILITY—The cooler operation of the "DARK HEATER" minimizes changes in heater shape during life, reducing the possibility of heater damage and heater shorts.

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Saul J. White
Chief Engineer, Audax, Inc.

No. 4 . . . “OUR NEW SOUND RADIATOR”

The bombardment over the past few years of sophisticated and craspot cabinets and speaker systems, reminds me of the legend of “The Emperor’s Clothes.” Like the myopic citizens in this fairy tale we have looked ourselves. We have been1 embarrassed by all writers of “revolutionary” enclosures, “new discoveries” and the final “break-through.” I too have been admiring the Emperor’s fine clothes, when in reality, as the child pointed out, the Emperor was stark naked.

Over the past few years I have had occasion to test some three hundred cabinet designs. These were mostly variations of the bass reflex and the closed infinite baffle types. Some were turntable designs, others were designed to be competitive designs, models of patented enclosures, etc. I have tested all manner of ports, ducted and unducted rear areas, at several resonating cavities, cabinets having flapper valances, others filled with bags of the finest quality membranes and sound absorbing panels, and dozens of different shapes and configurations. Some were submitted to us by hopeful inventors such as other. They wore no disguise—honest, unsophisticated human laymen; others of our own conception.

It recently struck me that all of the hundreds of measurements, the few, not a single one concerned a simple flat bass, or an open-back enclosure! I too had been led by the Emperor’s hyperbolic and disastrous adomnements. Amateurs and schoolboys had been tak-

Ing over the engineers’ sovereignty.

It sometimes happens that certain theoretical shortcomings prevent for years the introduction of a device which has been tested under practical conditions. For instance, the open back or flat bass speaker has had no acceptance among designers because our textbooks tell us that such a baffle results in the disappearance of low frequencies due to poor ‘flutter’ in the front and rear waves, and that the bass cuts off at 18 db per octave. When measured outdoors in an anechoic room there is a very substantial loss of low frequencies perpendicular to the axis of the speaker. Thus, the radiation contour for uniform output has the appearance of a figure ‘8’ (the classic flat open-back speaker is a dipole radiator because it is assumed to propagate sound in two narrow opposing beams.

Recently, listening to one of our experimental speakers incorporating certain of the foregoing principles thought of “‘8’” baffle set in a 4 inch frame, we were surprised at the quantity and quality of our anechoic sound room indeed showed low frequency losses which did not correspond to what we had been led to believe. Measurements in our anechoic sound room indeed showed low frequency losses which did not correspond to what we had been led to believe. For example in a living room there is a very substantial loss of low frequencies perpendicular to the axis of the speaker. Thus, the radiation contour for uniform output has the appearance of a figure ‘8’ (the classic flat open-back speaker is a dipole radiator because it is assumed to propagate sound in two narrow opposing beams.

We found an abundance of clean bass and in-

stead of two beams of sound, we could place our favorite armchair in any position with very little change in quality or level.

Naturally, these listening virtues merited further objective studies and we have come up with a really realistic speaker using the oldest of basic principles, but with certain changes in concept for which patents have been applied. The Emperor wears no phony clothes.

We have added refinements to produce a broad band response and we have kept the inherent distortion to an insignificantly low level. The final effective resonance is due to the “air-man-stiffness” of air in closed-back sys-

Audioclinic

Joseph Giovanelli

NOTE: I have had to handle a tremendous amount of correspondence from readers. Because of the amount, some questions will not be answered as soon as I would like, or as soon as you would like to receive them. I don’t want to rush my work be-

cause I wish to give you all the same service that I have tried to give you from the inception of this question-answering service. The questions which will take the longest to answer are those where diagrams must be drawn, and those with schematics accom-

panying them. Bear with me—you will hear from me as soon as possible.

All letters are acknowledged and all ques-

tions answered regardless of the suitability of the material for use in the column. This

week all can have a chance at getting the help you need.

Another thing which can slow down my reply to you and to many others, too, are

those letters which do not contain a stamped, self-addressed envelope. If you

figure the time it takes to address enve-

lopes and to put stamps on them, you can see that much time will be lost which could

be spent answering your questions. Of course, those of you in foreign countries probably cannot comply with this request, partly because of the lack of reciprocity of postal agreements and partly because the added expenses make them

unrealistic. Naturally, I do not expect you people to include a stamped, self-addressed envelope with your material. But the rest of you—please send it to me. Thanks very

much.

A special thanks, too, to those readers who have written me lately merely to say

that the material I sent them was of help to them. It is nice to know that you will take the trouble to say that what I wrote was of help. All too often we write only when we have some complaint, and it is very nice to know that there are those who will write just to say thank you. To you I say “thank you”.

Along this same line, I am very happy to be able to say that I receive very few letters critical of the approach I take in conducting “Audioclinic”. This is really very surprising to me considering the tre-

mendous number of letters I answer and the

even larger numbers of people around the world who read this column.

O yes, one more thing. I would appreciate it if you local readers would write me about your problems with sound reproduction, rather than to phone me as some of you have done in the past. I can give you better help by mail.

Now to the work at hand . . .

Phase reversal in Preamplifiers

Q. It is obvious that you can make a switching circuit of course the terminal terminals of a power amplifier which can serve to reverse the phase of one speaker—useful for stereo. However, you just can’t reverse output terminals of a preamplifier, if that is what you want to introduce the phase reversal. Some preamplifiers do have this feature. How is it accomplished? Name Withheld.

A. You are, of course, correct in your statement that merely reversing the leads of one of the output connectors of the pre-

amplifier will not give the desired result. The ground terminal of the preamplifier will be connected to the hot input terminal of the amplifier, and tremendous amounts of hum would be the result. If the impede-

ance of the amplifier and preamplifier were very low, perhaps the hum factor could be minimized, but it is really too much of a chance to take.

Fortunately, there is a way around the problem. In a power amplifier this same problem comes up—at least it does when the output stage of this power amplifier is a push-pull configuration. In order to op-

erate the push-pull amplifier in the proper manner, a 180 degree phase difference must appear between the grids of the stage. This phase difference must, however, be so ar-

ranged that the two voltages composing it are at equal amplitudes. This condition is achieved by the use of a phase inverter, or more properly a phase splitter since this stage does not merely invert the phase, but provides two signals in proper phase relationship.

However, aren’t these the very same con-

ditions we want in our preamplifier? The answer is, of course, that this is the very thing we want, except that we don’t neces-

sarily want to have both signals simulta-

neously. All we have to do, therefore, is to make use of the well-known cathode-follow-

er phase splitter, in which half of the load for the stage is in the cathode circuit and half of it is in the plate circuit. If each of these impedances is made low, this phase splitter could be used as the output stage of the preamplifier rather than the cathode

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follower so often employed. The output terminals would be connected between ground and the "hot" side of a single pole double throw switch. Position A could be connected to the cathode circuit coupling capacitor, and position B could be wired to the plate circuit coupling capacitor. Naturally, you do need the coupling capacitors to prevent the d.c. voltage from appearing in the output. Position A would be phase normal, and position B would be "phase reversed".

The other channel in the preamplifier would have the conventional cathode follower in its output stage. A cathode follower does not invert the phase of the signal feeding it; neither will the phase be inverted in the cathode half of the phase splitter, and this is why position A of the switch gives you "phase normal". This assumes, of course, that the preamplifier contains the same number of stages per channel, and this is most often true.

Negative feedback
Q. Many voltage amplifier circuits achieve negative feedback by connecting the feedback from the output of the second stage to the cathode of the first stage. Well, I guess I should have said that the output of the second stage is taken from the plate. Anyway, I can't see how this will give you negative feedback, and I will explain why. I think I can do this best by showing the signal on one half of a cycle. Let's say that the grid goes positive. This means that the cathode of the first stage will also go positive because the tube is drawing more plate current than it did with zero signal. This makes the plate of the stage go negative for the same reason. This negative voltage is passed to the grid of the next stage, and everything is reversed, with the plate of that stage going positive. The output from this plate circuit is fed to the cathode making the cathode go even more positive than before, and this should increase the signal to the next stage and so on. What do you think? Allen Sullivan, San Francisco, California.

A. Your tracing of the signal is correct in all particulars. However, the conclusions drawn from what you have observed are incorrect, and I shall try to explain why. Let's say for argument's sake that the grid of the first stage is directly connected to ground. Suppose that I introduce a signal between the cathode and ground, across the same cathode resistor to which you

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LETTERS

Conversions to “Interconversions”

Sir:

For the case where output declines with frequency due to a simple RC equalization circuit, the article on “Interconversions in Equalization Terminology” in the March issue presents the following formula to convert the loss at the dB-down point, f,

to the loss at 10,000 cps:

\[ db \text{ loss } = 20 \log \left( \frac{10,000}{f} \right) + 1 \]

A simpler formula is:

\[ db \text{ loss } = 10 \log \left( \frac{10,000}{f} + 1 \right) \]

This has two advantages. It eliminates obtaining the square root of the quantity under the radical sign, and it is easier to multiply by 10 than by 20. Letting \( F \) represent the loss at a desired frequency, a generalized statement of the formula is:

\[ db \text{ loss } = 10 \log \left( \frac{F}{f} + 1 \right) \]

Where the equalization circuit produces rising output with frequency, the formula may be converted to:

\[ db \text{ gain } = 10 \log \left( \frac{F}{f} + 1 \right) \]

Herman Burstein, 280 Twin Lane E., Wautagh, N.Y.

Triode Transformers

Sir:

Referring to the article “Triode Operation of the 88’s” by Robert M. Voss and Robert Ellis in the March issue, readers will be interested to learn that Messrs. Partridge Transformers Ltd., of England do manufacture an output transformer especially designed for KT88’s in triode operation.

This transformer, Number 3 of the CFB series, represents the perfection of the popular WWFB/0 series by the use of new materials and techniques. Use is made of the latest grain-oriented strip-wound “O” cores. This component is intended for equipment reproducing the full audio band width with the very lowest distortion of any kind. The complete unit is hermetically sealed for all climates.

Ultra Electronics, Ltd., (Sole Partridge U.S. Agents) 235 East 60th St., New York 21, N.Y.

“Third Man” Search

Sir:

For some time I have been looking for a stereo tape recording (four-track, 7⅛ ips) of the “Third Man Theme.” I am searching for the song as it was played in the movie, “The Third Man,” with the other and accompanying instrumentation. I am certain that if anyone can help me, you should be able to. If the song is not available on tape, then perhaps it is available on stereo record, and I could dub a tape from this.

If any of your readers has such a tape or record, I would appreciate learning of its source.

Lt. Col. Dayton F. Brown, Hq., PACAF, P.O. Box 287, APO 953, San Francisco, California

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The symbol Q indicates the United Stereo Tapes 4-track 7/1 ips tape number.

Peter Sellers and Sophia Loren
Angel CS 53910

This recording apparently was a spare time project that evolved while Sellers and Miss Loren were preparing for the Million Dollar Quadrophone. The title material from the film was used in the recording sessions held in London and Rome but only a week at a time and in keeping with the mood established before the cameras. The high points of the film, not common at any rate, are the infamous antics of Peter Sellers. His imitation of Alec Guinness is one of the very best that has been heard. In the record here we encounter a comprehensive recreation of a corny song hit of the Twenties. The musical revival is admirably unifying with the deliberate application of old-style groove cliches and record now. The closest match on the record will have listeners seeking a four-speed turntable in order to figure out what Sellers did to Gershwin's "Lady Be Good" at a recording speed of 16 2/3 rpm. The result is quite amusing at normal speed. Those in a position to try the slower playback will discover that, oddly enough, the orchestral accompaniment makes sense at both speeds.

Wild Stereo Drums
Capitol ST 1553

Ever since the day when percussion recording exploited the expanded light duties charge there has been speculation relating to the day when all major labels might have to join the percussion bandwagon with dots all over their sales. Most of the majors, although unwilling to disclose the subject of treatment, have been leasing a steady stream of percussion releases. Capitol, in this album, presents an interesting study in restraint. The jacket's front cover carries a low-key photo of a kettledrum but the reverse side blossoms with a faint harvest of dots. They're barely visible at arm's length but will convey the message to the fellow who refuses to buy a percussion release unless dots are somewhere in evidence. Along with other responsible labels these days, Capitol has gone about the task of recording a melange of skins (big-band drummers, Latin rhythm specialists, and drill-field cymbals and drums), with the conventional tools of the trade. The Tower men in Hollywood placed their faith in the simple virtues of good range in frequent gust dynamics and let it all go at them. Those of the majors, although unwilling to disclose the subject of treatment, have been leasing a steady stream of percussion releases. Capitol, in this album, presents an interesting study in restraint. The jacket's front cover carries a low-key photo of a kettledrum but the reverse side blossoms with a faint harvest of dots. They're barely visible at arm's length but will convey the message to the fellow who refuses to buy a percussion release unless dots are somewhere in evidence. Along with other responsible labels these days, Capitol has gone about the task of recording a melange of skins (big-band drummers, Latin rhythm specialists, and drill-field cymbals and drums), with the conventional tools of the trade. The Tower men in Hollywood placed their faith in the simple virtues of good range in frequent gust dynamics and let it all go at them. 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Percussive Persuasion, Vol. 3
Command R 54817

On an overall basis, the tape fan appears to be a central weapon in the battle of the bands and a collector in keeping up with trends that dominate the music market. This Command series tends to hark back to the old days. It is recommended to keep abreast of things but the big bang boys are still going strong on tape. The spring pop market has been dominated by the Command and Time labels and the end is not yet in sight. The fanatics tape user, if this will power in low enough, can now lose himself in such exotic items as "Gypsy Strings" and "Persuasion." The third volume of "Percussive Persuasion," offers, at least, the stability of seasoned performers. These include Joe Scovronis and Mel Davis trumpet; guitarist Tony Mattola, the trombone of Bobby Byrne and a percussion section featuring Don Mattola, Cliff Leeman, Artie Martelli and Bill Giblin. Willie Rodriguez was in charge of the Latin hardware.

Deutschmeister Band: Sousa Marches
Westminster WTC 145

This entire production leaves something to be desired in normal listening pleasure. Part of the problem lies in the decision of the mill Deutschmeister band conductor's program that is more ambitious than those which first established its reputation. The band's normal repertoire—one in which it stands unique—is the completely unpretentious march music of Central Europe played with the gusto of a group not expecting to be taken too seriously to heart. In general, the band's march music has lost its charm. When the Deutschmeisters buckle down to serious stuff intended

* 13 Forest Ave., Hastings-on-Hudson, N. Y.

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Dene Domingo and Les Baxter workouts for Latin percussion, the abrupt left-right separation demands more on deployment of manpower in the studio than upon channel switching at the control. At the recording of special effects occurs in the two segments featuring drummer Dick Harrell. There contrary to the recording of special effects, the normal procedure was recorded first. Other instrumental parts were scored later and then recorded over the initial track. In this way, they end up accompanying the drums.

Peter Nero: Pianoforte
RCA Victor LSP 3334

Victor has launched a new pop pianist with enough on the ball to dethrone one of two asking keyboard favorites. It seems to be an axiom in the record business that a good-selling pianist can take care of most of the bills of an average-size unit. He keeps up the pace set in his first release, twenty-six-year-old Peter Nero should have the 25th street mortgage paid off in no time. With a confidence that only an adequate grounding in the classics can provide, Nero plunges into ballads and swing favorites with equal verve. There's an unforced exhilaration in his style that spreds to the accompanying orchestra under the direction of Marty Gold. He interleaves a fleeting reference to Rachmaninoff in "My Favorite Darlings" and a deep dream of Chopin in "Night and Day," RCA's engineering department has called this piano group (that is remarkably clean). If you're still harboring doubts about the capability of the stereo disc and stereo-to-mono up-conversion, try this one with one of the cartridges of a design that has been in the market for only six or eight months may change your mind about the record—and the performer.

Bobby Hackett: Dream Awake
Columbia CS 8402

No sooner had some of us suggested that nothing new was left up the sleeves of the record industry, when Columbia comes along with a release which, in stereo at least, establishes a most refreshing combination of sound. First, they decided to feed a serious record with the several layers of tone furnished by a four-manural Wurlitzer pipe organ. Atrp these layers was then placed the glowing sound of Bobby Hackett's trumpet. This somewhat improbable combination works surprisingly well. With stereo maintaining the natural dispersion of sound, there is less pile up of sound from the organ and the trumpet has even a chance to hold its own. The bullets, understandably, were selected for easy size and Glenn Osser's arrangements are the final touch in an unexpected feast.

Les Paul and Mary Ford: Lover's Lucy
Capitol CS 8086

Les Paul's first stereo record has a rather unusual history. It offers a good close to the wide gap that separates the master tape and the commercial product of the two-channel medium. This track mon-

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You've read the thrilling news that the F.C.C. has finally approved Multiplex Stereo broadcasting on FM! Starting June 1st, FM radio stations will be permitted to broadcast multiplex stereo—and FISHER is ready with the adapter you will need to enjoy this remarkable new stereo service!

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Since 1935, Peerless has been the pioneer—designing and manufacturing transformers of the highest reliability to most-exacting specifications of the electrical and electronics industries. A policy of creative engineering, precision construction and rigid quality control has given Peerless acknowledged leadership—particularly in the design of specialized units. Pioneering in miniaturization, Peerless has also established the industry standards for reliability in sealing and ruggedness of packaging. Products range from units 1/10 cubic inch to more than 20 cubic feet, from fractional voltages to 30,000; from less than 1 cycle to almost a half megacycle; in 1, 2, and 3-phase or phase-changing configurations. Constructions cover the range from open-frame to potted, hermetically-sealed and vacuum-impregnated units. Whatever your transformer needs, Peerless can design to your specification and deliver in quantity. In addition to the units shown here, Peerless has solved these special problems:

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Circle 108

Audio • June, 1961

For a heavy weight band, they're in for trouble. They are certainly out of their element in these twelve Sousa marches. The way they change in tempo within a given march, however ingratiating they may be in an Austrian novelty, are quite out of place in the sober step of a Sousa favorite. Neither are the technical elements of this tape all that they might be. The stereo separation is logical enough but the distortion is on the pronounced side.

Esquivel: Infinity in Sound, Vol. 2
RCA Victor LSP 2296
Winterhalter Goes South of the Border
RCA Victor LSP 2271

Latin-American favorites and reverberation figure prominently in these releases. In the second volume devoted to imagination unbridled for stereo, Esquivel demonstrates that he has been finding amusement in recent trends in novelty records. There is certainly more of a suggestion of humor in the way he treats some of the favorite tricks of arrangers-for-stereo these days. The injection of comedy may make more palatable the otherwise familiar stunts in the placing of voices and instruments for maximum two-channel surprise. Some of the tunes are so loaded with far-out harmonies, all the clever touches may not be apparent the first time. Latin specialties such as El Negro, Bambina, and Espina Casi receive their share of spoofing along with swing standards. Esquivel takes particular pleasure in pointing up by means of imitating voices, some of the sillier sounds we've generally taken for granted in today's instrumentals. Although the illusion of space is somewhat more contrived than usual, the arrangement of Time on My Hands does fill every foot of the recording area with the sound of clicking—some of it real, the rest produced by the orchestra. Esquivelians should find this one of his best releases.

Hugo Winterhalter combines his efforts to domestic and imported Latin tunes but the over-all effect of the album is definitely North American. This is the lush approach carried to an extreme. Then too, in the processing, the whole thing tends to get out of hand. By the time they fail at manipulating the sound, the guy with a decent system is hard put to recognize the familiar characteristics of violins and cellos. Webster Hall, the scene of the recording, does not possess the acoustic quality heard on this record.

The Three Suns: Fever and Smoke
RCA Victor LSP 2310

The deluge of percussion stereo recordings has created more than one problem for established performers in the popular field. With a new breed of customer clamoring for the cheap thrills of arbitrary stereo separation, many of the name groups in the business have been faced with an unhappy choice. They could remain on the inactive list until the rage had run its course or they could attempt to get in the swim through modification or abandonment of their past formula. Events of the past months have tended to show out of the market some artists who have provided variety and change of pace.

(Continued on page 28)
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THE GOOD NEWS—STEREO BROADCAST

Well, the first glossy photo of a real, honest-to-goodness FM-multiplex stereo adapter has just come in the mail (cost $99.50), the F.C.C. decision on stereo broadcast is still a breathless bit of news—and it seems I made another of my left-handed prophecies. (A left-handed prophecy is one that was written before but published after the fact.) I said last month that maybe broadcast stereo would be this season's coming hi fi sensation. It will be, as witness this issue of AMTO, given over to the good news that took so long in coming.

You will of course look elsewhere in AUDIO for the technical description of the wiring system, if you haven't had it lying around in your files for a year or so already. (My General Electric press release on this system came out in the spring of 1960.) It is my business to take the wide view and observe what I may as to the implications.

Well frankly, I am delighted. For it seems to me that a situation which three years ago looked like a real "mess" is now soluble unless either an existing industry were to be wiped out (the music stations broadcasting multiplexed restaurant background material on a subscription basis), or unless the quality of FM stereo broadcasting were to be seriously compromised, has instead been resolved with all parties happy. We have found a way to have our cake and eat them too, without compromise, or so I gather at this point. And the method is ingenious and it is a wonderment—why didn't somebody think of it earlier, back in the sermonizing days of the Crosby-Halstead arguments?

Genius, to paraphrase the familiar phrase, is an infinite capacity to be simple. If I am right, the men at G.E.-Zenith (I'll make no distinctions) are to be congratulated for just that sort of simplicity. They figured a way to avoid all the clashes and conflicts and compromises and counter-arguments of the rival camps that first tried to launch stereo broadcasts three years back, and, it seems, their system is possibly superior even to the best of the original propositions. Hard to believe.

Components Plus...

You'll probably read that the prime feature of the now-accepted G.E.-Zenith system is that it requires only a relatively inexpensive conversion unit, the multiplex decoder, utilizing only a single tubo in its simplest arrangement. True, this is a big advantage. It's a vital one in view of the huge importance in radio of the mass market, both the small mass-produced radio sets and the millions of large, mass-produced consoles. The fact is, of course, that component style radio is all very fine, but radio itself, i.e., broadcasting, can't get along only on components. If we are to have broadcasting of any sort, it must be based on components plus mass-produced equipment. Period.

The broadcast system that will be successful obviously must provide a dual basis: (a) the means for top-quality sound, in the broadcast and in the reception, and (b) simultaneously, the means for simple, low-cost, mass-production receiving equipment.

FM radio has never, except in special cases and special areas, provided the full top-quality potential in actual practice, but it has fulfilled the mass-production aspect admirably. That's why AM still houses along, in spite of TV and FM combined. FM broadcast mono, none, has done an admirable job from the beginning system to the first proposition—top quality sound for top-quality reception. Unfortunately, FM's mass-production capabilities were underplayed at the beginning, and the medium almost went under for it; I was in on that near-debacle myself; I lost a good job right after the war when the FM boom failed to materialize as predicted.

Now, happily, in the last few years FM has found it is helped boosted up by increasing component sales and the general impact of the idea of hi fi, but also by an increasingly solid mass-production basis in the recent years. Now—only have guessed it even ten years ago—we have transistor FM AM pocket radios, not to mention all other sizes. Sound quality is not exactly the point in these models. Their mere existence proves my point, that quality broadcast depends on non-quality mass-production reception.

FM, then, is on solid ground at last, in the mono medium. And meanwhile, stereo, in spite of its not-so-humble progress, has slowly taken over more and more ground, everywhere but in radio. The persistence of the dummy FM-AM-FM stereo broadcasts and a few FM-FM arrangements shows that the missing link of broadcast stereo has been a very real one. After all, it is the last link in the chain of linked elements that includes stereo discs, stereo tape, tape recorders and players, the home hi fi component system and mass-produced stereo "hi fi" equipment (traditional with me). (You'll note that we now have another new man in the business. A few years back "hi fi" became "the hi fi"; now one goes out and buys a "stereo"")

Compromises

Thus, to go back to my earlier point, the new stereo system meets the two vital requirements that would somehow have to be met, both of them—top quality throughout, plus adaptability for inexpensive mass-production receiver equipment.

If both a stereo hi fi band and one or more background music bands were to be carried piggyback on a single FM transmission via multiplex, there just didn't seem to be any way in which they could keep out of each other's hair and yet remain uncompromised in sound quality. Even the reasonable compromise in the assigned bandwidths prepared by Editor McPherson was still based on the premise that we had to have both stereo and background music, on the same broadcast signal, imposed in the same manner, and thus still potentially subject at least to accidental interference.

What nobody saw, at that time, was the brilliant possibility—that we could multiply these two different and competing signals—one hi fi music, the other music broadcast upon the same FM broadcast carrier, there would be no interference. The two would not recognize each other, nor, so to speak, be aware of each other's existence, though part of the same basic signal wave. This was the blindingly happy G.E.-Zenith idea. The question was how—how does it have to be done to work out the details, since this system did not appear in public and before the F.C.C. at a good while after the earlier proposals.

Again, I refer you to more detailed explanations elsewhere, but just marvel with me at the neatness of the concept itself: Put your second stereo signal, (the difference signal), onto the main carrier via an empirical multiplex subcarrier, suppress the carrier, and use the remaining AM sidebands to frequency modulate the main FM carrier. Then, higher up (you have to 75 kc), put the background music signal on the same carrier via the present FM multiplexing. Thus the two will be mutually exclusive; the detector that brings one of these signals to life can't even "hear" the other signal at all. It's wonderful!

It looks like this

As the Boss explained the inner details to me (he's the best teacher I've ever run into), the FM stereo transmission under the new system will look like this—I'll give it to you in my lay words, just as a side prop to the more proper engineering account elsewhere.

From 50 to 15,000 cps, on the FM carrier is the main or sam channel, receivable as a standard FM mono transmission. At 19,000 cps there's a control "synch" signal, to grab the local oscillator (producing the subcarrier) in the home multiplex receiver, similar to the TV arrangement. That oscillator runs at 38,000 cps, the second harmonics of the control signal.

Then from 23,000 to 53,000, still on the FM main transmission, is the vital AM multiplexed signal, 15,000 cps on the side of the 38,000 cps AM carrier frequency, suppressed at the transmitter—only the side bands go out on the air. What? I said I, the sides without the middle? Sounds to me like a bottle of milk without the bottle. Yet as it is, the oscillator in your tape recorder puts back the 38,000 cps, synchronized by that 19,000 cps control tone. And the simple fact is the AM detector just tunes in on it, re-activating an AM sound signal.

And 'way, 'way up in the FM stratosphere, still on that same main FM carrier, comes the standard FM piggyback FM-multiplexed background music signal, different music, for different
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FM and AM stereo tuners on one compact chassis. Easy-to-assemble: prewired, prealigned RF and IF stages for AM and FM. Exclusive precision prewired EYE-TRONIC® tuning on both AM and FM.

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New type 4-coil Moving Magnet Stereo cartridge with smoothest response from 30 cps to 20,000 cps, and it has more than 25 dB channel separation from 1000 cps to 10,000 cps.

High Output Voltage, high compliance, low mass, plus exclusive symmetrical push-pull design for minimum recording weariness and the lowest distortion.

GA-12 Professional Stereo 12" Tone Arm

Engineered for resonance-free tracing at 1/2 g, stylus force. Plug-in head have 4-terrninal tips so that any type of cartridge can be mounted.

NEAT

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receivers. It's far away from the lower FM signal, whose top is 15,000 cps. and it can't even hear the AM signal that sits in between. Neat, neat, neat!

No interference, top stereo quality (50-15,000 cps on both AM and different signals) and everybody happy. Chapp receivers too, or so I hear, in spite of that $99.50 job name: "New." That is—-a type of cartridge is inherently possible and satisfactory within its own sphere of operations. Mighty important, I tell you, even if the toy product does cost $100, self-puffed. Imagine if it cost $99.50 to buy any stereo adapter. Or even $39.50. It won't, if all goes well.

Now there's only one pay-off to mention here. I wonder just how many hopefully thinking audiophiles have jumped to a conclusion that is as likely as a short circuit in a wet distributor. Namely, that AM for the second (difference) stereo channel is bad because it's subject to static and noise (whereas the main signal, FM, is immune to the noise)?

This, of course, was one of the most violent objections made to us back in the day of old FM-AM stereo broadcasts, one stereo channel via the FM transmitter and the other via AM. But the reason that stereo circuit, but not in the other, was far more distorting than the difference in tonal quality between the two channels.

Do we have that problem again here, with FM and AM both in use? Of course not! I almost fell into this trap myself, but managed to save myself and my reputation just before I sprawled. This AM is multiplexed upon a carrier FM signal; it doesn't exist in "free air" so to speak. The receiver picks up only the FM signal, carrying with it three different messages. The AM is purely internal, if you see what I mean. So—no static.

Sure, sure, elementary; but I'll bet a lot of folks get tangled up on this little point, just the same.

Sometimes I wonder what my wife must be like to be a "lay about" that must be the F.C.C. The explanations that must go on, with millions of dollars hanging on every word! Lay or no, I'd say that the new F.C.C. has done a good job this time, seeing a good thing when it was presented, coming to a relatively quick decision in view of the "recency" (as Mr. HARDING might say, he of that famous word, "malely")—the recency of the new set-up.

We'll all be talking more, much more, about the forms of equipment that are now likely for stereo broadcast and the forms of stereo entertainment that may crop up. That, of course, is very much within our province and if anybody around here wants a guy who knows the technical ropes of stereo and the parallel ropes of its main signal—the art of music—I'm all set to produce stereo music broadcasts galore. I can even explain sum and differences to the folks "out there," if I have to. That takes explainin', let me tell you, especially to Aunt Mamie, who thinks "stereo" is something she saw in the movies, with a giant screen.

Have recorder, can edit. End of plug.

THOSE "STEREO" PHONES AGAIN

I am really not happy about this to-do over the so-called "stereo" headphones. The engineers have incurred the annoyance of a number of manufacturers of two-channel phones by suggesting what is surely the plain truth, that these phones do not give a stereo sound, but rather a binaural sound, (each channel going exclusively to one ear) which is more or less realistic according to the widely varying methods of stereo recordings now being practiced. The sound may be lovely, exciting, a superb new sensation, it may be for awhile to automatic sound through headphones, and indeed it is. But it isn't stereo, and that is that.

Yet, for all practical reasons, the name stereo being what it is these days, this wrong terminology goes right along. I'm looking at an ad for a complete component stereo system and I see to a large metropolitan music store. Stereo amplifier/FM tuner. Stereo speaker system, two separate units. Stereo turntable, plays stereo and monophonic records. And stereo headphones. "If you've never heard stereo through quality headphones, we know you're in for a thrill!"

Very possibly. I don't mean at all to split hairs, nor to run down the genuine pleasure which many people have found in this "stereo" listening. Indeed, I've always been a headphone man, as many a reader knows, and I'm frankly delighted that this very useful form of listening has staged such an unexpected revival. For years, the mere idea of headphones had been anathema to any salesman—only libraries and laboratories, schools, language centers and the like have used them for purely practical reasons. But for home enjoyment— heavens no! Not commercial. Well, they are commercial now, and of a good thing. As I've already suggested, when home recording enthusiasts begin to discover the absolutely astonishing qualities of true binaural sound to come via earphones (you'll need batteries of them, for the whole family), then I think the two-channel phone business is really going to sprout. The time is near enough—it's practically now. This particular plug of mine is absolutely hoary with age by this time.

Meanwhile, there are stereo recordings and there are phones. I keep receiving a steady stream of inquiries as to what "Bauer circuit" that converts headphones into simulated stereo receptors, and have dutifully sent them on to Mr. B. But I have not heard further as to available commercial versions of his simple circuit. It seems to me that the answer to the whole question of "stereo" headphone listening is to be found in this circuit. Just install it in your phones—or your tape recorder, as an alternative stereo amplifier "phone" output—and then go right ahead and call the "phones stereo. Correct.

What sounds good and what doesn't, I'm afraid you have to find out for yourself. There are stereo recordings and there are phones. I keep receiving a steady stream of inquiries as to what "Bauer circuit" that converts headphones into simulated stereo receptors, and have dutifully sent them on to Mr. B. But I have not heard further as to available commercial versions of his simple circuit. It seems to me that the answer to the whole question of "stereo" headphone listening is to be found in this circuit. Just install it in your phones—or your tape recorder, as an alternative stereo amplifier "phone" output—and then go right ahead and call the "phones stereo. Correct.

What sounds good and what doesn't, I'm afraid you have to find out for yourself. There are stereo recordings and there are phones.
Quality Control at AR

The frequency response of every AR speaker is checked in an anechoic chamber before it is shipped. (Many other tests, of course, are also made.) Acoustic Research is one of the very few companies in the history of loudspeaker manufacturing, so far as we know, that have followed this rigorous practice.

The purpose of such careful quality control is to make sure, as far as is possible, that AR speakers provide natural reproduction of music, without rattles, buzzes, distortion, or pseudo-hi-fi exaggerations.

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AR speakers are on demonstration at AR Music Rooms, on the west balcony of Grand Central Terminal in New York City, and at 52 Brattle Street in Cambridge, Massachusetts. No sales are made or initiated at these showrooms.

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EDITOR'S REVIEW

THE STEREO DECISION

AFTER MONTHS of more or less patient waiting, high fidelity fans throughout the country were rewarded with the decision of the Federal Communications Commission on FM Stereo on April 19th. Now that the one system has been selected, we may all begin with our experiments toward building our own, or—and probably much simpler—start saving up the pennies to purchase one. At least, there is no further doubt as to which system we shall be using, and it is quite likely that some of the industry’s laboratories are working overtime in the search for the "most for the least."

The choice of a single set of standards for the transmission of the signal does not mean that only one type of "decoder"—a term which distinguishes from detector and discriminator, neither of which the device really is—will work. In fact, we already know of three different methods of doing the job, and there are undoubtedly several more. In any case, we are presenting as much information in this issue as we could possibly acquire in just three weeks from decision to pretime. At least we didn’t say "ALL ABOUT FM-STEREO" on the front cover.

Starting on page 18, Managing Editor Saslaw gives us the background, delineates the actual F. C. C. order which specifies the standards, and describes both transmitting and receiving circuits with particular attention to the Zenith decoder. On page 21, Daniel von Recklinghausen, H. H. Scott chief engineer, delves into mathematics and shows how the signal can be developed by any one of three methods, and how one of the methods can be used as the decoder. On page 24, Antal Csicsatka and Robert M. Linz who did much of the development work at General Electric, describe the G-E decoder, along with still further background information. On the whole, we feel that this issue will serve as a sort of high-level primer to familiarize the audiofan with all of the aspects of FM stereo.

It appears that there are several difficult problems in making a decoder work with a minimum of distortion. That is to be expected—we have most recently gone through it with color television, and those circuits are certainly complicated enough; and before that it was plain old black and white television (remember when there were 30 tubes in a TV set?) and so on as far back as radio itself. There is not much doubt that the first decoders—and they will be in the form of "adapters" to be used with existing tuners—will work, and the integrity of the manufacturers guarantees that. By the same token, it is certainly likely that the device will be simplified appreciably, particularly for complete radio sets, since their standards of performance will not approach those of component tuners and receivers.

The transmitting standards are quite severe, and rightly so. It is interesting to note that the frequency response of the main and subcarrier channels must be maintained within less than 0.5 db throughout the range from 50 to 15,000 cps, and that the phase differences must be held within three degrees at the transmitter. These standards are certain to ensure that the transmitted signal will be all that we could ask of it—it is now only necessary that our decoders be as good as the transmitters.

As to the advantages of FM stereo, very little need be said. One of the greatest, as we see it, is that it will now be possible to tape some good stereo music from the air. Heretofore about all we could do was to play recorded tapes, or to dub from stereo records. We should soon be able to begin building up a stereo tape library, just as many of us have done on mono over the past ten years or so. We hope we can look forward to more live stereo broadcasting of good music than is currently available on mono, but that will depend on the listener reaction and the number of stereo receivers that are in use.

Anybody can speculate about anything—some prognosticators claim this is the end of the phonograph record, others that there will be a great boom in new tuners and receivers, in loudspeakers, and in tape recorders. We doubt that the phonograph record will ever pass into the discard, at least within our lifetime. We honestly feel that there will be a considerably increased interest in FM reception, and that the over-all effect on the audio industry will be good. We are not at all pessimistic, nor are we over-optimistic. We just look forward to further infusion of the desire for good music because of FM stereo, and this will give us a greater variety of programs from which to choose our musical entertainment.

SEASON’S EVENTS BRING NEW KITS

This has been a busy Spring, what with hi-fi shows in Washington, San Francisco, Los Angeles, and London (we missed the one in Paris altogether), and then the F. C. C. decision followed closely by the convention of the National Association of Broadcasters, also in Washington. But of the many things we have seen at all the shows, the one that impressed us most was a kit to end all kits—a 1000-watt AM transmitter in kit form.

This item was shown by Bauer Electronics Corporation at the NAB show, but we shall refrain from profiling it, even though it does save some $1300 for an average of about 55 hours of assembly time. Can’t do that well with any kits we have seen heretofore.

Another surprising idea in the kit department is Heath’s latest, a garage door opener. What won’t they think up next? With prefabricated houses, instant mashed potatoes, prepared canvases for oil painting by the numbers, and even boats of glass fiber cloth, why shouldn’t General Motors bring out a do-it-yourself Cadillac?

We’d be glad to Profile one of them!
Exclusive Assurance of Quality

Only the Stanton Fluxvalve can provide the exclusive and patented features which make it the finest pickup available.

The significance of a document—a Letter Patent conferring exclusive rights and privileges on an individual to manufacture and vend an invention both new and useful—further signifies a most important responsibility upon that individual.

Endowed with this responsibility, Pickering & Company pioneered—through their outstanding participation in stereophonic development—the Stanton Stereo Fluxvalve, the very first (and only) stereo cartridge incorporating the revolutionary T-Guard stylus.

But this was only the beginning—through continued development—major advances in stereo pickup design were brought about by the use of Pickering & Company's long experience...special skills and exclusive techniques.

Thus; less than one year after the introduction of the stereo record, Pickering & Company introduced the Model 300 Stanton Stereo Fluxvalve. And, in a few short months, the 300 earned its reputation from the experts as—"The finest stereo pickup ever tested".

Isn't it time you found the true answer to stereo as it was meant to be?

We urge you to go to your dealer for a 300 Fluxvalve Demonstration—we know you will find its quality of performance almost beyond belief.

For those who can hear the difference.

Pickering

for more than a decade—the world's most experienced manufacturer of high fidelity pickups...supplier to the recording industry.

Pickering & Co., Inc., Plainview, New York

The Stanton Fluxvalve and Stereo Fluxvalve are patented (and patents are pending) in the United States, Great Britain, Canada, Japan and other countries throughout the world.
What Hath FCC Wrought?

DAVID SASLAW

After several years of study, the FCC has finally decided upon a system of FM stereo. The system approved has the capability of achieving fidelity as high as is now available with monophonic FM broadcasts. Here are some details—

ON APRIL 20TH OF THIS YEAR, THE FCC made known its decision to permit FM stereo broadcasting commencing June 1. The decision, although actively sought for many years, seems to have caught many people by surprise. The surprise does not center about multiplexing as such, but rather the system chosen by the FCC. On the one hand there have been comments implying that the chosen system is “not as good” as one of the systems not chosen. On the other hand, there have been comments to the effect that many FM tuners were rendered “obsolete” because of the FCC decision. Actually these reactions are quite natural considering the enthusiasm with which particular systems were championed and the unusual lack of factual information about the system chosen. At this point it might be well to point out that the Zenith-GE system performed as well as the best of the systems not selected, and in addition is essentially more flexible (able to retain the existing commercial FM multiplex, SCA) than the runner-up system (Crosby). As for the fear that some types of tuners would be unable to be adapted to stereo operation, this is just not so. More about both of these points later.

Exactly What Is the New Stereo System?

First of all it should be noted that the FCC merely established what is to be transmitted, not how it is to be achieved. In essence, what was approved was a basic equation which defines the signal to be transmitted (for the exact equation see the Daniel von Recklinghausen article on page 21). In addition, the FCC defined the transmission standards for this basic signal in order to ensure high quality broadcasts (from a technical viewpoint). Following is the section of FCC Docket 13506 wherein the transmission standards are defined:

§ 3.322 Stereophonic Transmission Standards.

(a) The modulating signal for the main channel shall consist of the sum of the left and right signals.

(b) A pilot subcarrier at 19,000 cycles plus or minus 2 cycles shall be transmitted that shall frequency modulate the main carrier between the limits of 8 and 10 per cent.

(c) The stereophonic subcarrier shall be the second harmonic of the pilot subcarrier and shall cross the time axis with a positive slope simultaneously with each crossing of the time axis by the pilot subcarrier.

(d) Amplitude modulation of the stereophonic subcarrier shall be used.

(e) The stereophonic subcarrier shall be suppressed to a level less than four percent modulation of the main carrier.

(f) The stereophonic subcarrier shall be capable of accepting audio frequencies from 50 to 15,000 cycles.

(g) The modulating signal for the stereophonic subcarrier shall be equal to the difference of the left and right signals.

(h) The pre-emphasis characteristics of the stereophonic subchannel shall be identical with those of the main channel with respect to phase and amplitude at all frequencies.

(i) The sum of the side bands resulting from amplitude modulation of the stereophonic subcarrier shall not cause a peak deviation of the main carrier in excess of 45 per cent of total modulation (excluding SCA subcarriers) when only one left (or right) signal exists; simultaneously in the main channel, the deviation when only a left (or right) signal exists shall not exceed 45 per cent of total modulation (excluding SCA subcarriers).

(j) Total modulation of the main carrier including pilot subcarrier and SCA subcarriers shall meet the requirements of Section 3.268 with maximum modulation of the main carrier by all SCA subcarriers limited to 10 per cent.

(k) At the instant when only a positive left signal is applied, the main channel modulation shall cause an upward deviation of the main carrier frequency; and the stereophonic subcarrier and its sidebands signal shall cross the time axis simultaneously and in the same direction.

(l) The ratio of peak main channel deviation to peak stereophonic subchannel deviation when only a steady state left (or right) signal exists shall be within plus or minus 3.5 per cent of unity for all levels of this signal and all frequencies from 50 to 15,000 cycles.

(m) The phase difference between the zero points of the main channel signal and the stereophonic subcarrier sidebands envelope, when only a steady state left (or right) signal exists, shall not exceed plus or minus 5 degrees for audio modulating frequencies from 50 to 15,000 cycles.

NOTE: If the stereophonic separation between left and right stereo channels is better than 20 decibels at audio modulating frequencies between 50 and 15,000 cycles, it will be assumed that paragraphs (l) and (m) of this section have been complied with.

(c) Crosstalk into the main channel caused by a signal in the stereophonic subchannel shall be attenuated at least 40 decibels below 90 per cent modulation.

(d) Crosstalk into the stereophonic subchannel caused by a signal in the main channel shall be attenuated at least 40 decibels below 90 per cent modulation.

For required transmitter performance, all of the requirements of Section 3.254 shall apply with the exception that the maximum modulation to be employed is 90 per cent (excluding pilot subcarrier) rather than 100 per cent.

* Managing Editor, AUDIO.
Broadcasting FM Stereo

Previously we indicated that the FCC had approved the form and the technical standards for the stereo signal, not how it would be achieved. The distinction is quite significant. For instance, the approved system is known as the GE-Zenith system. Both GE and Zenith have on file with the FCC diagrams of proposed methods for producing the signal in the desired form. Both diagrams happen to be essentially similar as to method of signal generation. (Compare Fig. 1 in this article with Fig. 2 in the Csiszatka and Linz article, page 24.) Does this mean that this method must be used by all broadcasters? Definitely not.

There are at least two fundamentally different methods for achieving the standard signal. One of them is the type illustrated by GE and Zenith and described in the Csiszatka and Linz article, the other system is described at length in the von Recklinghausen article.

To summarize the two methods, the GE-Zenith technique requires a matrix wherein the sum and difference signals are achieved. The sum signal is fed to the FM exciter after a suitable time delay (to keep it in step with the difference signal which follows a somewhat different path). The difference signal, on the other hand, goes through a 38,000-cps suppressed carrier AM modulator and then to the FM exciter. Of course, both the sum and difference signals are properly pre-emphasized (before the matrix in the GE diagrams, after in the Zenith), and the difference signal is allowed to eliminate the harmonics of the carrier.

Figure 2 shows the block diagram of an AM modulator (Zenith proposal) which will generate the 15,000-cps-wide sidebands around the 38,000-cps carrier (which is suppressed) and, at the same time, provide the 19,000-cps pilot signal. The method used in this modulator is to mix the output of two crystal oscillators to provide the 38,000-cps carrier, or, by a 2/1 division, the 19,000-cps pilot. The pilot is then added to the sidebands which remain after the carrier is suppressed and the combined signal passed through a linear-phase-shift low-pass filter. If we refer back to the FCC specifications we note that the maximum difference permitted between the main and subchannel is 3 degrees. For this reason, care had to be exercised to avoid introduction of unwanted phase shift.

This is especially true in a system such as this wherein the paths for the main and subchannel are not identical.

On the other hand, the second method for generation of the standard signal is far less critical as to phase shift. This system is a time-division multiplex switching system between left and right stereophonic program channels. In this system a switching device alternately takes the whole left or the whole right signal. In a way it is rather difficult to understand how switching rapidly between the two inputs will produce the standard equation, but the fact of the matter is that it does produce it. In actuality, the form of the standard equation is the key to its derivation; it is essentially a Fourier expansion of two variables. That is, if we were to take any two independent variables and expand them mathematically we would arrive at substantially the same equation. According to Carl Eilers of Zenith Radio Corp. (who worked on it), the idea for the now accepted system had its inception through mathematical analysis of the time-division multiplex signal. Strangely enough, in its own presentation, Zenith did not propose this method of signal generation. Instead they proposed the system shown in Fig. 1. As far as we know at present, H. H. Scott, Inc. is the only proponent of the time-division method of signal generation on a practical basis; they have announced the availability of equipment utilizing this principle. Although on the surface this method is much more sophisticated from an engineering viewpoint, it is quite possible that the matrixing method is much easier to integrate with existing equipment. Most likely this is the reason most of the emphasis has been placed on the matrixing method. It is also possible that the time-division method is not as well known as it should be.

Receiving FM Stereo

Just as there are two fundamentally different methods for transmitting the stereo signal, there are an equal number of methods for receiving it. It might be said that these methods are "mirror images" of the transmission systems; they essentially reverse the procedure of the broadcast station.

For example, let us consider the matrixing method. The sum signal is derived from a matrix and, except for some normal processing, is transmitted in that form. Referring to the block diagram of the GE adapter (Fig. 2 in the Csiszatka and Linz article) we can see that the receiver just reverses this process. The difference signal, however, must first be recovered from the sidebands in which it was transmitted. This involves reinserting the 38,000-cps carrier which was suppressed at the transmitter and then separating the audio from the carrier. In order to reinsert the carrier precisely where it should be, the 19,000-cps pilot is used; either to synchronize a local 38,000-cps oscillator or directly in a doubler circuit. We know that this pilot will give us the precise time location we need since it was transmitted with the signal. Then we can de-modulate. The difference signal is now

![Fig. 1. Block diagram of Zenith proposal for achieving the stereophonic signal.](image1)

![Fig. 2. AM modulator and 19,000-cps pilot generator.](image2)
ready for matrixing to recover the original left and right signals which started the whole process.

The switching (time-division) method, used in the receiver, is a "mirror image" of the time-division transmission method although there are several ways of effecting the time division. Figure 3 is the block diagram of the method used by Zenith and H. H. Scott uses another method as shown in Fig. 4 of the von Recklinghausen article. In both cases the switching is synchronized by a 35,000-eps signal derived from the 19,000-eps pilot. The H. H. Scott adapter is explained in detail by Mr. von Recklinghausen. A schematic of the Zenith adapter is given in Fig. 4. In reality very little explanation is necessary for this system once the time-division method of generation is clear; the receiver is only required to switch between signals at the precise rate used in broadcasting to reverse the process and extend the original left and right signals. The switching rate (as explained by von Recklinghausen) is 38,000 eps, the second harmonic of the pilot signal.

The natural question now is whether the matrix receiver will operate with a signal generated by the time-division method and vice versa. The answer to this, of course, is that the signal generated by both the matrixing and time-division methods is exactly the same in the air; the receiver sees the same signal no matter which method is used to generate it. I must admit, however, that to date I have never actually "heard" the time-division method (I did attend a demonstration of the matrixing method), but then how many people have?

Existing Equipment

Now to return to the apprehensions expressed by some people about the forced obsolescence of some existing tuners. Apparently it was felt that tuners that use Foster-Seely type discriminators would be unable to be adapted. The reality of the situation is that there is no valid technical reason for this fear. It has been stated that discriminators of the Foster-Seely type are inherently too narrow in bandwidth to handle FM stereo transmission, a situation made more difficult by the fact that in stereophonic transmission more energy is concentrated near the edges of the passband than heretofore. In fact, a well-designed FM tuner, whether it uses a ratio detector or Foster-Seely discriminator, can have a sufficiently wide bandwidth to handle stereophonic transmission under the rules adopted. The key words here are "well-designed." Certainly a poorly designed tuner with a discriminator will probably yield unacceptable distortion with stereophonic signals. But the fact of the matter is that such a tuner will provide distorted monophonic signals too. A poorly designed FM tuner, even with a ratio detector, will also provide unacceptable distortion. This whole matter can be summed up by noting that a high-quality tuner will provide a high-quality signal, whereas a poor-quality unit will distort—no matter what system of FM detection is used. In other words, the existing high-quality FM tuner is not obsolete.

Is the Monophonic Signal Degraded?

In our enthusiasm for the marvels of FM stereo, we tend to overlook the fact that many people will want to continue receiving monophonic FM programs for some time. Will they "pay the piper" for those who wish to have stereo now? In other words, is the monophonic signal degraded? The answer is no—and in fact this was one of the important reasons for selecting the GE Zenith system. The following excerpt from FCC Docket 13506 indicates that the degradation is only experienced in the stereo channel (system 4–4A is the Zenith-GE system, 1 is the Crosby system):

15. In comparing FM stereophonic systems, it is customary to use as the standard of comparison the signal-to-noise ratio obtained with monophonic transmission and reception for a given amount of transmitted power and other specified conditions, including height of antenna, transmission path and receiver sensitivity. When stereophonic transmission is substituted under the same set of conditions, the main carrier output and subcarrier output at the receiver will have reduced signal-to-noise ratios. The amount of reduction depends upon a number of transmission parameters, including the subcarrier frequency, the frequency swing of the main and subcarriers and the deviation of the main carrier caused by the subcarrier or subcarriers. The calculated loss of signal-to-noise ratio, compared to monophonic transmission and reception for each system is:

Monophonic System 1 System 4–4A
Receiver output 6 db less than 1 db

(Continued on page 28)
An FM Multiplex Stereo Adaptor

DANIEL R. VON RECKLINGHAUSEN

This adaptor utilizes time-division to achieve stereophonic FM reception; a method whereby switching rather than matrixing is used to recover the left and right signals.

After years of study and considerable field testing, the Federal Communications Commission has set the specifications for the compatible stereophonic signals to be transmitted from a single FM station. The system chosen transmits the sum of the left, A, and right, B, input channels on the frequency modulated main carrier. The difference between A and B amplitude modulates a 38,000 cps subcarrier with the subcarrier itself suppressed. The subcarrier signals in turn frequency modulate the main carrier. A 19,000 cps signal is also transmitted for stereo demodulator synchronization.

These and other pertinent specifications can be obtained from the FCC rules and regulations. Written in legal and engineering language, they are clear to the engineer engaged in this type of work but not necessarily enlightening to persons unfamiliar with the proceedings of the National Stereophonic Radio Committee (which performed the majority of the work of analyzing and testing the various stereo broadcasting schemes proposed).

The recording and reproduction of stereophonic signals had its inception in the 1920's and 1930's, then described as binaural signals. It was only natural that the attention of scientists and engineers was also focused on means of transmitting these signals to remote points. Carrier current telephony over cables and also radio links were investigated intensively.

The stereophonic system chosen by the FCC may be accomplished by the time-multiplex system shown in Fig. 1. Here, the input of a cable or radio link is switched rapidly between the two inputs A and B. The output of the cable or radio link is also switched rapidly to the two output terminals. Switch synchronization has to be provided so that the channel A input signals will not accidentally appear in the channel B output.

The signal waveforms of such a system are shown in Fig. 2. Here, the input signals, A(t), and B(t), are switched at a rate $f_s$ to the link. The composite signal $E_0(t)$ now shows portions of the two input signals in quick succession and a good representation of the two input signals is evident. If the load containing the composite signal is then switched in synchronism and at the proper time to the two output leads, the channel A and B output waveforms result. These waveforms can contain all the information present in the original two signals. The highest input frequency which can be transmitted by such a method is exactly equal to one half the switching rate, $f_s$.

Mathematically, the composite signal, $F_s(t)$, by switching $A(t)$ and $B(t)$ at a rate $f_s = \frac{\omega_s}{2\pi}$ becomes:

$$F_s(t) = \frac{A(t) + B(t)}{2} + \frac{1}{\pi} [A(t) - B(t)]$$

$$\cos \omega_s t - \frac{1}{2} \cos 3\omega_s t + \frac{1}{3} \cos 5\omega_s t \ldots$$

Eq. (1)

where $A(t)$ and $B(t)$ are the instantaneous input signals, A and B, as a function of time. It can be seen from this that the sum of the input signals is transmitted directly. This is also the compatible monophonic signal which can be utilized without any further demodulation. The difference between the input signals appear as amplitude modulation of a series of odd harmonics of the switching rate $f_s$.

The composite signal might be utilized for modulation of an FM broadcast station. However, the transmission of the higher harmonics of the switch-

Fig. 1. Basic time multiplex stereo system.

Fig. 2. Waveforms in basic time multiplex system.
ing frequency would result in radiation of signal components from the station outside its allotted 200,000 cps bandwidth, assuming 15,000 cps audio response with inputs switched at a 98,000-cps rate.

Restraint of bandwidth to include only the audio frequencies of A and B, and the first order sidebands of the switching frequency, results in the basic specification of the present multiplex system. This also has the benefit of a less stringent bandwidth requirement along with only slightly changed effective signal-to-noise ratio or change in separation due to phasing errors of the subcarrier employed for detection.

To be able to utilize the full amplitude handling capability of the radio channel (i.e. maximum deviation capability of an FM transmitter), the relative amplitude ratio of the main channel, \( A + B \) and subchannel, \( A - B \), has to be changed to give the composite signal \( E(t) \) which now has been made standard:

\[
E(t) = [A(t) + B(t)] + [A(t) - B(t)] \cos \omega_f t \quad \text{Eq. (2)}
\]

The composite signal can be generated by at least three different methods. The first one uses a switching modulator and a phase-linear low-pass filter. The second method would employ a two channel square law modulator acting on the two input signals. The third method would require the use of an audio matrix network (with transformers or resistors) and a suppressed carrier modulator. Here, two separate outputs could be obtained: the main channel output for direct modulation of the FM transmitter and the stereo subchannel for modulation of the FM transmitter at a later stage of multiplication where higher frequency modulation is possible.

The third method is most likely to be incorporated in FM transmitters employing phase modulation in conjunction with a frequency-to-phase correcting network and proper audio delay equalization to correct for the envelope delay of the early stages of the transmitter.

Receiving the Stereo Signal

The above discussion of modulation methods along with the mathematical description of the signal waveform and its development leads to several methods for separating the composite stereo signal into its left and right components. If the composite signal of Eq. (2) is passed through a square law demodulator driven by a waveform \( [1 + 2 \cos \omega_f t] \), the left channel output will be equal to \( 2A(t) \) plus fundamental and second harmonic of the inserted subcarrier, \( f_s = \frac{\omega_s}{2\pi} \). The right channel output \( 2B(t) \) can be obtained by driving a second square law demodulator with a waveform \( [1 - 2 \cos \omega_f t] \).

Since good square law detectors are difficult to come by in practice, a linear detector driven with a large reinserted subcarrier, \( f_s \), can also be used. This, in effect, uses a square wave for demodulation which gives the detector a multiplying function \( [1 \pm \frac{1}{\pi} \cos \omega_f t] \). This in turn requires a gain adjustment of the subcarrier signal by \( \frac{3}{2} \) prior to detection or the same gain adjustment of the difference signal after detection.

A third method of detection would employ the use of a bandpass filter for the selection of the subcarrier sidebands in addition to the use of a suppressed carrier AM detector and a resistive sum and difference audio matrix network with proper main channel audio delay.

All of these stereo detection schemes have one common advantage and one common disadvantage. The advantage is that they are relatively economical in parts cost, employing only two diodes or a beam deflection tube (such as 6ARS) for demodulation. The disadvantage is that all of these detectors produce a very large output at the subcarrier frequency, \( f_s \) (38,000 cps), and its harmonics (76,000 cps, 114,000 cps, etc.). These are removed only with difficulty by filtering without disturbing audio frequency response. This, in itself, is not harmful, since these frequencies are above the range of human hearing. However, these signals, if not filtered out, will tend to overload amplifiers and tweeters because of reduced power handling capability at high frequencies. The result is considerably higher distortion. More serious is that the bias frequencies of tape recorders fall in the frequency range of the subcarrier frequency and its harmonics. It is made poorer by the increased amplification of tape recorder circuits to compensate for the required tape pre-emphasis and high-frequency losses of the tape. Whistle tones known as "birdies" are the result of subcarrier signals causing tape overload. Therefore, it is absolutely necessary that subcarrier frequencies are prevented from appearing at the audio outputs of the multiplex adaptor.

In the H. H. Scott adaptor, the subcarrier is balanced out by means of balanced bridge demodulators and a 15,000 cps sharp cutoff filter is used at the

**Fig. 3. Spectrum of basic time multiplex system.**

**Fig. 4. Block diagram of H. H. Scott type 335 multiplex adaptor.**
audio outputs. This effectively eliminates any of the subcarrier frequencies at this point.

The forerunners of the multiplex stereo system chosen by the FCC have been described by a magazine writer as "the Radio Manufacturers' Dream". This writer was correct in his estimate since this system allows radio manufacturers to design sets of relatively modest cost which produce stereo of some sort. However, to produce high quality stereo worthy of the name "High Fidelity" a great deal of engineering and complex circuitry has to be expended in both tuner and multiplex adaptor design. For example, to achieve 30 db of separation, the phase response of the tuner-adaptor combination may not differ more than ±3 degrees between main and subchannel at all modulating frequencies. Similarly, the amplitude response may not vary more than ±0.3 db, and the phasing of the subcarrier with respect to the pilot carrier has to be constant at all r.f. input levels. For this reason, it is extremely important that the tuner and adaptor match each other and have a wide and phase-linear response including the required connecting cable. Any level controls connected between the tuner's multiplex output and the stereo demodulator circuitry will have a severe effect on phase and frequency response. Similarly, the frequency and phase response of the audio circuitry of existing tuners is not controlled closely enough to use the tuners regular audio output and maintain high separation between left and right outputs while deriving the subchannel information separately.

For these and other reasons, almost all adaptors derive both main and sub-channel information directly from the tuner's multiplex output circumventing all audio stages of the tuner. The wide-band ratio detectors used in most high fidelity tuners have a sufficiently wide bandwidth, wide frequency response, and low internal impedance to permit the use of up to a 3-foot connecting cable with negligible effect on amplitude and phase response. To maintain good low-audio-frequency separation, it was found necessary to maintain the low frequency input impedance of the adaptor in excess of 50 megohms. Sufficient amplification had to be provided in the adaptor to produce a 2.5-volt minimum output at 100 percent modulation of either left or right channel from the relatively low output of the wideband detector (0.3 volt typical at 75,000 eps deviation).

The Adaptor

Figure 4 shows the block diagram of the H. H. Scott type 335 Multiplex Adaptor. The signal from the FM detector (multiplex output) is first amplified in a high-input-impedance stage and then passed through a phase-linear filter attenuating frequencies above 53,000 eps. This removes any background music signals from the stereo demodulator inputs. A narrow band and noise immune 19,000 eps filter selects the pilot carrier. After further amplification it synchronizes the 38,000 eps subcarrier oscillator. All tuned circuits are temperature compensated so that the oscillator exhibits a warmup drift of only .01 per cent in the absence of a pilot carrier, the 38,000 eps subcarrier oscillator remains phase locked to the pilot signal so that maximum separation is maintained at all r.f. signal levels. Measurements with a wave-analyzer have shown that separation of left and right audio signals is maintained even with such low r.f. signals that the signal-to-noise ratio makes listening impossible.

The output of the 53,000 eps low-pass filter and the 38,000 eps oscillator drive the two balanced bridge stereo demodulators. Two wideband amplifiers following the demodulators have a common efficiency-balance circuit (as required by the difference of Eq. (1) and (2) above). This assures best separation. The de-emphasis and 15,000 eps cutoff circuits are in the separate audio channels rather than ahead of the demodulator or matrix networks. By this method, any component tolerance will not affect channel separation as it otherwise would. A stereo level control with low impedance output amplifiers complete the actual adaptor circuit.

A number of circuit refinements have been incorporated in this self-powered adaptor. A front panel switch permits listening to either multiplex stereo or AM-FM stereo broadcasts if an AM-FM stereo tuner is the signal source. Other switches engage noise filter circuits permitting stereo listening of weak signals with reduced noise and full frequency response or full separation. Both stereo amplifier and stereo tape recorder outputs are provided.

The FCC-approved system can be received with extremely simple adaptors that will provide adequate results with inexpensive FM radios and tuners. Unfortunately, for the more demanding music listener it is possible to design a multiplex equipment with the same high engineering standards found in our wideband tuners.

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Fig. 5. Front view of H. H. Scott adaptor.

Fig. 6. Top-rear view of H. H. Scott adaptor.
FM Stereo—The General Electric System

ANTAL CSICSATKA* and ROBERT M. LINZ*

Here, in abbreviated form, is an explanation of the General Electric FM stereo system by two of the engineers responsible for it. In addition, a description of a one-tube stereo adapter is given.

The key characteristics of the FM stereophonic broadcasting system adopted by the Federal Communications Commission are that it satisfies all the requirements the Commission set forth and can operate with a one-tube adapter to produce stereophonic sound from a conventional tuner and stereophonic amplifier.

An examination of system specifications (Table I) quickly enlightens the serious listener to the capabilities of the adopted system. In particular, reference is made to the fully separated stereo (30 db from 50-15,000 cps), while maintaining existing monophonic distortion requirements.1

The transmitter2 is most easily explained with reference to the block diagram of Fig. 1. The left, L, and right, R, signals are developed conventionally and then pre-emphasized separately before being fed to the matrix where the sum (L+R) and difference (L−R) are produced. The L+R signal is fed directly to the FM modulator in the usual fashion to frequency modulate the main carrier thus providing one portion of the stereophonic signal while simultaneously serving as the compatible monophonic signal. The L−R signal is fed into a balanced modulator where proportional sidebands are generated above and below the subcarrier frequency of 38,000 cps. The subcarrier is automatically suppressed, but the L−R sidebands frequency modulate the main carrier.

It should be noted that the carrier input to the balanced modulator comes from frequency doubling the input of a 19,000-cps oscillator. A parallel output from the same 19,000-cps oscillator goes into the FM modulator to act as the pilot carrier.


Table I

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<th>SYSTEM SPECIFICATIONS</th>
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**Main Channel**
- L + R audio (FM modulating main carrier)
- 50-15,000 cps audio band
- 90 per cent maximum main carrier deviation
- Standard 75 usec. pre-emphasis

**Subchannel**
- L − R 38,000 cps suppressed carrier AM subcarrier (FM modulating main carrier)
- 50-15,000 cps audio band
- 90 per cent maximum main carrier deviation
- 19,000 cps pilot carrier (FM modulating main carrier 8-10 per cent)
- Standard 75 usec. pre-emphasis

Separation between Left and Right Signals—30db between 50 and 15,000 cps

Distortion—Maintain existing FCC requirements

The receiver operates generally as depicted in the block diagram of Fig. 2, and is conventional to the discriminator output which is, however, taken ahead of any de-emphasizing networks. The L+R signal in an existing monophonic receiver would produce a compatible program, but in the stereophonic receiver it is fed directly to the matrix. The L−R sidebands and the pilot signal which are near or above the range of normal hearing would not be heard in the monophonic receiver. However, in the stereophonic receiver they must be decoded to produce the L−R audio signal. This takes place when the 19,000-cps pilot signal is filtered and doubled to recover the 38,000-cps subcarrier which is in turn added with the filtered sidebands to form normal amplitude modulation. This is detected to produce L−R audio for the matrix.

The matrix outputs, after passing through separate de-emphasis networks, are then the original left and right stereophonic signals.

A study of the spectrum of signals appearing in a discriminator output will help in understanding the system. Such a spectrum is shown in Fig. 3. Shown is a monophonic or what would normally be the 50-15,000-cps audio program, and the SCA signal (storecasting) with the SCA subcarrier at 67,000 cps and maximum deviation of 6700 cps by the SCA program.

Also shown is the stereophonic signal which is made up of a lower sideband...
FCC approves multiplex! And H. H. Scott is now producing the world's first Multiplex Adaptor for Wide-Band tuners. Now you can listen to exciting FM stereo multiplex broadcasts simply by adding the new H. H. Scott 335 Wide-Band Multiplex adaptor to your H. H. Scott tuner, regardless of age or model.

Only H. H. Scott adaptors use famous Wide-Band design which permits receiving both main and multiplex channels with lower distortion and greater fidelity than is possible with conventional circuitry. H. H. Scott's years of experience in engineering multiplex circuitry assures you equipment of highest technical standards.

The 335 Wide-Band Multiplex Adaptor has these important advantages:

1. Wide-Band circuits permit receiving the full dynamic frequency range, both on main and on multiplex channels, even in weak signal areas.
2. New switching methods allow you to fully control multiplex reception from the adaptor itself. You can receive either FM, FM Multiplex or AM-FM Stereo (if an AM-FM Stereo tuner is used) simply by operating the controls on the adaptor.
3. Adaptor is self-powered — no need for taking power from your tuner and possibly reducing component life.
4. All connections between tuner and adaptor are external. No need for making internal connections and upsetting tuner alignments. Connect it yourself in minutes, no tools required.

Self powered design eliminates complex installation and possible misalignment of FM Tunes. All connections external.

Special circuitry permits high quality tape recording of multiplex stereo programs.

Adaptor Defeat switches Adaptor completely out of system so you can receive AM-FM stereo broadcasts on your AM-FM Stereo tuner.

Noise Filter removes noise from both stereo channels. Full Stereo separation maintained.

Master Control: Position for regular multiplex stereo; for multiplex stereo with noise filter on sub-channel only (main channel frequency response unaffected); for regular FM broadcasts.

from 23,000 to 38,000 cps and an upper sideband of 35,000 to 53,000 cps, plus the 19,000-cps pilot.

Interleaving

There are important advantages for suppressing the carrier and transmitting a subharmonic pilot. One of these results in an interleaving effect which permits a 90 per cent maximum deviation on the main channel as well as 90 per cent on the subchannel, with the other 10 per cent in each case being reserved for the pilot carrier.

Interleaving, or nesting, of the L+R main channel signal and the L−R generated sidebands is one of the most interesting and important aspects of the newly adopted system.

Because of this effect, 90 per cent of normal deviation can be used on the main channel, and also the subchannel, for illustrative purposes; (C) shows L+R (sine wave plus pulses); (D) shows the L−R (sine wave minus pulses); (E) shows the L−R subcarrier sidebands and (F) the composite signal (minus the pilot for illustrative purposes) consisting of L+R and the L−R sidebands that would be the signal fed to the FM modulator. Note that its peak amplitude is not greater than the peak amplitude of L+R or the L−R sidebands. Also observe that there is a depression (caused by −R, the pulse) in the L−R sidebands, while there is a simultaneous peak (caused by +R, the pulse) on the L+R signal. When they add to form the composite, the L+R peak fills the L−R sideband depression.

If the subcarrier carrier is suppressed, the main and subchannels can have peak FM deviations limited only by the necessity to provide for the pilot carrier. Another advantage of the 19,000-cps pilot can best be explained at this time. Note that the 19,000-cps pilot falls in a clear channel portion of the discriminator output, with the L+R audio 4000 cps below and the L−R lower sideband 4000 cps above. It will be recognized that this affords the use of relatively

because one is producing peak main carrier deviation while the other is zero, and vice versa. Thus, the monophonic listener experiences a signal-to-noise loss of less than 1 db.

This interleaving effect arises from the fact that the sum of two variables (L+R) is high when their difference (L−R) is low and vice versa. Since the amplitude of the sideband envelope produced by the L−R signal is directly proportional to L−R, this relationship between a sum of two variables and their difference is maintained and the main channel and subchannel will interleave.

Perhaps a reference to Fig. 4 will help in developing an understanding of this phenomenon. In Fig. 4 (A) represents the L signal input; (B) shows the

binary square wave pulse on R, used for

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Best by Blindfold Test

THE WIDELY ACCLAIMED TF3

...THE PRECOCIOUS NEW TF2

In the moment of truth, impartiality is paramount. The curtain is drawn and preference depends upon sound quality alone as judged by the listener.

In a recent test, both the widely acclaimed Jensen TF-3 and our precocious newcomer TF-2 were preferred above "rated" systems costing much more. So it's wise to be your own thinking-man about hi-fi speakers.

Be sure to hear the TF-3 and TF-2... they may well be the "best buy" for you in hi-fi speaker systems. Fine woods... smart styling. For still more moneysaving, unfinished utility models are an intelligent choice... paint, finish or build-in as you choose.

TF-3 4-speaker 3-way system. Covers the full frequency range with a full size Flexair® woofer in Bass-Superflex* enclosure, two coloration-free mid-range units, and the sensational Sono-Dome® Ultra-Tweeter. Choice of genuine oiled walnut or unfinished gum hardwood cabinetry. 13½" x 23½" x 11¼".

Oiled Walnut... $99.50
Unfinished....... $79.50

*T.M. Reg.

TF-2 3-speaker 2-way system. Also uses a full size Flexair® woofer for distortion-free bass response, plus two special direct radiator tweeters giving smooth, extended highs. Choose from two cabinetry styles: the oiled walnut or the economical unfinished gum hardwood. 13½" x 23½" x 11¼".

Oiled Walnut... $79.50
Unfinished....... $64.50

Write for Brochure LG

Audio • June, 1961

www.americanradiohistory.com
simple filter circuits in the receiver for isolating the pilot signal so that it may be doubled to recover the subcarrier. This is an important feature of the system and is one of the primary reasons that a simple one-tube adapter can be employed.

Circuit Description

Figure 5 is a schematic of a doubler circuit which employs a tuned doubler amplifier to recover the subcarrier from the pilot.

The discriminator output from a tuner is applied to the control grid of the 12AT7 amplifier. The plate of this tube provides an amplified output signal which is applied, via an amplitude adjusting potentiometer and a time delay network, to the L + R signal input line of the matrix.

The output signal of the 12AT7 is also attenuated by a resistive voltage divider and is applied via a bandpass filter to the input of the detector. The filter is tuned to provide a bandpass from 23,000 to 53,000 cps with the series arm displaying an “anti-resonance” at the SCA frequency which, for the NSRC field tests, was 67,000 cps. If the “anti-resonance” is not designed into the filter, an annoying whistle may be heard because of mixing between the 67,000-cps SCA subcarrier and harmonics of the stereo subcarrier.

The output signal of the 12AT7 is also fed, via a resistor or capacitor, to the pilot filter, which is shown tuned to the pilot signal frequency of 19,000 cps. The output of the filter is coupled to the grid of the second triode of the 12AT7. This tube is operated as a doubler-amplifier.

The plate is connected to a circuit which is tuned to double the frequency of the pilot (38,000 cps). This frequency-doubled signal is applied, via a secondary on the coil of the tuned circuit.

light listening

(from page 10)

The Three Suns, a fixture for decades among top radio critics, have added music to their output. Most music to which the group has listened, have now felt it necessary to add a second channel of reception to the arrangements.

In their latest album, the old standby — electric organ and accordion — are accompanied by a variety of percussion, kettledrum, Chinese gong. In a further departure, a Salvation Army drum has been pressed into service. Listeners whose recollections are trained to music back to their hotel broadcasts will find little left of the early concert style. The arrangements by Charles Albertine generate a rhythmic image in every phase. Wild-knickers show up in the "Colossus" by March but his original composition "Smoke" offers the greatest reward to those who insisted on good bass response in their right playback channel.

The Fantastic Brown: the Lerner and Loewe Bandbook Columbia CS 8393

Normally, Columbia doesn't introduce a new album on its roster of hits with a single cut, but this release was already reasonably certain that the recording job on this stereo organ would be a good one. A favorite in my collection of audiophile acoustics in stereo is Columbia CS 8230 ("Ashley Miller at Radio City Music Hall"). Originally, the first aspect of this recording to strike the listener is the rhythmic command of a Wurlitzer exhibited by Raymond Shelley. I would hesitate to call it fantastic but a few measures of the opening selection, "Got Rhumba," explains the acclaim that greeted his appearance at the Detroit convention of the American Guild of Organists. In the same recording, the delegates assembled at that city's Fox Theatre on that occasion were Columbia's well-known organist, Dr. William H. Forrester. His enthusiastic endorsement of Shelley to the "house" office made possible this recording in the same setting. The Fox Theatre Wurlitzer was one of five installations designed by Jesse Crawford back in the late twenties when a hundred thousand dollars could buy one while of a four-manual. All the trimmings were included: two sets of electric organs, three xylophones, two marimbaphones, drums, cymbals, and percussion galore. Restored by a group of volunteers who worked after the theatre closed for the night, the organ presents a wonderful palette for staples such as "Birth of the Blues," Brazil, Mityl, and "The Band Played On."

Les Brown: The Lerner and Loewe Bandbook Columbia CS 8394

When show music reaches the popularity enjoyed by the Lerner and Loewe productions, it is sure to be put to a variety of uses. Here it is made to serve as dance music while Les Brown raids the rosters of four top "L and L" shows—"Canote," "My Fair Lady," "Glad," and "Brigadoon." Those familiar with the original cast recordings may be tempted to wonder what on earth the Les Brown arrangers accomplished with only reeds and drums to fill out the appeal of the tunes. One addition to the band was worked out for this occasion—the tuba of Phil Stephens. Arrangers Bill Barket, Barry, and Conneeck have used the five-saxes, five trombones, and other instruments to provide a new twist to the music. A delightful discipline of the passage one is the pleasure to hear in Columbia's realistic sound. This is the straight-from-the-shoulder impact of good band playing in a live studio. Coming through a bona fide sound system, an unvarnished job such as this can sound twice as effective as the flossed-in sound of the moment.
"Exciting!" says Julie London.

"IT's the Best!"

ONLY THE ROBERTS "990" STEREO tape recorder

combines these advanced features:

- 4-Track Stereo Record/Play
- 2-Track Stereo Playback
- 4-Track Monaural Record/Play
- Dual Head Outputs
- Dual Power Amplifier Outputs
- Dual Stereo Speakers / Portable
- Vertical operation ideal for custom installation

$399.50

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- Has "MAGIC MEMORY" - self contained stereo speakers, automatic on/off plus many other "Never-Before" Features
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- Same components as used in the Roberts classic 990
- "Beautys and this Beauty Does," says MCDONALD CAREY, star of motion pictures and television. "Tailored appearance and top performance, alike, in my Roberts Custom Series."

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- $599.50
- Additional $250.00 stereo service

ROBERTS ELECTRONICS, INC.,
Los Angeles 38, California

AUDIO • JUNE, 1961
"Reflection Coupler" Gives Stereo Spread

LEON J. KNIZE

By radiating the sound from the rear of a cabinet and using the wall as a diffuser to spread the sound, a remarkably good illusion is presented to the listener.

We know that sound waves, when leaving an instrument or other source, travel in all directions. This means that in any normal concert hall (or for that matter, any location in which music originates) reverberation begins; or, as we will shortly see, the stage (or in the performing area) even when only a solo instrument or voice is involved. The sound traveling upward into the "shell" of the stage or the ceiling of the performing area will scatter off the ceiling; the sound traveling to the back will scatter off the back of the stage; and that to the right or left will be reflected from the sides, as in Fig. 1.

By far the major portion of the sound reaching any person in the audience will be this scattered sound, even if this person were sitting somewhere in the audience where the direct sound reached him before it struck the walls, floor, ceiling, or some other object in the listening area. Basically, therefore, we must divide our auditorium or room into (a) the playing area, and (b) the listening area.

The playing area creates sound that is largely reverberant in nature; that is, it created a reflecting surface before it leaves the playing area. The listening area creates sound that is entirely reverberant in nature. We must add to this the fact that the rate of attenuation of direct sound is the same indoors as it is outdoors. The direct sound will reach a person far back in a listening area not at all, or at least reduced from the strength it had at its source. A reverberant sound, however, can leave a reflecting surface at practically the same intensity at which it impinges upon this surface. Therefore, a sound hitting a flat surface which is reflective enough to return this sound at its full intensity will reach the listening area almost as strong as the direct sound is, and when the sound is reflected from many points at once, as it may well be, the total reflected sound can be considerably greater than the direct sound.

Now consider a listening area that has more than one voice or more than one instrumentalist, as in Fig. 2. Here we have a more complex phenomenon occurring, since there are many sound sources simultaneously sending sound energy in all directions. Obviously these sound waves mix together and form a sort of turbulence. Just as obviously a large proportion of this sound mixture and reverberation occurs inside the playing area, so one might say that this reverberant and turbulent sound leaves the playing area in a body very much like fog or smoke; that is, it is diffused over the entire front area of the stage, both vertically and horizontally. Figure 3 shows an "apparent source" plane which might well be a sound-transparent screen at the front of the playing area. The X's show the apparent sources of both direct and reflected sound, and it will be assumed by the listener that his virtual sound source, or screen, is the actual source of the sound. The listener hears various intensities and directions of sound sources which—if one were sufficiently skillful and if sufficient channels were available for the equipment—could be duplicated by a multiplicity of loudspeakers in the plane of the sound screen. Therefore, it must be admitted that the sound leaving the playing area—assuming the use of a conventional stage and not the top of a mountain—is not limited to direct sound, but is a composite of direct sound and reflected sound of differing intensities and directions. Once this condition is recognized by the listener—and by the loudspeaker designer—the problem of creating the illusion of sound coming from a typical...
recording must of necessity alone be measured at its directivity and intensity. The imaginary plane would serve as the virtual source. The problem remains as to how to transfer the imaginary plane into the listener’s home.

Living Room Conditions

In the home we have a listening area which is generally somewhat smaller than the playing area at the usual live performance. It is well nigh impossible to duplicate the conditions of any given live listening area in the home, and completely impossible to duplicate all of them. Ideally, however, following the logic of our discussion on live performance playing and listening areas, if we can divide the listening area from the playing area we can come much closer to the reality of the original performance.

Let us go back to this insect of turbulent wall of acoustic energy which leaves the front of a stage—the imaginary sound-transparent screen at the front of the playing area. It would seem that the first ingredient in duplicating the live performance would be to create such a wall of diffuse turbulent acoustic energy, since this would then give us the feeling of the front of a playing area. However, with microphones placed relatively close to the source of sound, the resultant recording has relatively little reverberation in it. One channel differs from the other primarily in intensity. The exact reproduction of these two recorded signals has practically none of the reverberation which existed at our imaginary plane, in most instances. Yet the reproduction from the recording made of necessity be limited to the direct (and reflected) sound which reached the relatively close microphones, and these limited signals are all the information which is offered to the loudspeakers in the home or other listening area. The reverberant and stereophonic effect which the playing area lends to a performance is to a large extent missing, since at best we are capturing only a portion of the wall of diffuse acoustic energy with microphones placed in the usual positions.

If it were possible to take this imaginary plane of acoustic energy and transfer it to the listening area, we should then have re-created the original effect as heard by a listener at the live performance. In addition to the reverberant energy present at this imaginary wall, we add the reverberation of the listening area, with the result that we have arrived at a remarkably good facsimile of the original performance. All that remains now is to design a loudspeaker system which is capable of re-producing this imaginary sound source in the home or listening area.

The “Reflection Coupler” Stereo Speaker System by Scott of Annapolis

Having thus determined the requirements of a suitable stereophonic loudspeaker system, it only remains to fulfill them as closely as possible. By utilizing a wall of the room as a diffraction surface for diffusing and reverberating the acoustic energy coming from the loudspeakers, the Scott Radio Labs “Reflection Coupler” Speaker System succeeds in reproducing the conditions necessary to the imaginary sound screen, and thus in re-creating the original sound source in a listening area of limited size. Instead of the sound appearing to come from two “holes in the wall,” it appears to spread out all over the wall behind the loudspeaker system. Instead of an instrument appearing to be in its normal position when the listener is on the center line between the two loudspeakers, but moving to the left or right as the listener moves to the left or right, the instrument appears to come from the same point on the wall regardless of where the listener is. We have, in effect, moved the perfor-
Fig. 6. Internal construction of the Reflection Coupler loudspeaker system. (A), plan view; (B), rear elevation; and (C), section through (A) at X-X.

Fig. 7. Rear view of the loudspeaker system showing the placement and shape of the mid-high reflectors.
Concertone
MANUFACTURERS OF THE
WORLD'S FINEST TAPE RECORDERS

Presents the New
SERIES 90

A product of 14 years of excellence in tape recorder manufacture, Concertone's new Series 90 represents a major breakthrough of the finest caliber instruments into the lower-priced equipment field. Designed for rugged reliability under continuous performance conditions the Series 90 meets exacting broadcast requirements as well as those of the finest custom installations for recording studios, industries and audiophiles. Featuring a dynamic new tape transport and advanced electronics, the Series 90 offers the revolutionary new Concertone "Edit-O-Matic" and our exclusive flutter filtering system. Available in monophonic full or half track — stereo 2- or 4-Track versions — the Series 90 brings you the ultimate in professional recorders.

from $845.

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Available in studio consoles or portable case.
For vertical or horizontal rack mounting.
Look at all the professional features to be found in the new Series 90... an instrument that assures recording perfection and versatility unheard of except in the costliest tape recorders.

**INTRODUCING THE CONCERTONE "EDIT-O-MATIC"**

The countless advantages of high speed search, cueing and editing are demonstrated in Concertone's exclusive new EDIT-O-MATIC. High speed "SEARCH" enables quick cueing up to the approximate location desired on the tape. A flip of the "CUE" switch brings the tape into contact with the heads and simultaneously releases the brakes for easy manual cueing to the exact spot. A simple "mark and measure" scale pinpoints the precise portion of the tape to be edited.

**EXCLUSIVE CONCERTONE FLUTTER FILTERING SYSTEM**

Developed by Concertone, this unique and exclusive system virtually eliminates spurious vibrations and troublesome tape flutter. A dynamically balanced flywheel combined with a viscous damped tape tension arm provides silky-smooth tape handling and recordings virtually free from variations in pitch caused by any components in the tape path.

**STereo Versatility**

Accommodates up to 4 heads for maximum versatility. Stereo Models 93 two-track and 934 four-track each contain 4 triple-shielded magnetic heads with playback selector switch allowing user to choose correct stereo playback head for optimum performance. Multichannel erase head provides separate erase for each track affording easy monophonic and sound-on-sound recording.

**Professional Specifications**

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<tr>
<th>Feature</th>
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<tr>
<td>Tape Speeds</td>
<td>7.5 - 15 ips or 3.75 - 7.5 ips</td>
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<td>Timing Accuracy</td>
<td>99.8% or better over 1 hour run</td>
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<td>Frequency Response</td>
<td>40 - 15000 cps ±2.2 db at 15 ips</td>
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<td>40 - 12000 cps ±2.2 db at 7.5 ips</td>
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<td>50 - 7500 cps ±2.2 db at 3.75 ips</td>
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<td>Signal-to-Noise Ratio</td>
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<td>Full Track</td>
<td>55 db at 7.5 and 15 ips</td>
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<td>50 db at 3.75 ips</td>
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<td>Stereo</td>
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<td>the signal and playing back</td>
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<td>Total Harmonic Distortion</td>
<td>Less than 2% at zero VU.</td>
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<td>Crosstalk Ratio</td>
<td>50 db</td>
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<td>Flutter and Wow</td>
<td>Less than 1% rms at 7.5 and 15 ips</td>
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<td>Less than 3% rms at 3.75 ips</td>
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<td>Rewind and Fast Forward</td>
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<td>Input Impedance</td>
<td>High impedance unbalanced:</td>
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<td>50, 250, or 600 ohm balanced or</td>
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<td>unbalanced with plug-in transformers</td>
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**OUTPUT IMPEDANCE**

600 ohm balanced with terminating switch to allow connection to high impedance input.

**OUTPUT LEVEL**

±4dbm at zero VU.

**RESERVE GAIN**

to ±8dbm.

**DIMENSIONS**

Transport: 19" x 15 3/4" x 8".

Amplifier: 19" x 5 3/4" x 8 1/4".

**WEIGHT**

Transport: 48 lbs.

Amplifier: 12 lbs.

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Monophonic Recorders: Approx. 280w, 115V, 60 cps.

Stereo Recorders: Approx. 320w, 115V, 60 cps.

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For the first time in four years,

AUDIO visits the International Audio Exposition

Proof that people still go to audio shows is offered by the crowds during the four day successor to the "London Audio Fair"

LIKE MANY A LONDONER, two representatives of AUDIO started out on the evening of April 6, 1961 to see the Fifth International Audio Exposition. While the distance was somewhat greater than any Londoner had to go, it was no longer a trip than was required of, for example Gilbert Briggs, who came the 225 miles from Yorkshire in a motor car, with an elapsed time of almost eight hours (he drives slow). All we—AUDIO's editor, C. G. McProud, and its photographic consultant, Mort Weldon—had to do was to cue up in the approved London fashion at New York's Idlewild Airport and board Flight 2 of Pan American World Airways at 8:00 p. m. Of course, it was already 2:00 on the morning of April 7 in London, and the show was thoroughly closed for the night, but we went anyway. There'll always be a tomorrow, we felt.

And there was. After some six hours and forty minutes of wondering whether we had yet taken off (that's the trouble with Pan Am's jets, they are so-o-o-o smooth) we looked outside and there was London Airport North—scarcely changed from when we first saw it in 1953. Managing to be last off the plane (it was such a pleasant ride we were loath to get off, particularly considering the refreshments) we ran square into a Pan American photographer, John North, with his camera pointed our way complete with flash which was undoubtedly necessary in the early morning haze. After due consideration, we decided he was there to secure evidence in Pan Am's favor in case we fell down the landing stairway. His evidence we now have, and it appears on our front cover for this month. We did make it down the stairway uneventfully, had a short ride...
in a Pan Am bus, and were set down in a lounge where we
waited until they had assembled the requisite number of
immigration officials. We succeeded in convincing them we
were not going to stay over three months, that we were
tourists, and that we were going to stay in some hotel in
London (neither of us knew then which one), and they
stamped our passports and let us through to the customs
authorities.

Now if anyone ever wants to be treated like a gentleman,
here is the place for him, at least if he is an American
citizen. We made feeble passes with our keys for the
luggage locks while we were explaining that we had no
gifts for anyone in the United Kingdom, that we had no
more than 200 cigarettes nor more than 50 cigars nor more
than one pound (avoirdupois) of tobacco, and before we
got the locks open, the luggage all had chalk marks on it
and we were shunted out, but gracefully. Later we learned
that one pound (sterling) does not buy one pound (avoir-
dupois) of smokable tobacco in London.

After acquiring some spendable money at the bank’s
counter in the airport exchange for some U. S. green, we
ran into another traveling convenience—Pan American
“happened” to have a car going into the city and would
 gladly give us a lift (ride, that is, not elevator) to our
respective hotels. Thus, we were told, doesn’t happen to
everyone—only to those who consent to having their pictures
taken. So we got into the car with a driver who insisted
on driving on the left side (most Americans say “wrong”
side, but who’s to say which is right and which is wrong?)
of the road all the way to the city. That, we found out,
was customary in England, even though they go through
revolving doors just like we do, counterclockwise. We
mention that because we noticed later in Sweden that
even though they drive on the left side of the road there,
they do, at least, remain consistent and go around rev-
olving doors clockwise—even though their cars are all
left-hand drive cars just like we use in the U. S.

And thus ended our experience with Pan American
before the show.

Although the high fidelity show idea originated in the
United States, it must be admitted that the variations in-
troduced by C. Rex-Hassan, Festival Director, have much
in their favor. Instead of the usual exhibit rooms where
everyone congregates to ask questions of the attendants as

Hotel Russell, in Russell Square, was the scene of the four-
day International Audio Exposition. Not the most modern
of hotels, it had the advantage of high ceilings and solid
walls. Furthermore, the food and service were impeccable.

John Ridley, head of the British Audio Fidelity Records or-
ganisation, was on the scene in the booth and demonstration
room—seemingly at the same time—and still found it possible
to present “Adventure in Sound” on Saturday and Sunday
evenings to tell as entertaining as possible the story of Stereo.

C. T. Malone, applications engineer for Ampex (Great Brit-
ain) Limited, puts the 960 through its paces with stereo music
reproduced through a pair of 2010 amplifier/speakers. He
also had a 351 on exhibit.
well as hear the demonstrations, practically all of the exhibitors use two spaces—one a booth in the Exhibit Hall where nothing is heard except the questions of the visitors and the answers of the attendants, and the other a typical hotel-room exhibit where the equipment is demonstrated annually. This has mixed blessings, of course. While the listeners to demonstrations are not annoyed by the conversations between visitors and attendants, it is also necessary that the exhibitors show two places. At any rate, the crowds are distributed, and considerably more people can get the information they want with a minimum of disturbance, be it lectures or Attnerquant. And somehow, we can’t visualize Americans crowding up docilely to await their turn in the demonstration room, even though we have seen some of this in the early U. S. shows. But it works in London, and it works well. In fact, during the four days of the show, the turnstiles counted 39,143 visitors—which exceeds, we believe, any U. S. show to date. We presented ourselves dutifully to Mr. Rex-Hassan, affectionately called The Colonel, were received with the honor and fanfare we expected, and were promptly hustled off to lunch where we encountered many more of our old acquaintances. Lunch over, we finally got around to seeing the second day of the show.

Space does not permit the entire portrayal of the booths, rooms, and personalities that we visited, but the products that are most familiar to U. S. readers are represented in these pages.

AKG (Akustische u. Kino-Gerate GmbH)

One of the largest manufacturers of microphones in the world, AKG showed a new miniature condenser microphone which weighs only two ounces. This unit, Model C60, can be fitted with either cardioid or omni-directional heads, and is powered by a rechargeable battery pack or by a line operated supply unit.

Ampex

All U. S. readers are familiar with the 960 and 970, both of which are available in Britain, and undoubtedly almost everyone would like to have a 350 series recorder for his home system. These models were shown along with the amplifier-speaker units designed for home use, as well as for "location" monitoring.

Leslie Watts, Export Manager for Goodmans Industries, Ltd., is kept busy almost continuously explaining the wide variety of loudspeakers, driver units, horns, and other paraphernalia so dear to the audiofan.

Gilbert A. Briggs, the Grand Old Man of British Audio, and well known to every audiofan in the world. Late on Sunday afternoon, Mr. Briggs stepped out on one of the balconies for a bit of fresh air just as we came into his room. He consented to pose for this study which successfully masks his good humor and whimsicality and turns him into an Elder Statesman. Which maybe he should be.

Harold J. Leak (left), of amplifier, pickup, and now loudspeaker fame, poses with the Managing Director of the show organization, C. Rex-Hassan, whom we met for the first—but probably not last—time.
Audio Fidelity

"The little Company with the BIG sound" has established itself in Britain in a short two years—possibly aided by the fact that Ridley, head of the offshoot of Sid Frey's American enterprise, is himself an Englishman and thus is not faced with the language difficulties that others might encounter. We all remember him fondly from his presentations in both New York and Los Angeles.

Ferrograph

This year marks the introduction of the Series 5 Ferrograph which have a number of refinements which further enhance the usefulness and quality of these instruments. While the company has gone on record saying that the four-track system is not regarded by it as a true high-fidelity system of operation, it has acceded to demand and produced a four-track head for playback only. So far, however, no provision is made for recording the narrower tracks.

Garrard

The well known Model A and the compact Model 210 were both shown, along with the 4HF, the TPA-15 arm, and the SPG-3 stylus force gauge. Here, too, were the 301 transcription motor—available with a stroboscopic turntable. This is a desirable feature with a record playing turntable that has the adjustable speeds that are so useful to trained musical ears.

Goodmans

The exhibits of this company presented a large line of full-range loudspeakers in 12-, 10, 9½,- and 8-in. sizes, 12-in. woofers, pressure type high-frequency units, and mid- and high-frequency horns. In addition, there was a full line of complete systems in enclosures, and the ARU acoustical resistance units for use in home constructed cabinets.

Leak

The line of Leak amplifiers and preamplifiers is too well known in the U.S. to warrant special description, but they were all there in force and demonstrated to their usual high standard of excellence.

Lowther

Further steps "towards perfection" were shown by Donald Chave of Lowther—one of them being a new Acoustica enclosure which bears a striking resemblance to the "CW" horn-type enclosure described in these pages by D. P. Carlton some time ago. We are pleased to find this unit available commercially. Also on view was a new asymmetrical, push-pull, transformerless transistor amplifier.

Richard Merrick, Managing Director of Ferrograph, relieves some of his demonstration personnel and puts on his own selling pitch. While Ferrograph policies are serious and conservative, Dick is only serious when he is extolling his products.

E. W. Mortimer, Chief Research Engineer to Garrard and "Monty" to his friends, was on hand to make sure that all of the technical questions would be answered correctly. With most of these products he maintains the air of a proud father, as he well might.

Shure Brothers phone arms and pickups, as well as the microphones, were among the few U.S. products represented. But they drew the same interest in London as they have consistently done in New York, Los Angeles, San Francisco, Chicago, and other U.S. cities.
**Lustrophone**

A wide range of microphones is produced by this company, including "Steromic" stereo units, studio ribbon velocity models, and general purpose moving-coil units, covering practically every possible requirement for high-quality microphones for home, PA, and professional use. Also shown were transistor mixer units, floor and table stands, and a line of matching transformers.

**Quad**

Doubling as Managing Director and relief operator for his demonstration room, Peter Walker presented his practically timeless Quad amplifiers and tuners and his newer Quad electrostatic loudspeakers. The quality of his reproduction and the excellent choice of demonstration material made this one of the aural attractions of the entire show.

**Reflectograph**

A tape recorder not yet introduced in the U.S., the Reflectograph makes an excellent bridge between the high quality home machine and the true professional recorders. In several models to cover quarter- and half-track applications in mono and stereo uses, these machines offer superb reproduction for the critical user. Also available is a deck which can serve as a playback instrument alone for dubbing or for those who wish only to reproduce recorded tapes.

**Song**

The entire line of home-type tape recorders was shown and demonstrated, most of them having different type numbers than those employed in the U.S., even though the machines were the same. For professional users, the C-37A condenser microphone was shown—probably to incite the desire to own one, as do so many recording studios.

**Vitavox**

According to Mr. L. Young, Director of Vitavox, their line of Klipsch-licensed enclosures is unexcelled for mono reproduction, while for stereo the new Hallmark system makes it possible to get two speakers into the home at once. Vitavox also showed microphones, horns, and dividing networks of professional quality.

**Wharfedale**

Most of the Wharfedale designs in cabinets differ so greatly in appearance from those sold in the U.S. that it would be folly to describe them. The same acoustic principles appear in both, however, and the performance is what would be expected from Mr. Briggs' products.

Fi-Cord, a professional tape recorder which can be used for broadcast on 7½ and as a pocket memory on 1½, is discussed here by Sales Manager S. Duer (left) and J. Harrison, sales representative. The company also makes a unique dictating machine.

Tannoy is seen and heard everywhere in Britain—but nary a member of the demonstration staff could be found for this picture.

Director P. Merrick (left) and A. J. Williams of Wilmex (Distributors) Ltd. talk over a new reel of Irish Tape. Merrick is the son of Ferrograph's Merrick, which results in mutual aid for their respective businesses.

Sales Director S. Macadie (right) and L. B. Cash, representative, stand in readiness as the doors opened for the second day of the show. They showed a wide line of well built components.
Old and New Friends Week

A trip to London is always the occasion for meeting with newcomers to the industry, as well as those who have visited the U. S. in former years to attend our own shows, and this trip was no exception. This year, however, we finally made the acquaintance of our own counterpart in England, Mr. Miles Henslow, who is editor and publisher of Hi-Fi News, the oldest hi-fi magazine there, and of The Tape Recorder—only two years old—and of the Hi-Fi Year Book since 1956. As is usual with audio-minded people, Rex-Hassan, Henslow, and ourselves succeeded in finding something to talk about for hours, comparing publishing and exhibiting problems in our respective countries, getting ideas from each other, and collectively thinking up new ones after the manner of brainstorming. Then, too, we met old friends again—Donald Aldous, well known writer on audio and founder-member of the British Sound Recording Association, as well as technical editor of Record Review; Percy Wilson, who edits the technical section of "The Gramophone," and John Gilbert, one of his experienced audio writers; Andrew Reid and Joan Cutting, who handle public relations for the Radio Show in the fall; and, of course, H. A. Hartley, who was one of the first exporters of hi-fi loudspeakers to the U. S., and Mrs. Hartley. There is never enough time to see everybody, do the requisite amount of shopping, and see some more of London.

But we did manage to do some of the latter. On our last day, we engaged a taxi driver to show us Limehouse, got too far from the City proper, and arrived at the airport three minutes after our plane was scheduled to leave and we found that it had already left—and who expects planes to be there close to schedule. So we waited until noon the next day—not risking a trip back to the city but remaining at the airport hotel—and took Pan Am's Flight 101 instead of Flight 1, and 101 was exactly on time, too. On time at departure, that is, and thirty minutes early on arrival, making the westward crossing in seven hours and ten minutes. But with a good lunch on the way, the seven hours seemed like nothing at all.

We did find our excuse for visiting the London Audio Exposition, and our photographer, Mort Weldon, got most of the pictures we wanted, so now we have eleven months to think up some excuse to go to the next one. See you there?

In the Connoisseur room, Ralph West, well known British audio authority (left), and E. Emerson of the company watch the stroboscope on a new Connoisseur turntable. Also shown was a new loudspeaker of practical dimensions.

George R. Pontzen, technical manager for Lustraphone, is kept busy demonstrating recordings made through the company's microphones.

With an all-new Reflectograph stereo recorder to show, Brian Arbib points out the features of most interest.

In the S. M. E. booth, A. Robertson-Aikman, Managing Director, and W. J. Watkinson stand by to pass out information.

The back door of the Russell Hotel. Actually this is where the 39,143 people passed into the hotel to see the show—they came out the front door. But here were many non-exhibitors passing out circulars, so your pockets were full before you even got inside.
Never before so much performance, versatility and styling in a speaker as small in size as it is in price!

NEW ELECTRO-VOICE

PA 15

Small enough to be hidden... with a voice that can't be missed!

Now, from Electro-Voice—home of major PA speaker improvements since World War II—comes the most effective solution to many sound problems. It's the exciting new PA15! Features a driver located right up front—in the horn mouth itself—to eliminate one of the "bends" of ordinary reentrant horns... and to insure wider range and smoother high frequency response!

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Better check these other PA15 features:
- Modest size (6" x 9" x 9½") to fit anywhere.
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- Rectangular shape for best dispersion, minimum wasted power.
- 8-ohm or 45-ohm impedances available.

Write for full specs on the PA15 today!

FURTHER PROOF THE SMART MOVE IS TO ELECTRO-VOICE!
FISHER XP-4 SPEAKER SYSTEM

The Fisher XP-4 is a three-way speaker system consisting of four speakers in a bookshelf-size enclosure. Despite these innocent sounding words, there are many surprising facets to this speaker system.

Before exploring these facets we would like to dwell for a moment upon the visual appearance of this system. In our opinion the visual appearance of a bookshelf speaker system is of great importance. Although not as important as the sound quality, we must remember that one of the reasons the bookshelf system is the reaction against the unsightly large speaker systems. In addition a bookshelf speaker system is meant to be placed at eye level, and to be constantly in view.

The view provided by the XP-4 is indeed handsome. The unit we reviewed was finished in oiled walnut, and although we must admit a certain partinity towards oiled walnut, it certainly conveys a feeling of luxury.

The four speakers comprising the XP-4 system are a relatively long travel bass speaker (with some revolutionary features which we will go into later), a pair of cone type mid-range speakers, and a hemispherical tweeter with wide-angle dispersion. Over-all system balance may be adjusted to fit the individual home environment by means of a high- and low-frequency balance control at the rear of the speaker enclosure.

Bass Speaker Design

The normal speaker construction consists of a magnet, a voice coil which drives the cone; the cone, of course; and a metal basket which provides rigid support for the cone at both ends. Provision must be made for making sure that the cone and voice coil remain in proper relation to the magnet at all times. The bass speaker of the XP-4 system is essentially the same structure that we have just described except that instead of using a metal basket, the speaker enclosure itself has become the basket for the speaker. It sounds startlingly simple, doesn’t it? Instead of mounting the speaker cone to a basket, the cone is mounted through a surround directly to the front baffle. Obviously, in this respect alone, it is probably a money-saving innovation, but what about performance? Is it really a valuable innovation as far as performance of the system concerned? Although we were not able to corroborate it, it would seem to us that this design would eliminate some peaks and valleys in the low-frequency response of the system.

Our reason for saying this is that the basket of the conventional speaker undoubtedly vibrates and transmits unwanted vibrations back to the suspension of the speaker cone. Because of the size of the basket and the distances involved it would probably affect the low-frequency end of the sound spectrum. By removing the basket and having the vibrations now travel through the greatly increased path of the enclosure sides, which of course are wood, the vibrations are essentially damped out. If nothing else, this should make the response smoother. (More about this when we talk about the performance of the system.) Naturally if this system is to work well over a period of time, there can be no warpage in the wooden basket.” Obviously, one of the virtues of an extremely heavy metal basket is that it does not warp easily, and thus keeps the speaker cone in a correct position for a long period of time, indefinitely in many cases. Thus we can conjecture that the enclosure would be extremely well built with precautions taken to avoid warpage. Without being able to see within the XP-4 enclosure, we did note that it is extremely heavy construction, and seemed to be much heavier than many comparable speaker systems. It weighs some fifty pounds, and the enclosure is only 24 1/2 in. 14 x 10 1/2 in.

Performance

Reviewing speaker systems is at the same time the most frustrating yet the most enjoyable of the reviewer’s tasks. It is enjoyable because it necessitates long periods of listening to familiar music, and of course familiar music means music that we like to listen to. On the other hand, it is frustrating because we do realize that we are injecting our own personal taste and prejudices. We mention this merely to caution the prospective purchaser that insofar as speaker evaluation is concerned, our science is not as “scientific” as we would like it to be. Naturally, we can certainly discern gross distortions or limitations, but as yet we have not been able to distinguish between fine speaker systems except on the basis of personal preference.

This brings us to the XP-4. As we noted previously, we would suspect that the new construction for the bass reproducer would provide smoother response in the lower frequency. To our ear this was so. Although the frequency range extended down to only 30 cps, it handled this range exceedingly well and in a very smooth manner. At first the mid-range seemed somewhat thin, and there was a slight edge in voice reproduction. After some knob twirling with the balance controls at the rear of the high enclosure, we were able to reduce this problem. Obviously when the balance was set at the factory, it was set to suit some individual whose preferences were different from ours. The XP-4 handled high frequencies exceptionally well, and with excellent dispersion.

In summation, therefore, the Fisher XP-4 speaker system provides fine sound from a bookshelf-sized enclosure whose appearance will be an asset to most modern decors. In addition the new patented speaker design makes this system lower in cost than previous comparable systems.

ADDENDA

ADC-1 Stereo Cartridge

Audio Dynamics Corporation calls our attention to an error made in the May PROFILE where it was stated that the compliance claimed by the manufacturer for the ADC-1 Stereo Cartridge was 10 x 10^-4 instead of the figure of 20 x 10^-4, at which current models are rated. Although the figure given was excellent, it was still far below the actual value claimed for it.

Sherwood S-2200

Although it probably fooled no one, we stated in the April issue that “from the standpoint of sensitivity, Sherwood need take a back seat.” Of course we meant “Sherwood need not take a back seat.” If it were not so obvious, we would be thoroughly embarrassed.
In stereo receivers specifications alone can be deceiving. How then, do you recognize quality? Plug in a Pilot 654—and in seconds you'll hear it—quality that can be measured not only by specifications but by your own ears as well! You'll hear brilliant new clarity in every musical performance, thanks to the low 0.5% harmonic distortion of this powerful new stereophonic receiver. The 654 combines separate FM and AM tuners, 60 watts of power, and a total of 15 operational controls in one compact unit, no larger than many tuners. The Pilot 654 is the ideal way to set up your home stereo system. Simply hook up a pair of speakers and a turntable, and enjoy sound reproduction of incomparable beauty. Special features of the Pilot 654: coil-operating chassis—UL listed—for safe custom installation. Rumble filter, scratch filter, tape monitor, and automatic shut-off. Pilot's exclusive Stereo-P us Curtain-of-Sound third speaker terminal can be used for simultaneous remote monophonic performance, or three speaker Curtain of Sound. Complete with handsome brass and black enclosure, only $299.50. See the 654, or 30 watt Pilot 602 at $249.50, at your authorized Pilot dealer.

ANY SIMILARITY BETWEEN THE PILOT 654 AND OTHER STEREO RECEIVERS ENDS HERE

ALL PILOT TUNERS AND STEREO RECEIVERS HAVE MULTIPLEX JACKS. PILOT'S MULTIPLEX ADAPTOR WILL SOON BE AVAILABLE FOR RECEPTION OF FM MULTIPLEX STEREO. FOR COMPLETE INFORMATION WRITE PILOT RADIO CORPORATION, 37-34 36th STREET, LONG ISLAND CITY, N.Y.
LAFAYETTE KT-550 POWER AMPLIFIER KIT

The KT-550 is a 100-watt (50 watts per channel) stereo power-amplifier kit. Without question this kit is a prime example of the recent trend towards more powerful amplifiers and quality without compromise. We have taken notice of this latter trend several times in the recent past; it is certainly natural that we take special cog- nizance of things we like. Indeed, and in fact more important, the consumer has also shown approval for this trend. In any case, the KT-550 is an excellent amplifier which builds easily, certainly within the capabilities of almost any constructor.

As a side note we would like to point out that the KT-550 is most attractive in appearance. Normally when we think of such a functional instrument as an amplifier, we are not interested in its appearance. This is especially true since most of the line amplifiers are placed in some cubby-hole where they will not be seen. Be that as it may, this particular amplifier with its two-tone brown body and gold instrument panel is quite handsome in appearance, and deserves mention even though it be forever more hidden from sight. At least, when you must service it, there will be some joy in looking at it.

Circuit Description

One of the important new developments which has contributed greatly to the quality of recent amplifiers has been the use of multiple feedback loops. In the past the feedback comprised a single loop, usually from the voice coil back to the input stage of the amplifier. With this technique the feedback was limited to about 20 db. Higher amounts of feedback, which of course would reduce distortion, would also cause the amplifier to become unstable. With multiple-loop techniques, however, if one stage has twice the distortion of another, twice as much feedback is applied around it. This permits the use of larger total feedback without sacrificing stability. In the KT-550 six feedback loops are used with a total feedback of over 50 db. Referring to the schematic, Fig. 2, we will trace a signal as it proceeds through Channel A. The input signal enters at \( V_1 \) and is fed to the grid of the pentode section \( V_{30} \) (a 6BR8) which acts as a voltage amplifier. The output of \( V_{30} \) is connected to the grid of \( V_4 \) (6L6D) one of the driver tubes. The output of \( V_4 \) is also connected to the grid of \( V_{50} \) (triode section of 6BR8A). \( V_{50} \) is adjusted by means of plate-to-grid feedback to provide a gain of unity. The signal appearing at the output of \( V_{50} \) is therefore equal in level to the signal fed to \( V_4 \), but 180 deg. out of phase. This reversed-phase signal is then applied to the grid of the other driver tube, \( V_5 \). The outputs of tubes \( V_4 \) and \( V_5 \) are fed to the grids of the push-pull power output tubes \( V_x \) and \( V_y \), respectively. The newly developed 7027A beam-power output tube is used with fixed bias. To compensate for changes in tube parameters, and to avoid the use of matched pairs, an indicating meter and bias and balance controls have been incorporated. Bias controls \( R_m \) and \( R_1 \) can be adjusted to provide the proper signal to the meter which will ensure that \( V_x \) and \( V_y \) are drawing the same amount of current. In this manner both tubes are made to operate at the same quiescent point, and are therefore "d.c. balanced."

Dynamic or "a.c. balancing" is accomplished by adjustment of \( R_m \). The control changes the plate loads of \( V_x \) and \( V_y \) causing the voltage at the grids of \( V_x \) and \( V_y \) to change correspondingly. During adjustment the meter is connected across the two cathode resistors \( R_m \) and \( R_1 \). If the tubes are perfectly balanced when an a.c. signal is applied to the input of the amplifier, the meter will indicate zero. A 60-epi 20-watt test signal is supplied from a test jack at the rear of the chassis. All bias and balance controls are conveniently located on the front panel of the amplifier. The power supply consists of four silicon diode rectifiers in a voltage doubler circuit, and a fifth silicon diode and an R-C filter provide rectification and filtering for the bias-voltage supply to the output tubes of both channels.

Construction

The KT-550 is an unusually easy amplifier kit to construct. This is the result of the use of printed circuit boards for the major portion of the wiring. As a result of the reduced amount of soldering and wiring it took us just a shade under six hours to construct this kit. This came to two nights' work in practical terms. A contributing factor to the extremely easy construction is the manual accompanying this kit. It is certainly one of the most concise, clear, and easy-to-understand manuals that we have encountered for a power amplifier kit. Of special value in this manual are the pictorials and instructions describing how to solder connections to switches and to the printed circuit board. These are areas where the novice constructor commonly has difficulties.

On the whole the manual is excellent, as we noted, but we did discover four or five inaccuracies although they were of the sort which are easy to detect during construction. There was one error (not in the manual) which was somewhat more serious however. We discovered that a hole had not been drilled in one of the circuit boards. Although this was not especially serious for us—we just went ahead and drilled a hole with the proper size drill—the novice, however, would probably be quite alarmed especially since most of the components had already been mounted to the board by the time this was discovered. The novice would probably be drilling for fear of ruining all the work that he had done up to that point. We don't blame him.

Although not of vital importance, we would recommend that kit manufacturers include the plastic nut starters which are included in one manufacturer's kits. They could not possibly cost more than a few pennies, and yet they are probably the
ENJOY YOUR HI FI OUTDOORS THIS SUMMER!

Whether it's work or play or plain relaxation, you'll have more fun this summer with outdoor high fidelity by ALTEC. For a permanent outdoor installation, try the ALTEC 50A Horn—the wide range outdoor speaker that is completely weather-proofed for any climate. For portable outdoor high fidelity, take your pick of ALTEC compact speaker systems—they offer superior reproduction yet are light enough for easy portability. (You can enjoy your ALTEC compact indoors when you are not using it outdoors!)

And here's a practical point to remember: With new ALTEC stereo amplifiers as part of your central indoor hi fi system, you need no separate amplification to power an outdoor speaker! Each ALTEC amplifier features an auxiliary speaker tap so that you may enjoy one or more extra speakers anywhere in the house or yard.

PERMANENT:
ALTEC 50A "Bi-Acoustic" Horn offers smoothest, widest frequency response of any competitively priced all-weather speaker! Made of heavy-duty reinforced Fiberglas, comes with universal mounting bracket for easy mounting in any direction and to any surface or structure.

PORTABLE:
ALTEC 834A "Monterey" Speaker System features guaranteed 40-22,000 cps frequency range. Finished on four sides in walnut, blond, mahogany, or fruitwood for use vertically or horizontally. 14" H, 26" W, 14½" D.

FREE! Get the new 1961 ALTEC Stereo Catalog and informative Loudspeaker Enclosures Brochure at your Professional ALTEC High Fidelity Consultant's or write Dept. A-6.

ALTEC 835A "Montebery Jr." Speaker System is a smaller version of the 834A. Guaranteed 45-18,000 cps frequency range. 11¼" H, 23½" W, 11½" D.
ALTEC 836A "Lido" Speaker System boasts beautiful styling and sound to match. Available in walnut or mahogany, the "Lido" is 12½" H, 26" W, 12½" D.

ALTEC STEREO COMPONENTS INDOORS
POWER A SPEAKER OUTDOORS:
ALTEC 309A AM/FM Stereo Tuner and 353A Stereo Amplifier-Preamplifier are look-alike mates that offer a harmony of styling and engineering balance. The 309A features (FM) 2 mv max. sens. (equivalent to 1.0 mv, ref. 72 ohm antenna); 2.9 mv for 25 db quiet. sens. (equivalent to 1.45 mv, ref. 72 ohm antenna); ±1 db 20-20,000 cps freq. response and (AM) 3.2 mv max. sens.

The 353A provides 14 stereo or mono inputs, 6 outputs plus matricizing network for 3-channel stereo and auxiliary speakers anywhere in the house or yard. 100 watts stereo prog. pk. mw, 80 watts rms contin. freq. response ±1.0 db 20-20,000 cps at 25 watts / ±0.5 db 10-30,000 cps at 1 watt.

NOTE: The tuners above are fully wired for FM Multiplex Converter.
most convenient tool we have found for mechanical assembly. We recommend this as an inexpensive way to the "heart" of the kit builder.

**Performance**

The published specifications for the KT-550 are unusually fine, well up amongst the top-quality amplifiers available. This amplifier met every one of its published specifications. For example, we found frequency response from 20-30,000 cps to be within 0.55db at 50 watts output. Harmonic distortion was 0.12 per cent at 1,000 cps and 50 watts output. We measured IM distortion at 0.4 per cent, and hum and noise at 90 db below 50 watts.

In view of the excellent performance and easy construction, we would recommend this amplifier to any audiophiles who is willing to pay for performance. P-23

**NEUMANN DST PROFESSIONAL STEREO CARTRIDGE**

The Neumann name is one which is highly familiar to the professional in the recording industry. They have been making professional condenser microphones and disc mastering lathes for thirty years. On the other hand, the audiophiles would have had little opportunity during these years to become familiar with this name because until now the company has never produced a consumer item. In fact as we understand it, this is not a truly consumer item in that it was designed and is still used as a monitor for a Neumann-Felde stereo disc cutting system.

As we can note from Fig. 4 the DST is more than a cartridge, it actually is an entire plug-in head. For that reason it is only suitable for certain arms: namely the SME and the ESL arms, as well as the Neumann arm with which it was originally designed to operate. It should be noted that the SME arm should be the model with the anti-skating feature. The reason for the latter requirement for the tone arm is that the DST requires a stylus force of four to five grams compared with the less than one gram required for many currently available cartridges. The relatively high stylus force and the extremely low friction of the SME arm combine to cause the arm to "skate" toward the center of the record.

One might question whether the DST with its high stylus force would cause unusually heavy record wear. Apparently this just isn't so. We observed a record which had been played with a DST over a hundred times and there was no appreciable record wear noticeable—or audible either, for that matter. The secret to this extremely low record wear is the highly polished diamond used in the stylus. Of course, all things being equal, a stylus force of four grams will certainly produce more wear than a stylus force of one gram or less. But apparently all things are not equal. We can speculate that other stylus may not be as highly polished as the DST seems to be.

**Performance**

From its highly professional background we would expect the DST to be highly professional in performance. We were not disappointed. The frequency response from 10-20,000 cps was within ± 2 db. The channel separation at 1000 cps was 29 db and at 15,000 cps it was 23 db. One unusual appearing feature of the DST is that the stylus arm and indeed the entire underside of the cartridge is covered by a sheet of rubber-like material so that the stylus tip is the only component observable underneath the cartridge. Apparently this sheet supplies a certain amount of stress to the stylus and also protects it from dust.

In a listening test the DST produced some of the cleanest sounds we have heard in some time. In fact it is so free from coloration that it actually takes a little bit of getting used to. We must admit however that perhaps some of the excellent sound might be attributed to the professional Neumann equipment we used in conjunction with the cartridge; namely the automatic turntable model PA2a and the model WV-2 preamplifier. In summation, therefore, the Neumann DST stereo cartridge is truly a professional unit in all respects.

**NEUMANN AUTOMATIC TWO-SPEED TURNTABLE**

This is the turntable used for testing the Neumann DST cartridge. This turntable is high in quality and in price—a seemingly natural relationship. An unusual feature of this turntable is its small size. The mounting plate is only 14 1/2" x 12 in. The arm, as we can observe from Fig. 5, is proportionately small. The turntable is built on a solid cast plate. The hydastens drive motor on the one hand, and the turntable and the arm on the other, are separately shock mounted on this plate. Rotation of the motor is transmitted by means of a rubber belt to two idlers, either of which—depending on the setting of the speed selector switch—is brought to bear against the inner rim of the turntable and thus driving it. When the speed selector switch is in its neutral position, both wheels are free.

Next to the speed selector switch is the tone arm lever. Bringing this lever forward causes the pickup to lower slowly to the disc until it gently sinks into the groove. Moving the same lever gently to the right raises the arm just as slowly while leaving the motor rotating. The tone arm is also raised at the end of a record, or when the speed selector switch is manually depressed. Fig. 6 shows the location of the disc's starting grooves, a detent in the tone arm rest automatically locates the stylus directly over the lead-in groove of the standard 7, 10, and 12 inch diameter records.

The Neumann PA2a automatic turntable is obviously built to professional standards. It hardly need be stated how low wow and flutter is (.01 per cent rms). In addition this is one of the most ruggedly built units to cross our path in a long time. Previously we noted how small this entire unit is, and yet without base it weighs twenty-five pounds. It is rather difficult to point out all of the attributes which make this an unusually fine turntable. In reality, one need only look at the unit to see how carefully and meticu-iously it has been constructed. This is definitely a unit for those who want professional performance and are willing to pay professional prices.

**Fig. 4** (left). Neumann DST stereo cartridge.

**Fig. 5**. Neumann automatic 2-speed integrated turntable.

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Features of STEREPHONE SH-100

1. Its price is surprisingly low.
2. The tone quality is highly excellent (reproduction range: 30-15,000 cps). The tone quality of the low range, in particular, is no less excellent than the sound reproduced with a high-quality hi-fi system.
3. It is extremely rich in volume, but the volume control provided allows you to enjoy the reproduction at the most desirable volume.
4. The stereophonic sense can be adjusted from binaural to monaural.
5. The needle pressure is adjustable from 3 to 6 grams. Moreover, constant needle pressure is maintained by means of a special spring which completely prevents damage to the records.
6. A special protective mechanism is provided. In this mechanism the needle point does not come out until the record begins to revolve.
7. Three to four persons may listen to the reproduction if an adapter is used.

Neither Amplifier
Nor Loudspeaker Required!

Stereophone SH-100

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FUKUIN ELECTRIC, LIMITED
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THE VIKING "76 COMPACT" STEREO TAPE RECORDER

The Viking "76 Compact" is indeed aptly named. Measuring 13 x 13-in. across the front panel and requiring only 6 1/4 in. behind the panel, this unit certainly is appropriate for today’s ever-smaller and overcrowded equipment cabinets. We have often wondered which came first, smaller cabinets or smaller equipment. It’s sort of like the old chicken-and-egg riddle. No matter, the end result is smaller units which are easier to locate in today’s cramped quarters.

Lest anyone be misled into thinking that small size means small performance, we would like to make it clear that size and performance are not necessarily related, at least in tape recorders. One need only examine any one of several professional, portable, battery-operated recorders to dispel this unwarranted notion.

The "76 Compact" is a 2-speed (3% and 7 1/2 ips) tape recorder and playback machine. It records only quarter-track tapes, stereo or mono. A recording preamplifier is built-in in the unit and features two VU meters as shown in Fig. 6.

Operating controls of this unit have been reduced to the minimum. For example, to play back one need only operate two knobs, one knob for setting the machine to the play position, and the other to start the forward motion of the tape. For recording, the only additional operation required is to adjust the individual level control knobs while observing the VU meters.

There are two sets of inputs, one set on the front panel for high-impedance microphones and tape heads, and the other set on the rear panel for high-level inputs such as tuners and so on. Jacks are provided on the back panel for playback head output, and monitoring.

A single motor is utilized for all drive functions, power being transmitted through a round, cloth covered, flexible belt. Motion is transmitted to the capstan by means of a heavy, balanced turntable.

Performance

A recent trend in tape recorder design has been to raise the bias frequency to extend the frequency range of the unit. For example, the bias frequency of the "76 Compact" is 80,000 cps, which is the fifth harmonic of 16,000 cps, the latter being for all practical purposes the upper limit of this machine at 7 1/2 ips. The stated frequency response, both in recording and playback, is 25–16,000 cps at 7 1/2 ips, plus minus 3 db. Our measurements corroborated this, except that we measured 3-db down at 13,000 cps and 4-db down at 16,000 cps. Signal-to-noise ratio was 59 db and the playback-head output was 2.2 mv at 1000 cps.

In sum then the "76 Compact" is a compactly sized and priced tape recorder and playback instrument which would integrate well with modern, compact reproduction systems.

CROSBY R80 AM-FM STEREO RECEIVER

Over the past few years the name Crosby has become well known as the developer of a FM-stereo multiplex system. Although the particular stereo system championed by Dr. Crosby was not adopted, it is quite obvious that he is still one of the leading experts in this field. The R80 is a good example of this knowledge in that it contains full provision for FM stereo with the exception of an adapter appropriate for the system adopted by the F.C.C. All controls necessary to operate an all FM stereo system have been incorporated and are available at the front panel, in consideration of the probability that the adapter need only be a relatively small "black box," the audiofan will find the R80 ready for stereo when he wishes to have it.

The Crosby R80 is classified as a receiver because it contains an 80-watt music power stereo amplifier (dual 40) in addition to separate AM and FM tuners and sufficient controls to suit the most avid knob twister. In addition, it uses a twin "magic eye" tube which is used either as a tuning indicator or as a two-channel program-level indicator.

The appearance of the R80 seems to have been inspired by the space age; the control knobs remind us of the intake of a jet engine and the plastic lens over the tuning dials resembles the airfoil of a rocket. The R80 is shown in Fig. 7 in a wood enclosure.

The FM section contains a shielded front end consisting of a grid-fed r.f. amplifier (1/2 EC85) and a reflex triode converter (1/4 EC86) with a variable capacitance type semiconductor a.f.c. diode. Three i.f. stages are followed by a discriminator employing a pair of 12AU7 diodes for FM detection. A printed-circuit board is employed for the FM section. The 300-ohm antenna input is balanced.

The AM section consists of an r.f. pentode (6H6A) followed by a pentagrid converter (6BE6) and 6BA6 i.f. stage and a 1N541 detector. A rotatable ferrite loopstick is built in.

The amplifier accepts inputs from a variety of low- and high-level sources; phone (both magnetic and ceramic) and whip head are the low-level inputs, and tuner and auxiliary are the high-level inputs. The low-level inputs are preamplified to a 12AX7 which features 20 db feedback equalization circuits for magnetic cartridge and tape-head playback. This stage utilizes d.c. on the heater. The high-level inputs enter the circuit at this point and all signals are fed to the grid of a 1/4 12AU7 (tone control) and from there to a 1/4 12AX7 (voltage amplifier). Next the signal goes to a 12AX7 phase splitter and finally to the push-pull, self-biased, 7591 output tube. Over-all feedback 17 db per channel.

It should be noted that the circuitry of the R80 offers many control features which provide exceptional flexibility of operation although the fundamental circuit is quite conventional. One would suspect, just from examination of the tuner circuits, that the R80 is not in the "super-sensitive" category. Of course, extreme sensitivity is required in very few locations. Indeed, all of the high-sensitivity sets have a "local" switch which reduces signal level to avoid overloading the tuner.

Performance

As a receiver the Crosby R80 performs quite well. Frequency response is plus or minus 2 db from 20–40,000 cps and power response is plus or minus 0.5 db from 40–20,000 cps at 40 music watts per channel. Residual hum and noise is 58 db below 25 watts. Harmonic distortion in the AM section is less than 1 per cent. In the FM section harmonic distortion is less than 0.75 per cent at 100 per cent modulation with a 10 µv input.

All these statistics add up to performance at a relatively modest price. The Crosby R80 is well equipped to be the "nerve center" of a home music system.
After two years of research and development, a speaker system we can offer to the public on a 100% MONEY BACK GUARANTEE. Compare the A. E. S. Gigolo to any bookshelf speaker, regardless of price and if you do not feel that the Gigolo is the most outstanding unit you have heard, you may return it for a full purchase price refund.

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Don't Miss This One

Copland: Billy the Kid; Rodeo, New York Philharmonic, Bernstein. Columbia MS 6175 stereo

Nobody, but nobody, can play Copland like Bernstein. This is for my ear the finest coupling of these two pleasingly junctional scores to hit records; they positively titillate, and Columbia’s new style stereo is wonderfully grateful to the music.

CLASSIC MODERN


What a whal of a spectacular this is! As in others of the sort, the music is only one element among many in the package. As usual, the décor is varied and colorful, the information and illustration enough to keep you busy for hours. But this documentary, unlike a good many earlier spectacles, is full of vital stuff, an astonishingly thorough presentation of the man Stravinsky—by himself. He conducts, he speaks at length, he writes personal reminiscences most of which are humorous but blissfully insouciant, and on the whole, the known Stravinsky—by himself. He conducts, he speaks at length, he writes personal reminiscences most of which are humorous but blissfully insouciant, and on the whole, the known and the unknown Stravinsky stick to his familiar haunts, but in the process of telling his anecdotes, the name of the great man is kept in mind so that the miserably failures of his life are far more ridden with purpose than if they were not actually as different from the later music as we had thought.

The “Concerto” section is the most popular Bartok piece, one of his last; but recently we have found backing from the great “Third Piano Concerto” to the wild and wonder “Second Concerto”—now comes the “First”, even wilder and more remarkable (as we now hear) all the better for hi fi and in the listening not really so different from more familiar Bartok. This concerto does, to be sure, wax and bang in true Twenties style; but you will also hear many an endearing bit of the “Concerto in the style of Jane Astor” of almost twenty years later—and the similarity to the now well-known “Sonata for Two Pianos and Percussion” and the even better known hi fi version, “Music for Strings, Percussion and Celesta” will be immediately clear. In short, this unfamiliar Bartok will turn out to be remarkably familiar as a member of the Bartok recital family.

The early “Rhapsody.” From 1904 when the composer was only 25, is one of those big, splashy pieces of pure derivitiveness that borrows from everybody in sight, yet manages also to foreshadow much of the mature style of the composer. In it, Liszt, all Hungarian Rhapsody, with strong overtones of Brahms, César Franck, Strauss. But it is very often unaccountably Bartok too, as of much later, and though the music is long-winded in its youthful exuberance it is effective and entertaining. Quite a gay, this young Bartok.

The “First Concerto” gets a somewhat rough playing, understandably in a first recorded performance, the rhythms often hesitant and unsteady. The piano is excellently and the spirit right throughout. The early ‘Rhapsody’, more predictable, gets a polished and splashy performance. Just for fun.

I don’t know whether this is available in stereo; mine came in mono format.

Bartok: Concerto for Orchestra; Dance Suite. Concertgebouw Orch. of Amsterdam, Haitink. Epic BC 1129 stereo (mono: LC 3772).

It is astonishing to find how many aspects this late Bartok Concerto can reveal, under varying conductors and orchestras. It seems to be one of the most varied and rapidly changing of the works which it is said that only Bartok could write. The performance and the music of the Bartokian tenue, the rhythm, the tempo, the sonority, the style, all are remarkable, no matter who plays it. The Concertgebouw under Haitink plays a sort of high-level Tchaikovsky—I mean Tchaikovsky at a standpoint of the first rate. The same high-level is not seen in the concerto of solo violinists within the orchestra to the Bartok and the sharply similar treatment of the Tchaikovsky orchestra in his big works. The two men, all men, are both masters of detail within a large symphony orchestra, both could be described as having a wonderful lightness and transparency, within the big agglomeration of instruments.

There is, of course, a certain quality of honest conservatism here—It is good in such a well-rounded performance (though it can be dull in less fortunate circumstances). The themes and melodies are taken full-value and with leisure, each given all the time it can use for its best impact, and this adds to the Tchaikovsky flavor; for the Bartokian tenue under this same moderate approach is, again, remarkably like that of Tchaikovsky.

Only in the high-speed inst movement is the music somewhat out of its element. Bartok does it even faster but maintains a tempered steel sharpness even so; here there is insipid confusion and orchestral floundering.

The earlier “Dance Suite” (1925) is also slightly out of place in this moderate and thoughtful orchestral milieu; it is better played here in the many, buoyant, jazzy elements can have fuller play. Even at their most elegant the Dutch are seldom jazzy. Not in symphonic music, anyhow.


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is the musical testament of an old-line immigrant from Europe, a much-beloved Jewish composer who left the Old Country for our "promised land" and hereby thanks America for all that it means to him. The music is built around a number of familiar American tunes; it is pictorial, heroic, sentimental, touching in its honesty—and about as unpaintable today as you can possibly imagine. Also, the very vehemence of its defenders (indulging Stokowski) betrays, I think, a pretty sure doubt as to its musical value. Frankly, I found it perfectly awful, though this does not one bit reduce my admiration for the man himself nor for the feeling that led to such a heroic monstrosity.

The stuff is usually dated, in the true sense of that word; its whole approach and language is of a sort that is now meaningless, except perhaps in a misguided local affair of patriotic pagentry. The musical construction that might give it permanence is so dim, the style such a hodge-podge, the extra-musical dramatics so distracting, that not even Stokowski's magic can pull it together.

You will not find any reputable musician who will admit this in public, of course. Bloch was one of the great inspirations for American music in its budding years of this century and his name is sacrosanct. But if you expect a work of patriotic fervor—be warned. The going is heavy.

At the end of the big piece, a short excerpt from an actual speech by Bloch concerning this work gives his own patrottic feelings, in reasonably intelligible & interesting

Claire de Lune (Debussy Piano Recital), Philippe Entremont, Columbia MS 6214 stereo (mono: ML 5614) Piano Colors of Ravel, Leonard Penarredo, Capitol SP 8533 stereo

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PAST AND PRESENT

Gregorian Chants—Good Friday; Septuagesima. Choir of the Monks of the Abbey of Saint Pierre de Solesmes.

London OS 25229/30 stereo

Solesmes in France has lately been disting

uished for being near Le Mans, where auto racers tear their own apart. Le Mans was there all along; but long previously Solesmes had an enviable world-wide reputation as the center for the restoration of Gregorian chant to its original form, after many centuries of gradual corruption. The monks even devised moveable type for this old music and back in the 19th century printed the first of those huge volumes of chant that are now the official sources for Catholic Gregorian music. In the first decade of electrical recording these monks issued a monumental series of 78s, which were my own introduction to this music.

In comparison with several other recent LPs of Gregorian music I've been hearing—one from Germany and another from the U.S.A., the Solesmes means sound older, sinc with a very slightly more romantic approach and produce a peculiarly lovely slightly nasal tone that would seem to have a French origin. Their singing is deliberate, with a good deal of emphasis and quite a bit of swelling and dying away on individual tones. The pitch is no less than superb—in a half hour of unaccompanied singing they do not slip. (Try it yourself—just play the beginning of side 1 of the "Good Friday" disc, then the very end.)

I particularly enjoyed the first part of the Good Friday music, which is an exposition of

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the Good Friday story (in Latin, of course) somewhat reminiscent of the Lutheran "Pasa- 
mon drama" as set by Bach—three voices 
alternate, one of them an Evangelist, one the 
"Synagogue," and the third Christ himself. 
The Evangelist is somewhat neutral, while the 
other two have more individuality, one sing- 
ing higher, one lower. The entire story is told 
in terms of an exquisitely balanced series of 
short chant formulas, repeated dozens of 
times to new words. The serene, utterly mu-
sical confidence of these individual voices is 
something to marvel at and should move any 
listener.

Distler: Die Weihnachtsgeschichte (The 
Christmas Story). Norddeutscher Sing-
kreis, Wolters.

Barenreiter Musikaphon BM 30 L 1302

This poignant, restrained modern setting of 
the Christmas story for unaccompanied chorus 
and solo voices looks back beyond Bach, per-
haps to the "Christmas Story" of Heinrich 
Schütz in the early part of the 17th century. 
Its composer enjoyed only a brief musical 
fame; the growing Nazi militarism of the Thirties in 
Germany was wholly alien to his nature—as is 
abundantly clear in his sensitive music—and, 
if my slightly faulty German is correct, he 
entered only the first half of the war before 
committing suicide in final desperation.

His music is hardly forward-looking and, I 
suppose, could be called introspective to the 
point of near-decadence. On paper, perhaps. 
But there are times when it is good to look 
backward, to reverse, preserve, make anew 
true the traditions of the past that are 
threatened with horrific extinction in a world of 
terror. Great art has often come from 
such a situation and has been duly honored, 
the equal of any innovation.

The gentle Christmas story is told here 
mainly by an unaccompanied solo narrator (as 
in Schütz's Christmas Oratorio), who is surrounded in the music 
by others—an angel, Mary, King Herod, Sim- 
eon; the quiet flow of their voices is taken up 
here and there by the choir, unaccompanied, 
which sings a series of lovely choral varia-
tions on the familiar Christmas tune Lo, How 
a Rose e'er Blooming (Es ist ein Ros' ents- 
puppen) as well as brief contrapuntal motets 
on portions of the story's text.

The mood is quiet and reverent throughout, 
the music so removed, as indeed it must be, 
from the rigors of daily life and the gravest 
consequences of the Nazi regime's years of ex-
pansion. How else, surely, must the story of 
Christmas be told, today as then? If you 
would like to harken up some moments of 
Christmas peace in advance, against next 
year's department store Xmas rush, put aside 
this disc and bring it out next December.

Deller's Choice. Alfred Deller, counter-
tenor, with Gustave Leonhardt, harpsi-
chord and organ.

Vanguard BGS 5038 stereo

Vanguard's immense success with Alfred 
Deller has led to a few recent releases not 
exactly on the highest plane, though pleasing— 
yet this new recording, far from exhausting 
the Deller repertory, is one of his very 
best to date.

It is entirely of songs to harpsichord or 
orGAN (with a fiddle and cello here and 
there); the music is superb, the singing 
impeccable—there is no one I know of who 
can do it as well—and the variety of material 
is remarkable, the interest well sustained. (A 
solo harpsichord or organ piece now and 
then breaks the monotony of the same voice.) 
Best of all, Deller controls his vocal instrument 
more beautifully and rigorously than I re-
member hearing him before, with scarcely a 
tone anywhere of his earlier yawnish sort. His 
sense of pitch is exquisite. Few singers can 
match it. His feeling for purely musical drama 
and the dignity of simple expression is flaw-
less.

The music ranges back and forth, mainly 
English but with complementary Italian and 
German items; there is a Bach and a Handel, 
a brace of virtually brand new 17th 
English works (to most of us) by such as 
Humphrey, How, Weldon, an unusual orna-
mented version of a madrigal by Cintrana di 
Rore, decked out fifty years afterwards as a

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Lotte Lehmann—Opera Recital (Great Recordings of the Century).

Angel COLO 112

Those who remember Lotte Lehmann in her later career as one of the finest of all lieder singers will recall how we used to talk about her—"she doesn't have much of a voice, but..." and so on. That's the fate of all singers whose musical minds outlast their physical powers!

If you've heard Lehmann's 78 rpm recordings of Purcell's "My memory is right—or her famous "Rossenkavalier" recordings of the same period (Col. 110-111), you'll secretly be surprised at this set of short operatic "singles" from the high times of her earlier career, 1927 through 1932. She had a great voice then, as well as the familiar and fascinating Lehmann personality, so sincere, so dramatic, so dedicated to her music.

On these two sides are nine famous 78s recordings with orchestra and only two, Kommold and Carissimi, are of less than top musical calibre—but she makes them shine too. The best are Beethoven ("Fidelio"), Weber ("Freischütz"), and the two Strauss ("Fledermaus" and "Arabella and Naxos"), she was a pure German singer, who did even her French and Italian opera in German. A selection and revealing as Lehmann, "Listening to My Old Records", is the pleasantest of the excellent accompanying booklet.


Angel COHL 43

For a good many years, Adolf Busch and his pianist son-in-law Rudolph Serkin performed together, both in chamber music and in works for orchestra, with a good deal of the distinction that now goes to such an Alexander Schneider and Pablo Casals, brother and sister members of the Busch choir, played cello, as her brother-in-law Schneider has played to his brother's side.

I can remember many a Busch-Serkin event mark and the familiar impact of Adolf Busch's cello, not always accurate and often over-emphatic but always musical, is a sound symbol of an era for those of us who enjoyed his then-new small orchestra "Haroque" concerts and recordings—pressing the great movement of today towards "authentic" older music. The two were among the earliest of the sort in this country, though the idea was nothing new in Germany.

Serkin is still with us as a leader: instantly, the compelling power of his piano leadership will strike you in this famous old recording. A human dynamic of music! For all his later career, I suspect that those relatively youthful moments of superb Schubert playing have not been surpassed by him. By himself, Adolf Busch was often too heavy, too Germanic for an American taste; even on his own was nervously tense. Together, the two associate held each other to the optimum, and the eloquent but unceremonious playing of Hermann Busch made for the perfect trio.

After a quarter century, the playing here has an oddly old-fashioned eloquence, free of the unremitting tension that is soMarvelous in our music today. This is the way Schubert ought to be played, I'm tempted to say—knowing perfectly well that each age finds its own way to play any music that may be lucky enough to survive from an earlier period! This is one of the glorious ways that Schubert has been played, anyhow, during the 125-odd years since this music was composed.


Epic BC 1120 stereo (mono: LC 3762)

I tried this record mainly for the two lovely Beethoven "Romances," the first one of which is almost too famous years past. They aren't often played because they do not fit in any standard category—they are short, simple songs but require a full orchestra as well as a soloist. It was good to hear the music again, but I felt that these performances were somewhat hurried, missing that sublime slowness that is especially Beethoven's in such music. These move along too fast for the proper musical impact. Only the dignity, the impressive simplicity, that can be projected, and has been in other recordings. The music is more important, I think, than these players are allowing it to be. It is the very best of a type of expression that Beethoven particularly liked in his early-middle period.

The Mendelssohn Concerto is well and lightly played with a good balance between solo and orchestra, no unnecessary hoplun, a nice subtle tone from Grumiaux. Even without the drawn out of all the other versions, I'd be willing to settle for this one. (See following.)


Capitol SP 8518 stereo

Hold it! Here's another Mendelssohn, which out of curiosity I tried here: this one cut directly with the preceding, featuring Arthur Grumia-
aux and the Dutch orchestra. (Note that these two are perhaps the two highest-ranking orchestras in the world.)

The Capitol (E.M.I.) sound is sweeter and smoother than Epic's (Philips of Holland) and the performance is more drollful, to the point of being a bit slick. It's interesting that the Mendelssohn orchestra is peculiarly tough to capture in stereo against a solo violin, and Capitol's Philharmonia is distinctly subtitled and "backgroundish" here—more so than the Concertgebouw in the Epic recording though both versions subordinate the orchestra to the prominent solo violin.

Yes, I distinctly prefer the Epic recording. It is slightly rougher, but in the direction of real sincerity and musical expressiveness. As a matter of fact, the coordination and cooperation between solo and orchestra is better than between Milstein and his very expert orchestra man, Leon Barzin. Differences are slight in outward detail, but I sense rather definitely that the Milstein-Barzin cooperation was somewhat routine, if highly skilled, whereas the Grammaux-Hautink collaboration (Hautink is one of the two permanent conductors of the Concertgebouw) is a working ensemble of real expressivity.

All of which is to say that my first impulse as of the above—settled for the Epic recording—is sustained in subsequent comparison here.

Mozart: Symphonies No. 25 ("Little G Minor"), No. 36 ("Linz"). Pro Musica Orch., Klemperer.

Vox Pl 11.820

If I am right, these recordings are out of an earlier Vox catalogue, put down when Otto Klemperer did not yet have his present conductor's reputation, that has so selectively come his way in the last four years, during which his Angel recordings have made him famous on records. Klemperer went through an unfortunate period in late middle life but his return to "full production" has been most extraordinary. A comparison of the two covers photographs of the man with perhaps suggest the change; the side face on the front shows the wise, contemplative aspect of a great musical mind, the front face on the back of the album shows the nervous, high-strung, slightly fainthearted look of his less successful period.

The Mozart symphonies show both aspects of this conductor. They are, indeed, fault, rather tense in the performance. But in spite of it, the masterful understanding of shape and line comes through. Comparison can be made with Klemperer's Angel recording of the No. 22 with the Philharmonia.

The sound of these is quite acceptable, though somewhat on the wooden side, lacking in upper sheen. If they are no old as I think, in the original, Vox has done an excellent job of refurbishing.

ECHT- AND NEO-BAROQUE

Bach: Sonatas Nos. 3 and 4 for Violin and Keyboard, in E Major, C Minor. Hans-Heinz Schneeberger, violin; Eduard Muller, harpsichord.

Barenreiter: Microphon BM 25 R 902 (10"

The German-Swiss firm that rides the bear (Barenreiter) is now being imported hereabouts and I'm lucky enough to be on their reviewer list. Their product is ultra-German in the highest sense—even to that typically complicated die number on the record, as well as the somewhat chastely designed soft record cover (quite lovely, even so) and, most important, the marvelously played Bach.

It takes a German understanding. I sometimes think to play this ultra-German composer as he must be played. In particular, this violinist is unbelievable "right!"—his instrument is subordinated to the whole music both in the playing and in the recorded sound (which places him somewhat off-mike for a beautiful blend of the harpsichord), his fingering and bowing as precisely accurate as though the tones were played on an organ, his phrasing superbly musical, making even... (continued on page 68)
and all that

STereo

Charles A. Robertson

Stereo

Jesse Fuller: The Lone Cat
Good Time Jazz S10039

Railroading and its associated sounds stir the imagination of amateur enthusiasts as well as professionals, and by now the piece of track which has never seen a portable tape recorder is loneliness the longest-shaped and the newest diesel monster is harnessed to test stereo equipment, while distant whistles of the last steamer locomotives are being faithfully documented for space-age posterity. Before the first microphone was placed beside the roadbed, however, blues artists had already passed by, on the way picking up the rhythm with only the gait of the man and the vibrations of the railcar. Fuller, who acts as a one-man band to tell of three separate journeys on his own stereo performance.

Although the blues are full of railroad lore, with only subject matter of an anatory or monitory nature turning up more frequently, such purely descriptive pieces are usually set apart and designated as train blues. Early blue artists made them into individual specialties and always had one ready to roll. Fuller started learning as a youngster when working on the railroad.
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points as West African “Highlife,” the gospel church, contrasting Peruvian rhythms, and London’s own South Bank. The show is very nearly given away at the start, as the first item programmed turns out to be Stravinsky’s Ebony Concerto, written in 1945 for the Woody Herman herd. What follows is in the same general tradition, with a bow or two in the direction of Darius Milhaud, and should attract an equally large and cosmopolitan audience. A tradition can be said to exist in this sort of endeavor indicates how quickly jazz moves along. Solos from the jazz-oriented make certain that time marches just as fast, and rigid conduct with a light, airy, tender, spacious recording hall was employed, and percussive effects on the stereo version are sufficiently spectacular without aid of channel-switching fakery. The arrangements of the Boston Pops and Lewishon’s concertos might take heed and brighten summer fayre by scheduling these works, or commission others from similar composing teams in this country.

Art Farmer: Art
Argo L61678

Since organizing the Jaztet a year ago, co-leaders Art Farmer and Benny Golson have worked to make their group a winner and are being repaid by growing approval from clubs coast to coast. They have just missed achieving the same success in the studio together, perhaps because everyone concerned was asked to discard the Jaztet LP’s to act as showcases. Neither seems to worry much when recording, and mundane affairs are far away as Farmer meanders effortlessly through this gratifying collection of ballads. Whether sales reach a million copies, or a dozen appears to be of no concern as long as he’s happy with the playing on his best. Farmer can create the introspective mood on trumpet as Miles Davis, yet phrases so distinctively that he is never called a Davis imitator. He also searches out neglected songs, recording Four Post Riders, Younger Than Springtime, and Goodbye, Old Girl. Pianist Tommy Flanagan is an equally lucid partner, and the rhythm section, particularly Out Of The Past, Jaztet members Tommy Williams, bass, and drummer Albert Heath complete the quartet. Engineer Tommy Nola’s stereo setting maintains the warm and intimate qualities.

Jimmy Smith: Home Cookin’
Note 57B4050

Having won a reputation for igniting the Hammond organ with configurations fiery enough to singe rare porterhouse, Jimmy Smith turns on the back burners to slowly cook a mess of blues until thoroughly done. The menu was inspired by the homey confines of a restaurant which Kate Bishop operates near the backstage entrance to Harlem’s Apollo Theatre, but the proverbial amount of seasoning is entirely up to Smith and his assistant chefs. Smith cooks at a leisurely pace, carefully testing each concoction at every stage preparation, and anyone in search of short-order cooking had better look elsewhere. The main dishes are See See Rider, and Smith’s own Messin’ Around, with Kenny Burrell, guitar, and Percy France, tenor sax, supplying the extra touches. Burrell also brings along two recipes of his own—a tasty Sugar Hill, and a well turned Come On Baby. Everything is nicely spiced out in the stereo version, and engineer Rudy Van Gelder never lets the hearty organ sound overpower Burrell’s softer rhythm passages.

George Shearing with Nancy Wilson: The Swingin’s Mutual
Capitol ST1524
Aretta Franklin with The Soul Bryant Trio
Columbia CS8412

If record companies still think the only way to launch a new young combo is to hire an expensive arranger and large studio band, they are living by these two albums should be a way toward disproving the theory. Nancy Wilson has two previous Capitol albums to her credit; and some favorable reviews, but the free music enjoyed here with the George Shearing Quintet was never heard before. The lightly swinging background is listlessly dedicated to buoyant Things We Did Last Summer, and a sultry All Night Long. A claim that the date came about because of mutual admiration is easier to believe than listening to the pianist’s double vibrato on the singer’s slightly whist. They also append the program quite serenely, which is especially true of the numbers alone, reprising Lullaby of Birdland, Blue Lou, and Margie Hyams’ Don’t Call Me. After The Perception of the LP is even more informal, with a steady stream of jazzmen section tenor sax, flugel horn, trumpet, and a party atmosphere. The eighteen-year-old miss began singing in her father’s gospel choir in the days before the advent of radio, and by 1948, Sam Cooke is helping to further her new career in night clubs and theaters. Ray Bryant is another who lends encouragement, and his piano is a great help on the adult-sounding Free, and By Myself. Some numbers are frankly directed at the teenage market, and the lists of hit singles are already reeling Love Is In The Only Thing, and Today I Sing The Blues. This last tune comes from Curtis Lewis, who is in frequent sessions with All Night Long. Having satisfied both age groups, the singer plays her own brand of pitch-perfect jazz with the arrangements with The Show Must Go On.

Sid Cooper: Percussive Jazz, Vol. 2
Audio Fidelity DFS7007

Of the sum total of seventeen musicians engaged in decoding Sid Cooper’s arrangements, most find the rhythm section and all are kept fully occupied. The area around and in between stereo space. With the right selection of performers, one can take off like rockets or soar gracefully about before disappearing into space. The music is no simple and direct as a ping in one speaker, followed by a pong in the other, in hope to satisfy both jive and traditional tastes, who have become addicted to lots of percussive action. Cooper provides purposeful dancing, cooing charts for the musicians, charts for the engineers, and finally charting a safe course for readers of rhythm section. Cooper’s job is no longer limited to keeping a bandleader happy, and electronic computers soon may take over.

Cooper picks tunes that are resistant to rugged treatment, featuring Bobby Rosegar- den’s rough-hewn bongo drums and Sol Gubin’s cow bell on Moonshiner, and Don Ar- nold’s guitar on his own Percussion Diver. Some positions are filled twice over, with organists By Muna and Nick Togas, trumpeters Bobby Weed and Andy Ackers, vibists Harry Bauer and Eddie Costa, and Tony Morris as the other guitarist. That noted saxophonist Sonny Stitt has joined on a few numbers, and the usual bassist Jack Dejohnette, Bobby Alexander, and Fred Wilkes, are all equally capable of as an astronaut diploma.

Limerick Party
Cook 1074

As the special dispensation granted to make this recording distinct, the Biczhe publishes the Benevolent Society for the Preservation of Ancient Rhymes & Limericks may never be granted again, all serious composers are ad- vised to envelop while they can. The group assembled at the chairman’s house the week- end before Ash Wednesday, and there seems to be some doubt as to this is the seventeenth meeting—if you believe an usual happy in Ennui Cook’s New England at all. Some rhymes on the year, others all too venerable, others are told with a new twist, and a few are recent enough to include refer- ences to Los and electronics. The words are told with varying degrees of inhibition as the proceedings get under way, who left their last names at the door, and with increasing frankness after 1 A.M. By then, dissident members are telling out daring recitals in an outside hallway, and the host finally hearten the individualists to go alone.

The fact that the next chairman is willing to change a similar fate, the stereo version will probably cause the barring of all microphones in the future. Quite likely, he is come aware for the first time of what a four-foot parabola can do when they hear themselves in conversations that were once held far from any electronic device. These
amusing asides crop up all over the room and all interludes on the agenda. The principal stereo mixes must compete with a public address system unfortunately, and a vocal quartet sounds like a rock-and-roll group. Of course, it could happen that the members will elect Emory Cook, permanent engineer and playback tape recorders to release for future meetings.

The Belafonte Folk Singers At Home And Abroad

Members of the Belafonte Folk Singers always act as though the call to solo comes from an unexpected inner urge that can be satisfied only by bursting into full-throated song. This effect is better calculated and results from the planning of Robert DeCormier, who conducts the group and works hard to make every performance appear spontaneous and unrehearsed. It all sounds like a plot to fool the public, but DeCormier's goal is much more difficult to attain. He hopes each member will find it impossible not to become emotionally involved in the role ascribed and audiences are well aware when the transition from acting is successfully accomplished. The fact that it occurs frequently can also be attributed to experience with the unpredictable Harry, whose absence gives the soloists an open track on this occasion. Roy Thompson is featured on "Black-Eyed Blues, Rain, Rain, and My White Horse." Neil Wright takes over on "Rain, It Rain, Bob Harry on "Poor Boy," and Jelli Gonsalves on "Tampa."

Too much stereo movement is never allowed to rock the boat in an excellent Webster Hall recording by Bob Simpson and Ray Hall.

**MONO**

Bob Wilber: Blowin' The Blues Away

Classic Jazz CJ9

This LP is the outgrowth of a Music Minus One session organized to prepare a survey of the blues for younger audiences and provide a reference course for any older players who want to brush up on the latest trends at home. The nine easy solos are offered in alternate versions, with either Bob Wilber or Clark Terry laying out. Under the heading "Evolution of the Blues (MM10096)," and" touch briefly on each current subject at the blues, soul jazz, Latin rhythms, and the gospel church. Both experts on their respective horns are heard summarizing at top form and their own soloist at the end of the title "Clark Terry Sings." Discussing: A vocal talent hitherto unrevealed on records, the former Ellington trumpet star bursts forth in a robust entreaty of his own called "Tango Blues." Terry works at present for Quincy Jones, a leader who wants his new band to acquire a group personality the public can readily identify. Note that Terry's secret is out. Jones had better take advantage of his new shouting before alert record companies start talking contract.

Wilber, who speaks of the rest of the quintet in laudatory terms on the liner notes, takes credit for planning the date and arranging the missing parts in scores furnished with each "MM" set, but any references to his own playing are omitted. Such modesty is wholly unnecessary, especially in view of his ability to scan all periods of jazz on other clarinet.

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or tenor sax, and a style unladen with eccentricities makes him an ideal mentor. Besides, who else would think of going to Lehr for a blues walk? Pianist Dick Wellstood contributes the Maryland Farmer, and Blue Note Blues. Bassist George DuVivier is always reliable, and Panama Francis sticks to the basic ingredients in displaying a beat that sells millions of records. Thanks to clarity of Dave Hancocck's recording, novices will have no trouble following any instrument.

The Bud Freeman All-Stars featuring Shorty Baker Prestige/Swingville 1952

When Bud Freeman played with Tommy Dorsey, the sound of his tenor sax characterized the band much as the leader's trombone, and things never seemed the same after he left. His choice of harmonies and distinctive way of phrasing, which set the style for the entire sax section, always pleased dancers. Jazz listeners were just as satisfied, despite a preference for the longer and meatier solos he recorded with small groups of displaced Chicagoans. There are no Chicago boys in this quintet, and Freeman takes the label at face value to play like the old Dorsey sax section once did at the Hotel Commodore. As an extra incentive, pianist Claude Hopkins leads a rhythm section that makes the whole affair even more agreeable to dancers.

Only a brief audition of the lyric wiles of Freeman and partner Howard "Shorty" Baker are needed to stretch the Dorsey analog to a point further. The trombonist, as jazzman rather than lead, and without consider their running manner of surrounding the melody a more fitting tribute than all the posthumous big-band recordings one can never bear too heavily on Spain's, Love Me or Leave Me, and Red Net For Me. Baker recalls his days as a leading light in Ellington's trumpet section on Shorty's Blues, but heads in the direction of By Oliver in whose Vector's Dance. Another original titled Movin On, an excursion into current soul jazz, turns out to be a detour for Everybody Loves My Baby. Now that LP's based on the Sarah Jane formulas seems out of the market, perhaps the time is right for an equally swinging approach from a different corner.

The Bix Beiderbecke Legend RCA Victor LPM2323

George Arskiian, who prepared a three-volume set of reissues on Colickest to tell the complete story of the Bix Beiderbecke story, continues to investigate the cornetist's career, dipping into his rich legacy at this time, and his latest report adds appreciably to the fact that side of the legend. One important piece of evidence is a previously unreleased Jean Goldkette before 1926, even though this paraded at the Detroit Athletic Club on November 24, 1924. Uncovered in 1966, it proves without doubt that Beiderbecke played with Goldkette before this particular solo lost the job for two years. Charles Edward Smith relates just how it happened in the accompanying four-page brochure and several revealing bits of information from Paul Mertz and Fee Wee Ransell are also printed for the first time. Taken together, these features add up to an essential album, and the excerpts included from Paul Whiteman days and recording groups are merely that much extra frosting on the cake. Additional collector's treats are alternate masters of chorus with Whiteman on Changes, and Lonely Melody.

Josh White: Spirituals & Blues ELECTRO EKL193

The sudden burst of interest in young and old blues singers on the part of record companies is just the spur Josh White needed, and he digs into his material with renewed vigor. Even while enjoying an international reputation that waxes and wanes like other musical trends, he must have felt lonely from want of competition. That he thrives on it as well as any other blues singer is evident by his strong, prideful treatment of such stories as Black Snake, Silicon Blues, and Southern Exposure. Langston Hughes is the writer of the vivid lyrics to Red Sun. Five spirituals are delivered with gentleness and hope. The singer sets his own pace on guitar and never forces the beat into a false fervor, Bill Lee, bass, and drummer Walter Perkins are the accompanists, and Dave Jones engineered the date.

Songs Of Memphis Slim And "Wee Willie" Dixon Folkways FA2385

Previous albums by this seasoned pair of blues singers have presented Slim or the other as featured vocalist, leaving the old man out of the billing but not completely out of the picture. This time they share the stage, and share alike, taking turns at recalling favorite tunes, inserting alternate verses and joining in together on the choruses. A musical tour of some of the cities and places best known to itinerant blues singers is included at no extra charge. In fact, three separate ways of getting to Kansas City are outlined in graphic phrases attributed to Jim Jackson, Bill Big Brounks, and Willie LoveHotel. A rolling piano solo by Memphis Slim, a hootie shout by Slim, and the old man out have never been in Nashvile for sure. Anyone still unaccustomed with these two amiable characters will find this an ideal introduction. Once the preliminaries are out of the way, the acquisition of the LP's under their individual names is inevitable.

The Curtis Counce Group: Carl's Blues Contemporary M3574

Organized in Los Angeles in 1966, the Curtis Counce Group was about three years ahead of its time and disbanded shortly after the death of Carl Perkins, the pianist whom this album is dedicated. The reputation of the group's surviving members, and the record shows clearly that of Frank Butler, who just now is gaining the recognition he deserves. A drum solo lasting five minutes, but probably the only jazz alto sax track ever recorded. Why Joe Jones calls him "The greatest drummer in the world." Counce recently toured Australia as bassist with Benny Carter, while Harold Land is leading his own group. Land's tenor sax is headed to good advantage on I Can't Get Started, and trumpeter Jack Sheldon contributes Pink Lady. This 1967 session was the last for both Counce and his group, but perhaps the time is right for an equally swinging approach from a different corner.

King Oliver Johnny Dodds And Kid Ory Epic LA16003

A prospering record club is evidently the reason for the repackaging of these essential collectibles. Epic released them on LP, before, but a new audience and market has developed in the last few seasons. The dozen King Oliver sides date from 1925, when the New Orleans cornetist was trading chase choruses with Louis Armstrong at Chicago's Lincoln Gardens. The sessions held the same year for Gennett now available on River, with Jimmy Crean and Eddie Lang, and the greatest trumpet player ever recorded for Victor is thoroughly documented on LP.

Johnny Dodds, who headed his own group on clarinet at the neighboring Riverside's after leaving Oliver, recorded under the New Orleans Wandroers name with Kid Ory in 1926. Relieving the cornetist to be Armstrong, collectors placed a high premium on the records. Later proof that the fine blues choruses are the work of George Mitchell does nothing to impair the value of these performances. The Chicago Footwarmers and Dixieland Thumpers, with Natty Domignge on trumpet, does add another dimension to this already well-represented. Charles Edward Smith provides ample notes in each case, and the remaining oral is mentioned elsewhere. These recordings are carefully done. Let's hope all the club members buy copies, everybody. All, then brings the Clarence Williams Blue Five LP, featuring Armstrong and Sidney Bechet, which his affiliate Phillips has released in England.
that you may, indeed, be in for a thrill, as the ad says, when you try your first phones. Or you may merely be mildly amused. Some of you may even be distressed, as I have been, by unreal and "out of focus" effects, as described in my earlier discussion.

What I would like to add here is merely that the effects upon the ears vary greatly from one recording to the next, according to the microphoning used. None of the microphone systems were intended for reproduction with one channel exclusively going to each ear; all were meant to be heard via the cross-relating spread of stereo speakers, each ear hearing both speakers, as disparate sound sources in space. But if you treat those mikes as surrogate ears, which is what happens in earphone listening, you may be accident or chance receive a very exciting signal. Or a very garbled and nonsensical one. It all depends.

Cross-Mike and M-S

I suspect that the European stereo recordings that are made via the M-S system, two mikes in one case plus a matrixing circuit, or by the simple cross-mike arrangement, two mikes at an angle and close together, will provide some very realistic binaural listening—perhaps better than the actual stereo via loudspeakers. (I am not very enthusiastic about this rather mild stereo, where the two-channel effect through speakers is so gushed as to be an almost inaudible step away from straight mono sound.) Two mikes in this European arrangement make two tolerably good and well-paced ears, and that's all you need. It sounds terrific!

Indeed, recordings of this sort could well account for much of the genuine pleasure reported by earphone "stereo" listeners, and for the lack of unpleasantly noticeable falseness or fatigue effects. These listeners, to be sure, aren't hearing stereo; but they are hearing something even better, real binaural, or a very good semblance of it.

On the other hand, a recording made via twenty or thirty mikes, in and out of isolation booths, blended through two-channel reverb, artificial or otherwise, is just not binaural in any conceivable sense! Like trying to look at a scene through one of those new Japanese Kaleidoscopes. Multiple images, overlapping, beautiful but—at least in this sort of fancy stereo sound—incomprehensible.

To tell the truth, the analogy is dangerous, because in the kaleidoscope you do not usually try to discern reality of any sort (though you can, if you work hard at it); whereas in "stereo" listening via phones you are necessarily trying hard to create a mental image of a musical performance, as we always do in any listening to reproduced music—and you are fighting against a raft of dizzy, incompatible, contrary-minded sounds, near and far, throwing the two ears out of gear and every which way. Exciting, but quickly exhausting, conducive to severe ear strain if your listening imagination is at all subtle.

Come to think of it, the way to fix up your 'phones (you manufacturers and you home tinkerers) is to install a variable Beyer circuit, adjustable to compensate as well as possible for these large differences in stereo recording. Leave it to Mr. B. to cite the variables; maybe an on-off switch would be plenty. Variable or no, though, I don't honestly think you should rust your 'phones in peace on your head until you have figured out this little problem some way or another. Worth your attention.

Let me add a quick and necessary postscript: In terms of loudspeaker listening I am all in favor of the highly tricked-up stereo now being used in some classical recordings and feel that, though sometimes it goes too far, in general the tricks have added a great deal to the purely musical effectiveness of the stereo medium.

The development is reasonable and honest, for we must not forget that all recording is based on illusion, via the unique laws that apply to the recorded medium. We do not try for a literal concert sound, nor for an exactly transcribed "live" performance, but rather for the soul of that performance, the meaning and sense of it, in terms of recording.

The "laws" of stereo are many and varied and more is found out about them every day. But nobody has yet clued me in that for true binaural hearing we need more than two ears, and those more than a head's distance apart.
CONCERT HALL procedure being almost as rigid as Latin declensions, the departure from customary practice invariably arouses comment. Such was the case when the Canadian violinist, Hyman Bress, gave his second New York recital early this year. There was nothing unorthodox about the program, which included works by Mozart, Brahms, Prokofiev, and Schoenberg. The deviation occurred during the performance of Schoenberg's Fantasia, Op. 47, when slices of the music's twelve-pages were projected on the Town Hall movie screen. The picture was large enough to be seen clearly from most parts of the hall so that score readers in the audience could follow the intricate notation. This visual device won Bress two additional paragraphs in the New York Times review, a headline story in the New York Herald Tribune, and an article (with photographs) in Time.

Although Bress believes the score screen is primarily aimed at modern repertory, it is interesting to speculate on how this classroom technique would affect concert life were it be used on a larger scale. First, it would bring about the emergence of a new class of worker, the musical projectionist—a sort of cinematic page turner. Replacing the warning bell in the projection booth would be copies of the scores to be performed down on the stage. The duties of the musical projectionist will be much more demanding than those of his movie counterpart, who only has to change (reels) every eleven (or twenty-two) minutes. Shortly after the score projectionist becomes a regular part of the musical scene, performers and concert managers will come to realize that the slide system, though perfectly adequate for the utilitarian standpoint, is cumbersome and inflexible. While few or no "turns" occur in a Scarlatti sonata, or in movements of a Bach solo violin partita, the opening of Ravel's Daphnis and Chloe (Suite No. 2), with its two-bar pages flashing by every five seconds like telegraph posts on a railroad journey, would set a brutal pace for the projectionist—and Lord help him if he gets his slides mixed up!

One remedy for this state of affairs would be the moving scroll method, a "horizontal teleprompter" used in the Japanese film, Gate of Hell. Here, the score would travel across our field of vision in a tempo consistent with that of the music as performed. Operated by a skillful projectionist, the effect could be quite musical.

The score screen will provide rich opportunities for the musician with pedagogical tendencies. The pianist who is ever on the alert for inner voices now will be able to spotlight his "discoveries" by means of three techniques: arrow, zoom, or color. The arrow, employed for years by a publisher of study scores, is a crude indicator. Zooming is a familiar device in our camera-conscious age, but one which, with repeated use, brings on vertigo or mal de mer. That leaves color. Of the three, this is easily the most artistic method: a colored counter-melody would be detected at once, without the necessity of injecting any non-musical signpost.

Beyond merely pointing up melodic lines, color could also be used to enhance moods, reflect degrees of intensity, and separate strands of a complicated orchestral work. In Rhapsody in Blue, the entire page might be drenched in the title color, projected on the screen in varying shades. The opening clarinet cadenza could begin in a pale baby blue, and rise up in a deep ultramarine at the climax of the glissando. And think of what color could do for Schoenberg's Five Pieces for Orchestra, Op. 16, with its "pointilliste" instrumental texture! Why, if colored scores took hold, they might begin to music what color-coded wires are to the electrician, except that color associations of course, would be left strictly in the hands of the performer.

There are other ways of suggesting mood without altering the notation. Take Chopin's "Raindrop" Prelude, for example: the repeated A Flats could be made to fall, glistening, on the page as the pianist plays them. (Remember the old movie sing-alongs: "Follow the Bouncing Ball"?)

Turning from notation to general aesthetics, the darkened stage is a pleasant concomitant of the score screen. Let's face it, there are some performers whose physical attributes clash with their musical talents. Now the public would be able to hear Glenn Gould (the first to come to mind) without having to watch his now celebrated twists and fidgets.

The question arises as to what to do about between-movement pauses. Should the last page remain in view, or should the next be prepared to prepare for the music to come? I hope the concert halls will not adopt the Italian movie theatre practice of showing commercials between parts of a film.

We might then have slides reading—This score may be purchased at the "X" Music Shop in either full or miniature size. Visit the "X" Music Shop tomorrow. Or, "X" records exclusively for your records. And other timely reminders.

The larger concert halls had best prepare to buy the giant screens. The normal screen, while perfectly adequate for most pre-20th century music, falls down com-
plely when confronted with, say, Schoenberg's *Gurre-Lieder*, which is scored for 4 piccolos, 4 flutes, 3 oboes, 2 English horns, 7 clarinets, 2 bassoons, 10 horns, 7 trumpets, 7 trombones, 5 tubas 6 kettledrums, bass drum, cymbals, triangle, glockenspiel, snare drum, tenor drum, xylophone, rattle, several large iron chains, gong, 4 harps, celesta, and full string complement. There are also 6 soloists, 3 four-part men's choruses, and an eight-part mixed chorus. This is definitely in the Vista-Vision class.

As Hyman Fries must have realized on the morning after the recital, the score screen can be a risky business for the performer. The critics were quick to point out that the young instrumentalist was not always in full command of the notes, and that he failed to follow the spirit of the dynamic indications. We are entitled to assume that few in the audience, including the critics, were well enough acquainted with the work to detect any musical lapses, without having recourse to the score screen. But with standard repertory, total (or near-total) recall is a necessary part of the critic's equipment. Nevertheless, the score screen could prove enlightening to the layman and, by way of being a reminder, to the critic as well. The *Love Duets* from Act I of *Bohème* is a case in point. The final note dies out, pianissimo, as Mimi and Rodolfo go out into the Parisian night. In most performances, however, both tenor and soprano are reluctant to leave the stage quietly, preferring instead to swell out to a grand fortissimo. With the score screen plainly in view, and indicating *pp*, would the singers now dare to float the composer's intentions? (Don't answer that question.)

Transposing arias is a common practice in the opera house. The star with a brilliant upper register may raise the pitch for his key aria in order to exploit this facet of his voice; the aging singer may, on the other hand, wish to lower certain arias when he finds he cannot produce the top notes. All this is not lost on the few members of the audience who possess absolute pitch. The others will not suspect anything by merely checking the score screen. Why not then install a headphone on the back of each seat to transmit the "A" to various "relative pitchers"?

The performer need not regard the score screen as a mute monitor. It could easily save his concert some evening when, as sometimes happens to the best of musicians, memory lapse strikes.

---

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Is smaller than our other models, Costs less than our other models, Operates with a 12 watt amplifier, And - has the KLH sound.

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If you want trouble-free, dependable performance and an installation that lasts for years, look into "Ceramikes" first.

---

**Specifications for Complete "Ceramike" Line**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Frequency response</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-10A</td>
<td>Tape recorders, etc.</td>
<td>50 to 11,000 cps</td>
<td>63.5 decibels ±2db</td>
</tr>
<tr>
<td>CM-11A</td>
<td>Фree, Фree, Фree</td>
<td>50 to 11,000 cps</td>
<td>36 decibels ±2db</td>
</tr>
<tr>
<td>CM-118</td>
<td>&quot;Flex-Mike&quot;, For audio-visual, tape, etc.</td>
<td>50 to 11,000 cps</td>
<td>36 decibels ±2db</td>
</tr>
<tr>
<td>CM-119</td>
<td>&quot;Fidelity&quot;, For audio-visual tape, etc.</td>
<td>50 to 11,000 cps</td>
<td>36 decibels ±2db</td>
</tr>
<tr>
<td>CM-12A</td>
<td>For stereo tape, also greater sensitivity</td>
<td>80 to 9,000 cps</td>
<td>36 decibels ±2db</td>
</tr>
<tr>
<td>CM-12B</td>
<td>For stereo tape, also greater sensitivity</td>
<td>80 to 9,000 cps</td>
<td>36 decibels ±2db</td>
</tr>
</tbody>
</table>

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**Sonotone**

Leading Makers of Cartridges • Speakers • Tape Heads • Mikes • Electronic Tubes • Batteries
NEW PRODUCTS

- **Automatic Turntable.** Combining the advantages of a high quality turntable with the ease and convenience of the automatic record playing mechanism, the new Miracord Studio-H introduced in this country by Benjamin Electronic Sound Corp., is claimed to be the only automatic turntable with hysteresis motor. The tone arm features an adjustable counterbalance, for adjustment of stylus force. The turntable is 12 inches in diameter, and is constructed in one piece of a non-ferrous material. It is dynamically balanced and weighs seven pounds. Of especial value to those desiring the convenience of automatic mechanisms is the pushbutton operation. One need merely press the button indicating the appropriate record size. The Studio-H will accommodate 7-, 10- and 12-in. records. In addition, the Studio-H is extremely handsome in appearance; satin chrome finish on all machine parts, and baked enamel finish on the table deck and other services. The plug-in head accepts all cartridges now in use. Also available is the lower priced Miracord Studio, which features a heavy-duty, shaded four-pole induction motor in place of the hysteresis motor. The Studio-H is priced at $99.50; the Studio is $74.95. Benjamin Electronic Sound Corp., Corona, N. Y.

- **Automatic Repeat Tape Recorders.** Featuring a "Magic Memory" automatic repeat, the new Roberts Models 440 and 144 DPA repeat all or any part of the tape by simply pushing the "repeat" knob back to the desired position. Complete 1800 feet tape rewind takes just sixty seconds; thus with the "Magic Memory" these Roberts recorders can play for a full nine hour period with just six 60-second inter- vals during that time. The Model 440 comes complete with power amplifiers and forward and facing stereo speaker system, and is priced at $109.50. The 144 DPA is identical to the 440 except that it comes without the built-in power amplifiers and speakers. It is priced at $649.50. Roberts Electronics, Inc., 493 N. Highland Avenue, Los Angeles, California.

- **Dual Trace Oscilloscope Kit.** Keynoting Radio Shack's entrance into the kit field (on a large scale anyhow) is the new Dual Trace Oscilloscope kit which sells for less than $80.00 is the first available kit form as well as the first available at a cost of under several hundred dollars. Because of its ability to observe two signals simultaneously, it is possible with this oscilloscope to observe, for example, the leader can be spliced into a roll of tape at intervals to check the performance of a recorder, or it can be used as a leader. As the Strobe tape passes through the tape recorder, it is exposed to the flickering light. If the lines appear to stand still, the drive system is running at the correct speed. If the lines seem to advance, the drive system is running too fast, and if they seem to lag, the drive system is running too slow. By making an endless loop of the Strobe tape, the speed of the capstan can be tested. The Strobe tape kit is packaged in a clear polyethylene package complete with instructions. It lists for $2.90. Robins Industries Corp., Flushing, N. Y.

- **60-Watt Stereo Amplifier.** Featuring fifteen front panel controls and switches and twelve inputs, the new Sherwood Model S-5500 amplifier provides 25 watts (music power) per channel. Included in the front panel controls are 12 db/octave rumble and scratch filters (effective at all inputs), friction locked bass and treble controls (each channel separately or both channels simultaneously), function switch, selector, stereo balance and individual gain, loudness, tape monitor switch, loudness in-out switch, phase-reverse switch and stereo-reverse switch. To facilitate home or professional type stereo tape recording, two cathode follower outputs and front panel tape monitor switches have been included to give complete recording flexibility. Hum and noise is 50 db below 24 watts (radio input) and 60 db below 24 watts (phone input). Frequency response is plus or minus one db, 20-40,000 cps; 1. M. distortion is 1.5 per cent, and harmonic distortion is 0.5 per cent or better, both continuous. Damping factor of five assures optimum performance with today's low-efficiency speakers. Dimensions are 4 x 14 x 14 inches; price is $159.50 (manual case). Sherwood Electronics Laboratories, Inc., 1500 N. California Ave., Chicago 18, Ill.

- **Strobe Tape Recorder.** Manufactured in western Germany, the new Körring Model MT-1385 is a four-track stereo record-playback machine with features unusual in its category. A three-head machine, the Körring permits synchronized dubbing. You can actually hear the first recording while the second recording is being added. In addition the recording is modified...
Here's the wonderful new Bozak companion speaker that goes with the party!

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On floor, table, or hung on a wall, the new Bozak BARD is the life of the party! Singly or in pairs for stereo, the BARD provides ample volume without distortion, overcoming high-level "party noise" without stridency.

patio
Good music multiplies the pleasures of outdoor sociability, and the handy portable BARD makes it easy to provide. The sturdy stand is always steady on flagstones or uneven surfaces.

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No need to leave the music behind when you go for a dip! And if you forget about your BARD and leave it out over night, don't worry—it's completely weatherproof!

The new Bozak BARD is the ideal supplementary loudspeaker—easily portable, strikingly decorative, and typically Bozak in the fine musical quality of its sound! Its unique appearance reflects its unique design, fully utilizing the advantages of the hemisphere— one of the most perfect infinite-baffle enclosures. Many other exciting features—universal stand-up or hang-up base, plug-in connection, completely weatherproof construction, decorator styling!

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The First Book of its Kind—No Other Like It!

SOUND in the THEATRE
by Harold Burris-Meyer and Vincent Mallory

N
othing like SOUND in the THEATRE has ever been published. It is the first
book to set forth in authoritative detail what you can do with sound by electronic control,
and how to do it whenever the source (singer, musician, speaker, etc.) and the audience
are present together. The book develops the re-
quirements for electronic sound control from the
necessities of the performance, the char-
acteristics of the audience (hearing and psycho-
audition), and the way sound is modified by
evironment, hall, and scenery. Sound
sources are considered for their susceptibility
of control and need for it, and the many tech-
niques for applying electronic sound control
are described and illustrated in thirty-two spe-
cific problems. From these problems are de-
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• 40-Watt Stereo Amplifier. Engineered for the control and reproduction of all stereo monophonic sources, the Lafayette LA-240 provides 20 watts in each channel and is equipped with terminal jacks for eight- or sixteen-ohm speakers. Full range of controls includes independent concentric bass and treble controls, continuously variable separation control which allows adjustment from full stereo to full monophonic, individual volume control for each channel, loudness switch, rumble filter, mode switching, selector switch plus individual hum balance controls for each channel. Inputs consist of five stereo pairs (aux., tuner, ceramic phono, mag-phono tape head). Outputs include dual-tape-out and dual eight- and sixteen-ohm speaker terminals. Power out-

rived systems and equipment specifications. Complete procedures are given for: Planning,
assembling, and testing sound control installa-
tions—Articulating sound control with other
lements of production—Rehearsals and per-
Formances—Operation and maintenance—
sound control equipment.

THE AUTHORS
During the past thirty years, the authors have developed
the techniques of sound control in opera, open-air amphi-
theatres, theatres on Broadway, theatres on-the-road and
off-Broadway, in concert halls and night clubs, in Holly-
wood and in the laboratory. Some of their techniques are
used in broadcast and recording as well as in perform-
ances where an audience is present. From their laboratory
have come notably successful applications of sound con-
trol to psychological warfare and psychological screening,
or rather than the input signal. Because of the
head construction and other circuit features, a recording can take place on
one track, while the other is playing back independently. Tape speeds are 3% and
7½ ips and wow and flutter are less than plus or minus 0.2 cent at 7½ ips. Other features of the machine are recording-
level indicator, automatic shut-off, and a low-noise transistor input stage. The Körting MT-158S comes in an attrac-
tive carrying case and weighs twenty-

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PAT

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put of the LA-240 is 20 watts per channel at less than one per cent total harmonic distortion at 1000 cps, less than 0.25 per cent at 14 watts, and less than 0.12 per cent at one watt. Intermodulation distortion is 0.78 per cent at one watt and 0.34 per cent at 10 watts. Frequency re-

sponse at full output is 50-70,000 cps, plus or minus one db. Sensitivity for full output at 1000 cps is 0.75 volts for high level inputs and 5.5 mv for low level inputs. Hum and noise is 75 db below full output for high-level inputs and 50 db below for low-level inputs. Supplied with enclosure and legs, the LA-240 is priced at only $79.95. Supplied with a gold finished cover and gold and gold front panel with gold-metal knobs. Layayette Radio, 165-08 Liberty Ave., Jamaica 32, N. Y. F-8

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Circle 67B

NEW LITERATURE

● Hi-Fi Component Brochure. A revised edition of its high fidelity component brochure was announced by Shure Brothers, Inc. Several new components are featured in the publication, along with illustrations and specifications of standard models in the Shure line of phonograph cartridges, tone arms, and other high fidelity equipment. Among the new components listed is the N21D tubular stylus which is available in combination with the Shure M3H and M78 stereo Dynel cartridges. Also new in the catalog is the stereo conversion preamplifier Model M-65, designed to provide equalization with amplification for conversion of ceramic inputs to magnetic inputs. The brochure is available through high fidelity dealers or by mail request. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. F-9

● Sonotone Audio and Electronic Products. The new eight-page Sonotone catalog contains photos of all products with detailed specifications for each. Included are Sonotone's latest ceramic phonograph cartridges, crystal cartridges, tone arms, magnetic (velocity) equalizers, mono and stereo tape heads, and ceramic microphones. It also displays the Sonotone rechargeable flashlight battery cartridges, loudspeakers, and electronic tubes. Copies are available free from Electronic Applications Division, Sonotone Corporation, Elmsford, New York. F-10

● Electronic Test Instruments. The 1961 Hewlett-Packard Catalog of Electronic Test Instruments is available. The 220-page catalog contains complete listings, descriptions, and specifications of the more than four hundred test instruments offered by Hewlett-Packard Company. It also includes a sixteen-page descriptive listing of the special systems and instrumentation produced by the company's Dyemec Division. Instruments are grouped by type or function in the catalog. Each group is preceded by application data which summarize the equipment offered, and discuss latest measuring techniques. The catalog is only available upon written request to company stationery. Write to Harry J. Lewenstein, Hewlett-Packard Company, 1601 Page Mill Road, Palo Alto, California.

Circle 67A
Handel-Beecham: Love in Bath. Royal Philharmonic, Beecham. (Angel S-35504 stereo)

I remember a Beecham recording of a part of this ballet score under its stage title "The Green Engagement," but a few numbers have appeared in other Beecham suites and a few items are included in their own, Beecham or no. But it is the late Sir Thomas who is most likely the composer here— not Handel.

Why fuss over authenticity in such a case? There isn't a trace of it, not even to Handel's own scores, which are lavishly rearranged and in some cases re-composed, or fused together—as in the marriage of the familiar "Largo" with a rhythmical figure quite definitely not from the "Largo" nor probably from the same opera if from any Handel. Most of the music, even so, breezes along happily and with musical shaping...shapeliness and with Beecham-built joints hardly showing at all, the harmonies generally untampered-with except in the sequence of pieces, the orchestrations sublimey Beecham.

Beecham's ballet (never yet performed on stage) was to be about a young lady who goes to Bath and meets a young gallant, marries him in some far-off Place. I've been reading all this in the Austen's "Northanger Abbey" and I suspect that Sir Thomas had been reading it too. Striking similarity, and I had thought myself that the Austen pictures of Bath society in the 18th century would make a marvelous period play, or a color film like that memorable "Importance of Being Earnest" of a few years ago. Anyhow, give Sir Thomas credit for good entertainment, plenty of Handelian tunefulness and only a reasonable amount of audio distortion.

BOOK REVIEW


Based on a series of special summer programs on noise reduction at the Massachusetts Institute of Technology, this new book edited by Dr. Leo L. Beranek provides a broad and detailed base for engineers and other technically trained personnel in the fields of noise measurement and noise control. Dr. Beranek states in his preface, "No effort has been made by the editors to produce a handbook or an inclusive compendium. Rather, this text seeks to lead the reader by gradual steps from the beginning of the subject into the more advanced aspects. Each man with a noise problem should find assistance in this book."

Chapter 1 of the book, "History of Early References" provides a review of the development of the techniques of noise reduction as they became codified and placed in a scientific field. This chapter also contains a bibliography including 107 items. The book is then divided into four parts: the elementary behavior of sound, the decibel notation and its use in expressing sound levels, the methods and instrumentation used for sound and vibration measurement. In this section the chapters on selection of instrumentation written by A. C. Pinkham and on the performance of sound and vibration instrumentation by G. W. Kamperman are particularly interesting.

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noteworthy. The latter chapter contains a number of excellent tables and charts outlining the performance of a considerable number of sound and vibration pickup devices and indicating instruments, and the cases required to connect the pickup device to the amplifying or indicating instrument. Part 2, "Fundamentals of Noise Control," contains three chapters on the propagation of noise both outdoors and in enclosures of various kind, a chapter on the effects of noise, and a chapter on "Criteria for Noise and Vibration in Buildings and Vehicles." These chapters provide a basic review of the criteria by which tolerable noise levels are set, thus providing a basis for noise reduction design when combined with the measured or predicted noise levels, the determination of which has been described in the earlier chapters. Part 4, "Practical Noise Control," contains 5 chapters detailing practical applications of the material found in the first three sections in the areas of ventilation, noise control, machine and shop quieting, office and residential noise control, the control of jet noise and the control of noise in transportation. Three appendices contain the conventional tables of decibels and pressure and power ratios, a brief but excellent discussion of systems of units used in handling the mechanical aspects of acoustical problems, and a table of conversion factors. In addition to the bibliography of Chapter 1, each individual chapter includes a comprehensive list of references and suggestions for further reading. The book is well illustrated and brings together in one place much of the information assembled and published by Dr. Bernad and his colleagues in individual scientific papers and technical reports.

The only major omissions appear to be in the areas of the design of doors and in the discussion of the influence of the fundamental acoustical resonance of a vibrating panel on its sound transmission in the low frequency region. These omissions notwithstanding, this book is a most valuable contribution to the literature in a highly specialized branch of acoustics. It should prove of considerable value to studio engineers striving to provide a minimum background noise level in their recording studios as well as to anyone involved with the design of noise control features for residential construction, including both apartment houses and individual homes.

Lewis S. Goodfriend

**REFLECTION COUPLER**

(from page 35)

loading of the mid-high loudspeakers. These reflectors are thermo-formed from 3/8-inch sheets of Plexiglass and attached to the back of the cabinet with wood screws. It is only necessary that the cabinet be located not less than five inches from the back wall for effective operation.

All wood parts of the cabinet are made of ¾-inch plywood, and all joints are made with glue in addition to wood screws, except for the bottom panel, which is the diaphragm equivalent access to the woofers. Both woofers, and mid-high units are front mounted and gasketed to prevent air leakage. The entire space behind the two woofers and the portion of the center slot below the "baffle" boards is filled with predetermined amounts of Ultralite glass wool cut into rectangular "blocks." The amount and configuration of these blocks has considerable effect upon overall performance, and is the result of a large amount of experimentation. Once determined, however, the performance is readily repeatable from one unit to another.

**Performance**

In the present era of low-efficiency loudspeakers, it is pleasant to note that the Scott Radio Labs Reflection Coupler will give good performance with ten- and fifteen-watt amplifiers without the undesirable effects of amplifier overload.

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- **PRECISE FIGURE 8 PATTERN**
- **FOR STEREO AND MONO USE**
- **STEREO SPACER**

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**SPECIFICATIONS**

- **Response:** Plus or minus 1 db to 60 KC.
- **Power Curve:** 0.01% THD at 20 watts to 20 KC.
- **Square Wave Response:** No ringing or distortion from 20 cps to 20 KC.
- **Permissible Feedback:** 30 db.

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**DYNACO ING.**


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**DYNACO B&B**

FOR STEREO AND MONO USE

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higher than normal for typical listening room use (except for the dyed-in-the-wool hi-fi fans, who are more likely to run levels above 100 db)—with a power input of 2 watts into the loudspeaker system on nonmagnetic material. This level was measured in a typical living room with plasterboard walls and with the cabinet located four inches from the wall and approximately in the center of the longer wall. The room dimensions were 16 by 20 feet, the floor covered by a wool carpet lain over hair padding, and with a sofa and two chairs of typical upholstery. Medium-weight draperies-covered windows in one long wall and one short wall.

Frequency-response measurements indicate the range of the unit to be essentially flat from 35 to 16,500 cps. This figure is given to satisfy the curious, for under no conditions can anechoic chamber measurements be considered indicative of performance in a room. They are, however, indicative of what the instrument puts out as acoustic energy into the air under controlled conditions, and as such may be compared with similar figures given for other loudspeakers measured under comparable conditions. The principal advantage of the "Reflection Coupler" Stereo Speaker System is that it eliminates the need for two loudspeaker cabinets and instead creates a truer image of the original performance than is usual with conventional speaker systems. Added to this is the unobtrusive appearance of the unit, which makes it possible for the audiophiles and music lovers to obtain reproduction with minimum repercussion.

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AUDIOCLINIC (from page 4)

took your feedback. If I make the cathode positive by means of this signal, am I really drawing more current, or am I caus- ing the stage to draw less current? The answer is that the stage will draw less current. Why? Well, look! The grid is grounded as we have said. Let's say that
the cathode is one volt above ground. This meets the condition that the grid must be negative with respect to its cathode for proper tube operation under Class A conditions. If I remove the grid from ground and apply a signal which will make it positive, or should I say more positive, the potential between grid and cathode is reduced and more current will naturally flow, and we will have the conditions you have already described in your question. Good, then let’s return the grid to ground and apply the signal only between the cathode and ground, just as is done with the feedback signal from the plate of the second stage. (Naturally, there can be no signal from that plate now, so we will apply it artificially, maybe even from a battery. You can try all of this very easily, too, if you want to take the trouble to broadband a stage, and you can watch all of this for yourself.)

We’ll make the cathode more positive. The grid is grounded, so this is the same as saying that the grid has been made more positive. Remember that the grid is now grounded so that if the cathode moves more positive, the grid must, of necessity, be more negative—not with respect to ground, but with respect to its cathode and that is the only thing which counts here.

For purposes of clarity I set the grid at ground potential, but it could have been at any potential with respect to ground. I would imagine that in most instances it would be positive with respect to ground. It is true that the grid makes the cathode go positive at such times but the signal from the second stage which appears at the cathode also makes it, the cathode, go positive more than would have been true if the grid alone were acting here. This extra amount by which the cathode has gone positive with respect to ground—independent of grid signal—will cause the grid to go more negative, and this tends to reduce cathode and plate current, making them tend to go more negative. This, after a long way around, is negative feedback for it is making the stage behave in a manner opposite to that in which it would behave in the absence of the feedback.
Industry Notes...

- Tandberg Announces Enlarged Facilities. Tandberg of America, Inc. recently announced plans for tripling facilities in Oslo to meet increased demands from American consumers for Tandberg stereo and monophonic recorders. New facilities include a nine-story building with increased research and manufacturing accommodations, as well as additional employee recreational facilities, including a swimming pool.

- Panon Acquires Masco Intercom Company. According to Salo Nightingall, president of Panon Electronic Industries, the acquisition of Masco by Panon will be of substantial benefit to both corporations. We anticipate achieving substantial economies in general overhead and operational costs. It is our intention to maintain separate sales organizations for both companies.” Manufacturing operations and general management of both Panon and Masco will be located at Panon plant in Newark, New Jersey.

- Stan Neufeld, Distributor Sales Manager for University Loudspeakers, Charles Bay, general sales and merchandising manager of University Loudspeakers, announced the appointment of Stan Neufeld as distributor sales manager. Mr. Neufeld will be responsible for sales covering all product lines in University's line of high fidelity and public address components.

- Shure Bros. Appoints. The appointment of Ronald Boston as a manufacturer salesman was announced by Shure Bros. F. V. Machin, Shure vice-president, stated that Boston will handle special sales assignments under the direction of C. L. McCabe, manufacturer sales manager in the Cleveland office.

- American Concertone Appoints Western Division Sales Manager. Barton O. Williams has been appointed Western Division sales manager for American Concertone, Inc., a division of Astro-Science Corporation in Los Angeles, California.

- Allen W. Greene Elected Daystrom Vice-President. Allen W. Greene, president of Daystrom Company, subsidiary of Daystrom, has been elected a corporate vice-president. Mr. Greene will continue as president of Daystrom Company, a post he has held since 1959.

- Prediction Appoints Fleischman. Sidney Fleischman has been appointed sales manager of Precision Apparatus Company, a subsidiary of Electro-Mechanics Inc. He is a veteran of over twenty-five years in the electronics field. Mr. Fleischman will be in charge of marketing and sales for the precision test instrument line. He will also handle sales for the Government, and special contracts.

- Reeves Soundcraft Elects Vice-President. The election of Arthur J. Seiler as vice-president and director of Reeves Soundcraft of Danbury, Connecticut, has been announced by H. L. Reeves, president. Mr. Seiler is also president of Alley Surface Company of Wilmington, Delaware, a company recently acquired by Reeves Soundcraft Corp.

- At the same time Reavers Soundcraft Corp., a subsidiary of Reeves Soundcraft Corp., announced the appointment of Michael W. Chitty as chief engineer. Mr. Chitty was formerly associated with Canadian Marconi, Limited, as division manager.

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