AUDIO

NOVEMBER, 1961
50¢

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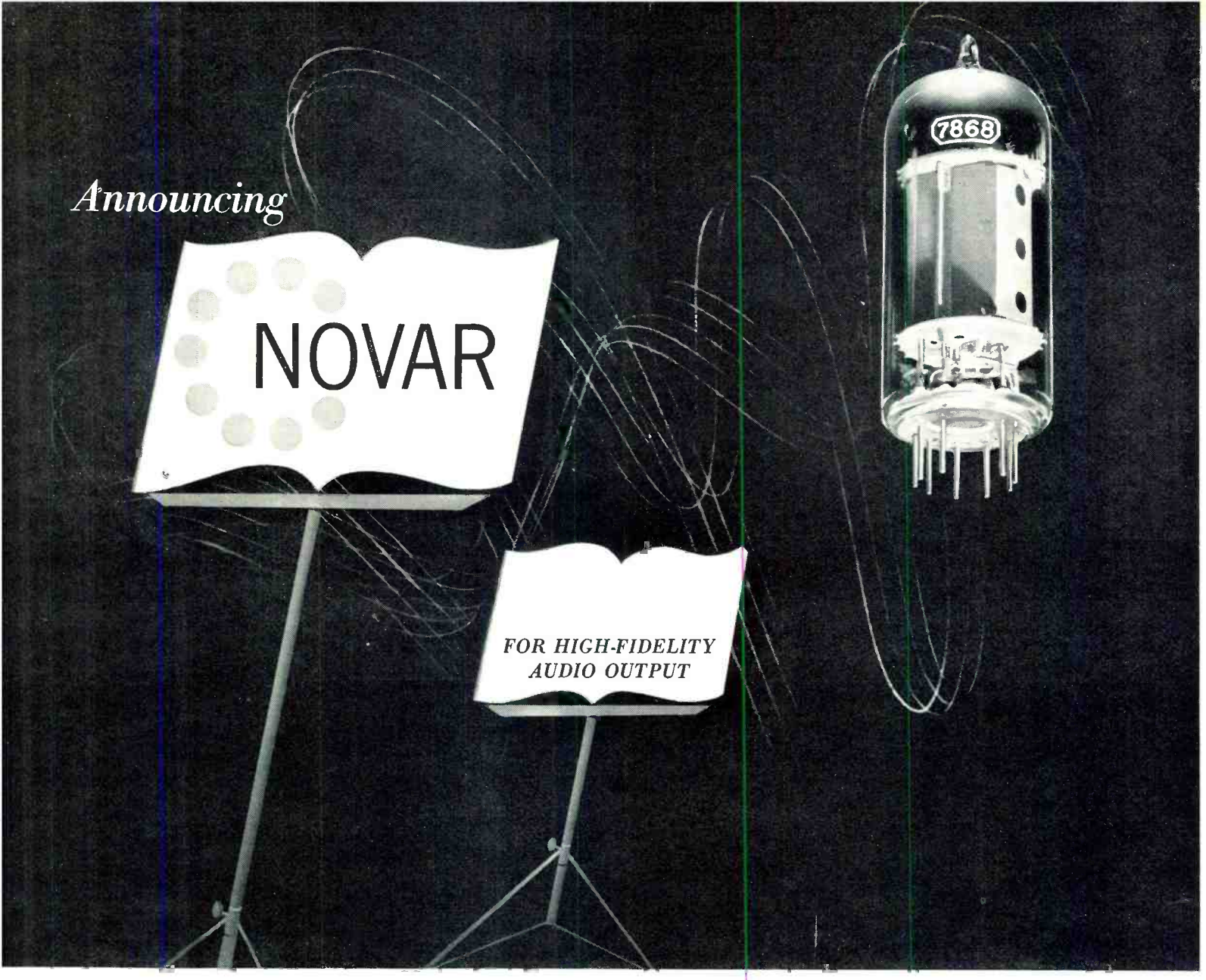

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With this new tube RCA brings all the advantages of novar design to high-fidelity circuitry.

RCA-7868 is a high-perveance 9-pin novar power pentode for output stages of hi-fi audio amplifiers, phonographs and radio receivers. You'll get up to 44 watts of power output from a pair of them in Class AB_1 push-pull service in audio amplifiers.

RCA-7868 is the first hi-fi tube type in RCA's new novar line of large, all-glass 9-pin receiving tubes. Its cost to you is less than that of any equivalent tube regardless of base configuration.

RCA-7868 has all the advantages of novar design, the *only* all-glass, integral-base receiving tube design to offer:

Larger internal lead diameter—for strong cage support and high thermal conductivity for very effective heat dissipation.

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RCA Dark Heater—found exclusively in RCA receiving tubes... additional assurance of reliability.

RCA 7868 has two base-pin connections each for grids #1 and 2; special radiator on siderods of grid #2 assures cooler operation.

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AUDIO

NOVEMBER, 1961 Vol. 45, No. 11

Successor to RADIO, Est. 1917

AUDIO Articles

AUDIO Reviews

AUDIO Profiles

AUDIO in General

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AUDIO clinic

JOSEPH GIOVANELLI*

Poor Phono Equalization

Q. I recently built a speaker system. When connected with my amplifier and FM tuner, it sounds fine with nice, clean lows. I recently bought a turntable and cartridge. I paralleled the two channels of the cartridge by means of a "Y" adapter and feed this into the magnetic phono jack on the back of my 12-watt preamplifier-amplifier combination. When playing monophonic discs, the low notes appear to be attenuated. I have played only one stereophonic disc (monophonically) so far and cannot compare the low notes on it to those heard when using my tuner at this time.

The recommended load impedance of my cartridge is 47,000 ohms per channel. When I parallel these, I get 23,500 ohms. I do not know the load impedance of the input of the phono positition on my amplifier combination. Is there some mismatch that I don't know about or am I just imagining the loss of lows?

If you suggest paralleling the inputs with some value of resistance, would you state the value and also the wattage of the resistor? Since I don't know the impedance at the input of the phonograph position of the unit, can you suggest to me a way of measuring it? Charles M. Mckeough, Philadelphia, Pennsylvania.

A. First of all, it is possible that you are lacking low frequencies because the discs used for the comparison simply in themselves lack lows. Otherwise, there is no reason why the paralleling of the cartridge sections should result in a loss of low-frequency response. If the recommended load impedance presented to the cartridge was not observed, there would be a change in the amount of high frequencies present in the playback of the discs in question. If the resistor at the input of the stage was too low in value, highs would be attenuated; if the resistor was too high in value, highs would be accentuated. In either case, the lows would remain unaffected.

If you are lacking lows, it is possible that there is something wrong with the equalization circuits in your amplifier. The use of a frequency test disc and a voltmeter will quickly tell you the story with regard to equalization. I can go into more detail about this test procedure if it is desired.

To determine the input load actually presented to the pickup you need only to connect an ohmmeter across the input to the phono position of the preamplifier with the cartridge disconnected. The resistance measured at this point will represent the load seen by the cartridge. It should be adjusted as is required by the characteristics of the high-frequency response.

More likely, however, you may possibly have connected the two outputs of your pickup out of phase. Suggest you check this first.

Determining Speaker Resonance

Q. I wish to build a bass reflex enclosure, but I do not know the resonant frequency of my woofer. The speaker has a nominal impedance of 8 ohms. Richard Teperson, Cincinnati, Ohio.

A. Every musical note has an audio frequency, or pitch. If you have good musical pitch, or if you have a piano handy, you can tap the speaker cone and note the tone which was produced. You can then figure the frequency of the tone using standard reference pitches and the proper ratios between musical notes. I shall be glad to explain this further if requested.

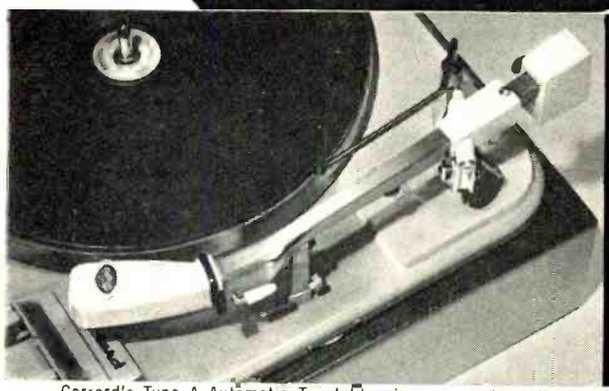
If the foregoing procedure is impossible for you to use, you will have to run an impedance curve of the speaker. To do this, an audio oscillator is connected across a series network consisting of a variable resistor (0 to 100 ohms) and the speaker to be measured. Feed in various frequencies and adjust the value of the variable resistor so that the voltage across the resistor will equal that of the voltage across the speaker. Do this for each frequency fed into the speaker. Then, measure the resistance of the resistor with an ohmmeter. This will give you the impedance of the speaker directly in ohms. At same low frequency you will encounter a sharp rise in impedance. This is the resonant frequency. When the speaker is properly installed in the bass reflex enclosure, the impedance curve will be smoother at this resonant frequency than was true of the curve of the speaker in free air. Thus, the use of this technique provides a method of adjusting the bass reflex enclosure for optimum performance. The port loading is adjusted for the smoothest impedance curve over a small frequency range above and below resonance.

There is another method for obtaining

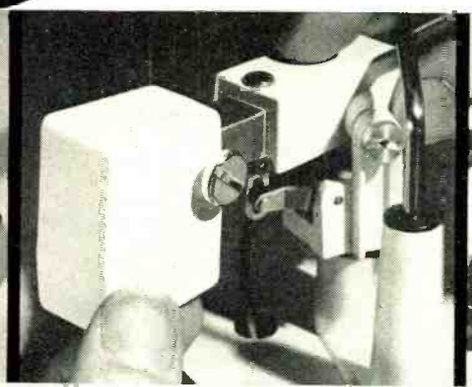
* *3420 Newkirk Ave., Brooklyn 3, N.Y.*

Here very simply is why Garrard's LABORATORY SERIES Type A Automatic Turntable has become America's number one record player

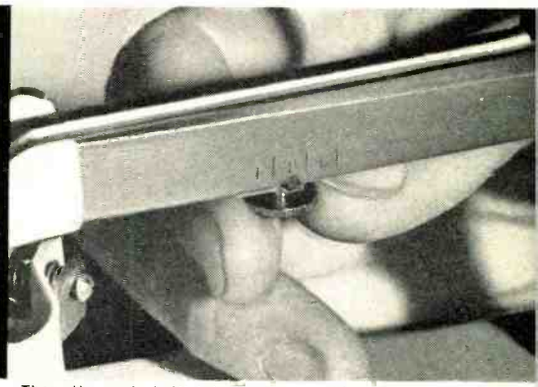
Garrard has combined a dynamically balanced tone arm; a heavy, full-size turntable; a laboratory-balanced precision motor... **plus** the convenience of the world's finest automatic record-changer (to use when you desire). Each is a precision device comparable to **professional equipment** of the kind which, up to now, you would have had to buy separately.



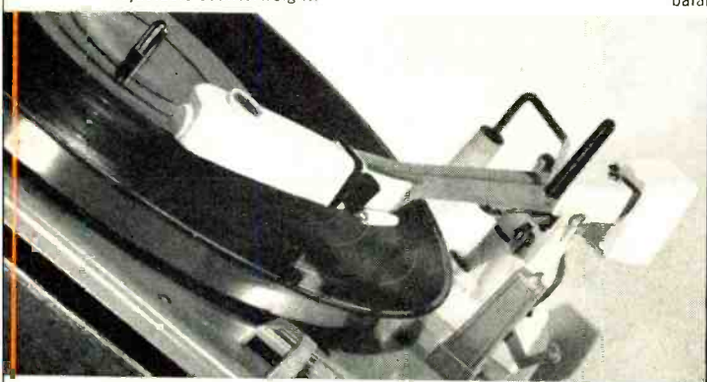
Garrard's Type A Automatic Turntable gives you a **true** dynamically-balanced tone arm, with the extremely important, heavy adjustable counterweight.



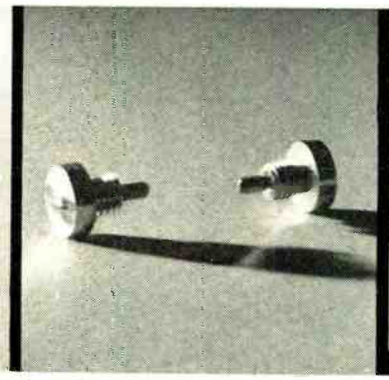
Thus, to adjust the stylus tracking force, you simply move the counterweight until the arm is in perfect balance, **at zero pressure.**



Then, the scale **built into the arm** enables you to set the lightest tracking force prescribed for any cartridge, even those labelled "professional."

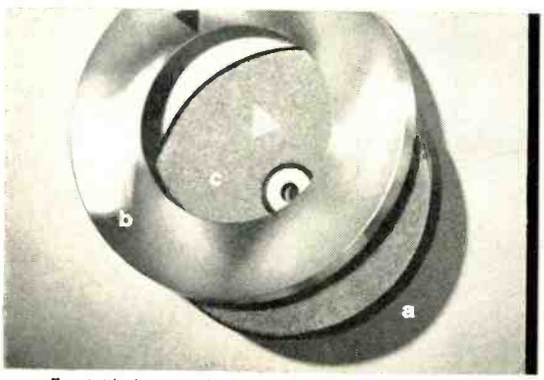


Once balanced and set, the Type A tone arm will track perfectly **each side of the stereo groove,** even if the record player is intentionally tilted or the record warped.

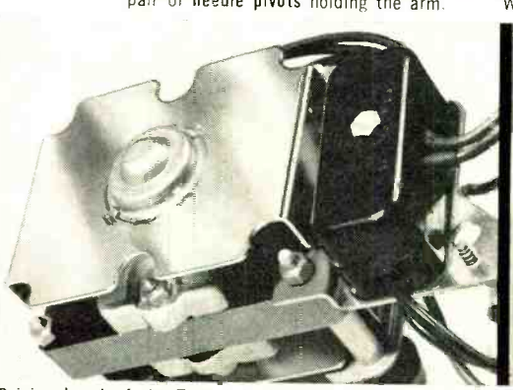


Perfect performance also requires minimum swing friction... guaranteed by the pair of **needle pivots** holding the arm.

Another important feature is Type A's non-magnetic turntable... heavy-cast, full-sized, **and balanced.** Weight: 6 lbs.



Turntable is an exclusive **sandwich design,** (a) drive turntable inside; (b) heavy, polished, cast metal turntable outside and (c) a resilient foam barrier between.



Driving heart of the Type A is Garrard's Laboratory Series motor with **top and bottom shielded** by specially designed plates, eliminating any possibility of magnetic hum.

Garrard's exclusive pusher platform record changing mechanism **is foolproof**... gives the Type A the tremendous convenience of automatic play.

An extravagant concept, yes... but the price of the Garrard Type A Automatic Turntable is exceedingly modest... only $79.50. For literature, write Dept. GS-11, Garrard Sales Corp., Port Washington, New York.

Garrard
world's finest

the resonant frequency which will give faster results than the above but will not give the impedance curve of the speaker. With this method a fixed resistor is used in series with the speaker. The value of this resistance should be approximately equal to the nominal impedance of the speaker. At resonance you will note a sharp drop in voltage across this resistor.

Intermittent Static in an Amplifier

Q. For the past few months, whenever I turn my set on or off, I hear a heavy, static noise for about ten to fifteen seconds. While playing records or FM there is very little noise—in fact, virtually none. This equipment has operated satisfactorly for the past six years. I have replaced tubes in the amplifiers (only) and this did not clear up the trouble.

Six months ago I changed a ground connection to avoid a loop effect. Could this be the cause of the trouble? My radio serviceman could not help me. If you could give me the theory of such troubles perhaps I can find the actual cause myself. Alex E. Gold, M.D. Hempstead, N. Y.

A. Frankly, I do not know the source of the static-like noise. I can, however, tell you how to find out its cause.

First, disconnect the audio cables from the inputs of your amplifiers, leaving the amplifier outputs connected to the speakers. Turn on the equipment and note if the noise occurs. If the noise does not occur you know that the amplifiers are not at fault.

Next, connect the preamplifier to the inputs of the amplifiers. Again turn on the equipment. If the noise is heard, you will know that it is coming from the preamplifier. All inputs to the inputs to the preamplifier should be removed during this test. If the noise does not occur, then you will have to assume that it is in one of the units which feed the preamplifier. It is not unlikely that a tube is defective somewhere in the preamplifier circuit, so check all tubes first.

The checks now to be outlined are to be followed regardless of whether the difficulty was found to be in the amplifier or preamplifier. If the amplifier is the culprit, start with the output.

Test Procedure. Assuming that the problem is a result of some defect in the preamplifier, start with the cathode follower, and short each successive grid to ground, working backward through the preamplifier. This shorting should be done preferably with a large capacitor—1 or 2 μf. (The capacitor will offer a very low reactance path to the a.c. signal voltage applied to the grid as compared to the value of the grid load resistor of that grid circuit thus, bypassing the signal. The capacitor is recommended because some stages are directly coupled to the plate of the previous stages or these stages are floating above ground. Directly shorting the grids of these stages to ground could short out the d.c. component of such circuits, which could cause damage to the equipment, and at best yield faulty results. The capacitor offers virtually infinite opposition to the

(*Continued on page 79*)

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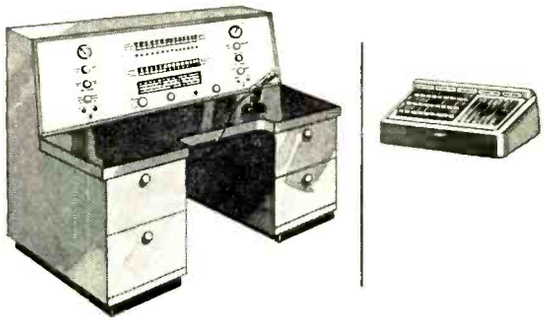
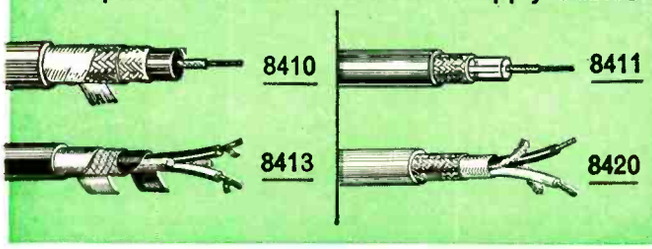
Every wire and cable you need for sound and intercom service and installation



Belden Sound and Intercom Cables are designed and engineered for highest audio efficiency and quiet performance. These cables are available in a wide range of types, sizes, and insulations, for all sound and intercom installations. Ask your Belden Electronics Distributor for complete specifications.

Microphone and Shielded Power Supply Cables



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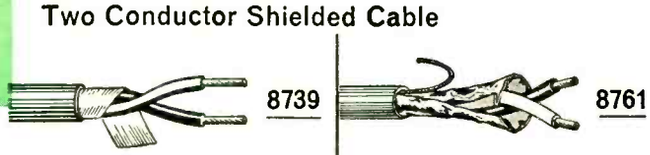
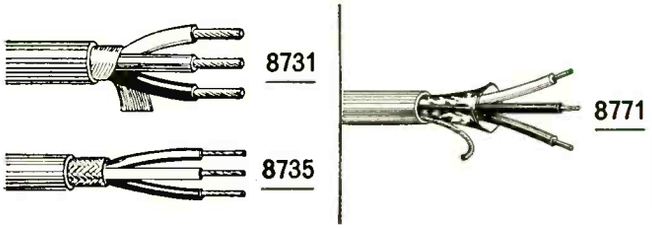
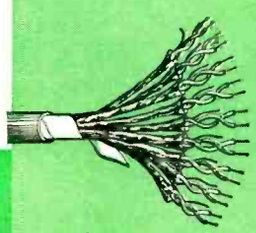
Two Conductor Shielded Cable



Three Conductor Shielded Cable





Belden Multiple Pair Individually Shielded Cables use Beldfoil*, a Belden development and a major breakthrough in the search for quiet cables.

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..1 to 51 pairs

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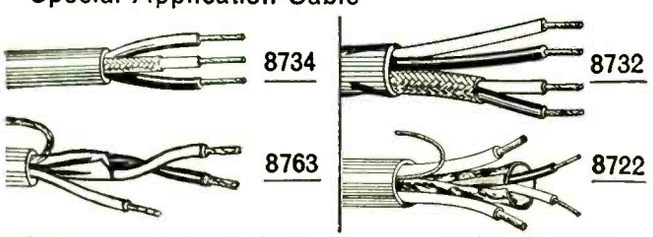

Hi-Fi Connecting Cable 8421

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8-8-0

LETTERS

Wrong Number

SIR:

If any readers write to me about my article in the October issue, "FM Sweep Alignment Unit—Austerity Model." I am of the opinion that his letter might be returned since you have shown my address incorrectly. It should be P.O. Box 160, Madison Square Station, New York 10, N. Y., instead of Times Square Station.

I hope that if any readers' letters are returned, they will re-direct them properly.

ALLEN R. GREENLEAF.
P.O. Box 160, Madison Square Station,
New York 10, N. Y.

(*Let's hope the Post Office pays some attention to the Zone numbers, but if they don't* AUDIO *will reimburse any reader 10c for any returned envelope addressed to Mr. Greenleaf.* ED.)

Multiple Speakers Again

SIR:

I have just studied, with great interest, the article by James F. Novak in the September issue. Since two of my own articles on the subject were cited as references, may I reply?

Mr. Novak charges that the popularity of small-speaker arrays such as Mr. Mahler's designs and my own "Sweet Sixteen" appears to be due to "subjective listening" and adds that I offered "no acceptable explanation" why many speakers are better than one. He has apparently devoted a great deal of effort and no small expense to an attempt to debunk the array concept.

I have no quibble with his mathematics or his measurements. I do, however, seriously question his conclusions.

The entire article is based upon a single underlying assumption—that calculations of performance and lab measurements are directly applicable to judgement of a loudspeaker system's performance in the home. While this assumption is admittedly a most valuable tool in the design and preliminary testing of new systems, I feel quite strongly that it falls short when applied at the ultimate-consumer level.

The point I am trying to make is this: since the typical audiofan's acoustic environment contains so many unpredictable factors, he can expect no correlation at all between lab-measured speaker performance and the sounds produced by the same unit in his home. Room resonances, reflections, sound absorption, and so on, all combine to alter the system's characteristics. The smooth curve of a lab-standard unit may become jagged, and conversely, the jagged curve of a "low-quality" system may be smoothed into a thing of beauty.

Let's look again at Mr. Novak's charge that the popularity of small-speaker arrays is due to "subjective listening." I ask, can listening be done by any other means? The only appropriate test for a loudspeaker is, "How does it sound in the home with program material?" and the only way to perform this test is through subjective evaluation and comparison against known standards. The results of these tests can be "objectivized" (if I may coin a particularly gruesome word) by statistical means if enough such tests are performed. Bell Telephone Labs learned this long ago, and this in essence is the method I followed in measuring performance of the "Sweet Sixteen."

I am grateful to Mr. Novak for his exhaustive treatment of the subject; although I cannot agree with his final conclusion, his measurements have confirmed what I have believed to be a fact for the last two years—that the total performance of a small-speaker array in the region below 1000 cps is in virtually all respects equal to that of a single top-quality woofer. The performance above 1000 cps must remain a matter of subjective judgement.

In conclusion, I feel that Mr. Novak has brought into focus one of the major points connected with evaluation of different loudspeaker systems—the fact that systems which are comparable in sound quality show up vast differences in laboratory tests. I am sure that he will agree with my closing remarks: Before any one comes to any decision concerning loudspeakers, he should *listen* to the units involved, *in his home,* rather than *reading* specifications and making the decision on the basis of measurements alone. If this course is followed, the listener will know that the system he picked sounded best to him in his own surroundings—and what else, after all, can we expect from any good speaker system?

JIM KYLE,
1851 Stanford Ave.,
Santa Susana, California

(*That last paragraph sounds singularly like the advice we have given for these last fourteen years. We do not believe there are any "experts" or "authorities" who know more about what a given individual likes than the individual himself. We have always said, "Listen to the products of the reputable manufacturers and then choose the one you like best." If every manufacturer was absolutely right in his design and manufacture, it would seem as though all of their products would sound exactly alike. Since they don't—and that's an understatement—our best "out" is to* listen *and then* choose. *But,* listen *to a wide variety of program material,* listen *carefully and thoroughly, and* listen *for more than a few minutes before making the choice.* ED.)

Lost, Strayed, or . . .

SIR:

Two AKG microphones were carried off from our Room 334 during the N. Y. Audio Show. These units were: a D24B60, serial number 1565, and a D11N. Prospective purchasers are cautioned about the D24, since the serial number is known. If both these microphones were just borrowed, we would be pleased to have them returned at the borrower's convenience.

V. J. SKEE,
Electronic Applications, Inc.,
194 Richmond Hill Ave.,
Stamford, Conn.

Electronic Speed Control

SIR:

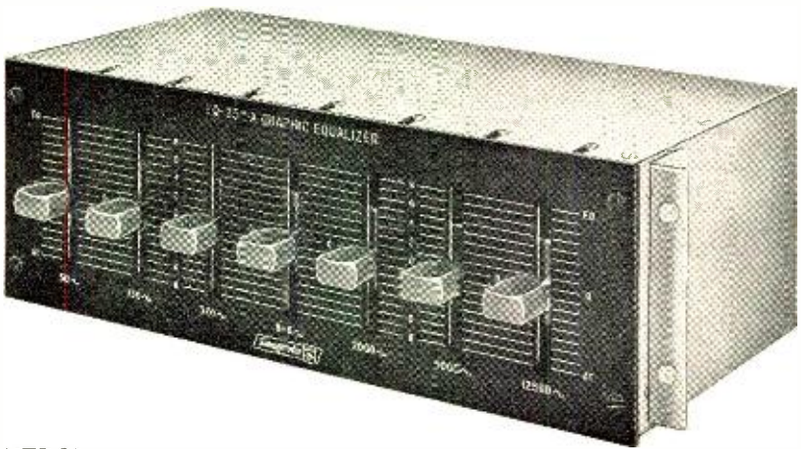
How about getting one of your contributing experts to develop an electronic speed control for turntables and tape recorders with either four-pole or synchronous motors, and using parts that are all available from the usual suppliers. It should have sufficient power capacity for any turntable or tape recorder, and a wide range of speed adjustment.

KEITH CONRAD.
Wayland, N. Y.

(*And we'd welcome a story like this, too.* ED.)

Langevin

MODEL EQ-252-A GRAPHIC EQUALIZER



7 POSITIONS FOR ULTIMATE CONTROL OF SPECTRAL QUALITY IN RECORDING, TV-BROADCAST AND MOTION PICTURES

FEATURES

7 Selected Positions of Variable Hi-Lo Equalization and Attenuation.

Gold plated, Noise-free, Switching through ±8 db in 1 db steps during active use.

Hum-free performance through toroid coils from −70 to +24 dbm.

No tubes or power required — all passive Bridge T circuits in one integrated unit.

Small size: 3½" x 10½" x 5¾" deep.

The Langevin Model EQ-252-A Graphic Equalizer fufills the critical need for multiple control at the subjectively important points of the audio range. It employs miniaturized, military quality, gold plated, etched circuitry in each of the 7 plug-in filter units, resulting in a passive assembly requiring no tubes or power supplies. Only input and output connections are required. Sliding Levers permit 8 db of equalization and 8 db of attenuation in 1 db steps at 50, 130, 320, 800, 2000, 5000 and 12,500 cps during the program through noise-free gold-plated switching. Modern controls give quiet operation at −70 up to +24 dbm.

Filter assemblies use sealed toroid coils for hum-free operation. Careful design delivers ±½ db accuracy. Overlap from one filter to the next gives combined flat output when levers are in a straight line in any equalized or attenuated position (see curves). Special frequencies are available to order; overlap may or may not provide combined flat output between adjacent positions as the standard frequencies shown have been calculated for this effect. In zero position each or all filters are flat (resistive only, 16 db loss) from input to output. Because all passive circuitry is used there is no distortion when operated up to plus 24 dbm. Impedance is 600 ohms in and out; for other impedances use Langevin line to line transformers, Model TF-602-C. The model EQ-252-A is limited to 600 ohms impedance for the reason that lower impedances would double the size of the equalizer components every time the impedance is halved.

SPECIFICATIONS

Circuit: Bridged T; **Impedance:** 600/600 ohms; **Insertion Loss:** 16 db; **Operating Level:** −70 to +24 dbm; **Positions:** 7, with 8 db of equalization and 8 db of attenuation at 50, 130, 320, 800, 2000, 5000 and 12,500 cps in 1 db steps; **Distortion:** none; **Coils:** Sealed toroids; **Power Requirements:** none; **Response:** See curves; **Panel Finish:** Black, satin finish, non-halation, anodized aluminum; **Terminals:** solder type, turret; **Filter Sections:** 7 plug-in, printed circuit type; **Size:** 3½" high by 10½" long by 5¾" deep overall.

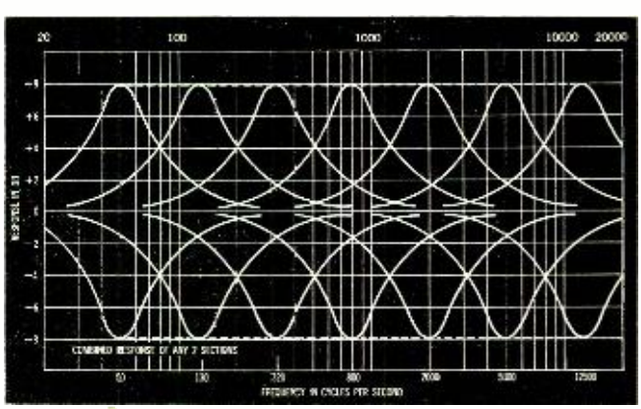
ORDERING INFORMATION

Model EQ-252-A Graphic Equalizer equipped with red knobs, complete with mounting hardware and instructions. Weight, net 9 lbs.; 14 lbs. shipping. Price, Net $475.00.

Recommended Accessories

When lower impedances than 600 ohms are required, use the following matching coils in and out:

Model TF-602-C Line to Line Transformer, Weight, Net, 2¾ lbs.; 3½ lbs. shipping. Price, Net, $25.50.



CHESTER SANTON*

Enoch Light: Stereo 35/MM
Command RS 826

The Command label has switched to 35-mm film for its master recordings. The change-over is being made with a lot more hoopla than we witnessed some time ago when Everest began to use film instead of tape for their original recordings. Actually, the new Command process needs only minimum assistance from the publicity department because some improvements are obvious as soon as you try this record on a decent system. One question occurred to me while listening to this disc. Did they need all fourteen microphones to manage the orchestra? I'm completely willing to grant that problems are bound to arise when you spread out sixty men on the stage of Carnegie Hall and then try to record for maximum instrumental presence in a parcel of pop tunes. Two or three mikes could hardly be expected to do the job in the positions favored for such material by most engineers. At any rate, I'm inclined to blame the multitude of mikes for the results I got in trying this record on two different systems. On the first set of components, I experienced a sensation of presence that I had never heard before on that particular rig. It was a pleasant surprise because the system has fairly steep rolloff in the speakers at both the high and low end. Transferring to the second system, which I know to be more linear in response throughout the spectrum. I discovered that the record was considerably less exciting and that the number of mikes involved was more evident. The arrangements may be a clue. They seem more frantic the second time around as they try to live up to the claims on the cover that do more than imply that the supreme thrill of a lifetime awaits anyone lucky enough to get within earshot of this disc. When are those boys in the back office going to relax? After all, fellas, it's only a record.

Thunderstorm
Riverside Fortissimo XK 8005

The collection of sounds on this record first appeared on one of Riverside's conventional pressings a few years ago. The stir created at that time could not be called a deafening one. The blame did not lie with either the listener or the record company. All firms turning out well-engineered discs in those days faced a similar problem. The discs sounded only as exciting as the stereo pickups then available. Of the two basic "commodities" being recorded, music fared somewhat better when played with those cartridges than did the challenging sounds represented on this disc. As stereo pickups began to assume a response that could be described as reasonably linear, as separation at the upper end began to approach the present figure, records such as this began to deliver the goods. The Fortissimo process developed by Riverside gives their original thunderstorm and other episodes a new lease on life. In this new pressing, the street noises and low murmur of traffic before the thunder begins to roll are good indications of improved signal-to-noise ratio. Select a fairly high setting in playback volume and you'll hear a raft of incidental sounds throughout the disc that weren't particularly noticeable in the earlier edition. Most of Side One is devoted to the storm. The story of its lengthy progress is spelled out in the continually shifting sound of rain—in the air and ultimately coursing through the drains close to the mikes. The Coney Island carousel and a Maryland farm tractor are typical examples of close-up recording. Most of the front-to-rear motion has been assigned to the tractor. The sports car race, tobacco auction and the small-town parade are only moderately interesting. The widest groove excursions (rivaling most of those heard on test records) have been saved for the last band of Side Two: the sounds of the liner "Queen Mary" as it prepares to leave New York harbor. The blast of the ship's horn may depress the nap of the living room rug but not the spirits of its owner. The harbor seems to serve as an excellent reflector of the other sounds in this episode—tugs, children's voices and wheeling gulls. These are soon forgotten when the blast of that horn tickles every bolt along the whole length of the vessel.

Reginald Dixon at the Blackpool Organ
Capitol ST 10285

If you feel that your collection of organ recordings should include at least one Wurlitzer played on foreign soil, here is a good chance to take care of the matter. A further point of interest in this recording is the opportunity to hear the M-S system of stereo miking as applied by EMI in a "live" auditorium. Capitol Records set into motion this exceptional chain of events for the organ fan with the decision to release in this country a three-manual Wurlitzer recording made at Blackpool, Britain's famous resort town on the Irish Sea. Reginald Dixon, the featured organist in this release, has appeared at the Blackpool Tower Ballroom since 1930, building a sizeable following in all parts of Britain with year-around BBC broadcasts, telecasts, and recordings that date back to 1932. Dixon's association with the Tower Ballroom has survived several interruptions: service in the RAF during World War II, a 1957 fire that necessitated the rebuilding of the organ and, three years ago, an operation involving a nerve in the organist's right arm. His complete recovery is demonstrated early in the record as he skims the keyboards in a dizzily-paced version of the *Sabre Dance*. All the tunes are well-established American favorites. A sure and fluid sense of rhythm in specialties such as *Toy Trumpet* and *Chinatown* may surprise listeners who have associated deft console work solely with American organists. The ballads are built on warm layers of the organ's lower voices that are spread out in a pattern singularly free of complications. The bracing sea air that draws visitors to the resort would appear to have a tonic effect on the pipes themselves.

Michel Legrand: The New I Love Paris
Columbia CS 8440

As a rule, whenever a record outfit refers to one of its releases as a landmark, the well-oriented listener is inclined to reach for his pouch of salt. Record reviewers, in particular, have been known to take an extra grain as soon as the publicity mills begin to grind. Sales figures, however, proved conclusively some years ago that Columbia really had something unique in the first album by Michel Legrand titled "I Love Paris." Further evidence that the Parisian conductor had caught on in the American market came in the steady procession of albums that followed. In the mono version, the original "Paris" release became one of the best selling instrumental albums in record history. Now it has been remade for stereo. The arrangements are the same so the technical work gives us an excellent chance to get up to date on current stereo techniques in the French capitol. The recording characteristic used here can hardly be described as a self-effacing one. The highs meet you more than half way. Once you reduce the prominence of the upper frequencies, you'll find that the miking offers a stereo canvas that is singularly free of seams. Particularly impressive is the cohesion of the whole family of strings during the slow ripple effects of *La Seine*. The bouncy, impertinent, trademarked Legrand style shows up well in a tune from a Maurice Chevalier show of 1930. Perhaps the neatest trick in the album is the Gallic accent given to music by our own Cole Porter, Mack Gordon, Vernon Duke, and Jerome Kern.

Jackie Gleason: Lover's Portfolio
Capitol SWBO 1619

This latest Gleason production is his most ambitious project in the romancing department he set up in the record catalogs some ten years ago. Packaged in a black portfolio is a four-stage, two-record album designed to guarantee a Big Evening. In order to make matters easier for the beginner, Mr. Gleason divides the evening into four convenient sections—with music and drinks carefully designed to accompany each segment. It must be stated immediately that J. G. has stinted nowhere along the line. The pianist during the preliminary stage is obviously a top-notch performer in the cocktail circuit despite the fact that he is not identified on the label. In the next section, the Dixie Jazz Group is pungent and very much to the point in its style. Side Three of the album furnishes dance music in highly authentic society-band swing. The last episode finds Jackie up to his favorite tricks, this time leading one of the best-sounding "Music For Lovers" orchestras he's ever assembled. If you feel that Dr. Gleason's Magic Elixir of Salutory Sound has proved beneficial to you in any of the 18 previous Capitol bottlings, this latest formula needs no further endorsement from me.

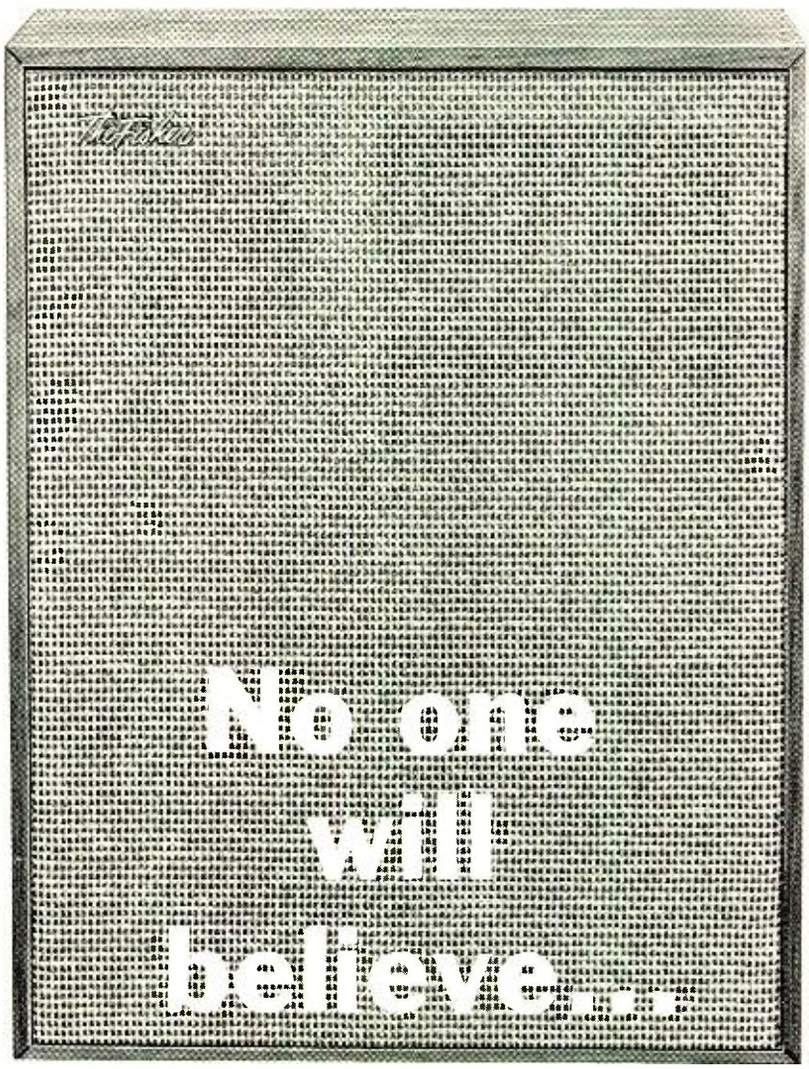
Primitive Percussion—African Jungle Drums
Reprise R 6001

Were any record company to consider an actual tour of all the regions of Africa represented in this release, the shipping costs for recording gear alone would probably rule out the project. With most of Africa occupying the spotlight these days, all sorts of expedients are being used by the record industry to bring the music of that continent into closer range. Directors of field expeditions who have tracked drum rhythms such as these to their native lair may throw up their hands in horror at the mere idea of recording this material in a clearing on America's West Coast. This six-man Californian percussion team boasts only one African member—Adinortey Puplampu of Ghana. Helping the enterprise are studio facilities that are far more conducive to luxuriant highs and lows than a typical field recording site. The informal repertory ranges from a 6/8 war rhythm of the Egyptian Sudan to a Watusi Wedding Dance from Ruanda-Urundi.

Ella Fitzgerald: Get Happy
Verve ✪ VSTC 256

In this release, Ella forsakes the scholarly devotion to the work of an individual composer found in her series of Songbooks. While few listeners will claim that this tape constitutes the major Fitzgerald album of the year, Ella's unique standing among popular

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



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vocalists still draws the attention of knowledgeable tape fans. Here they will find passing reference to Gershwin and Berlin but most of the program is made up of morsels typified by *You Turned the Tables on Me* and *Beat Me Daddy Eight to the Bar*. Adding a further touch of variety is the fact that four well-known bandleaders furnished arrangements for this session. We are not given the identity of the orchestra heard with Ella but the arrangers are Nelson Riddle, Frank DeVol, Russ Garcia, and Paul Weston. The last-named turns in the real jolt of the album. Usually associated with "background" music that has an easy-going drawl, Weston provides a jazz springboard in *Blue Skies* that launches Ella into one of her better imitations of instrumental improvisation. The sound in this release is similar to that of previous Verve recordings despite the fact that the label has been acquired by M-G-M Records. I find it less easy to Get Happy with the disc version. The record is unnecessarily bright on my set up.

Dance Music of India

Capitol T10263

Credit the import department of Capitol Records with the knack of uncovering a genuinely off-beat item every now and then. The classical music of India has intrigued the repertory divisions of several leading labels although we have no indication that it has aroused equal enthusiasm in the bookkeeping departments. Indian music has been gaining even more highly-placed friends. Yehudi Menuhin in addition to his regular concert tours, has been one of the most active Western spokesmen for the cause of Indian harmony. Although based on ancient melodic scales and rhythmic patterns, the instrumentals heard here are aimed at a much wider audience than one capable of listening for hours on end to the subtle gradations of the lute-like sitar and the tabla drums. Fleshed out with the modern sound of strings, flutes and a percussion section containing finger cymbals, gongs, xylophone and giant drums, this is the sort of light music you would encounter today in the film and radio studios of India. Capitol's accuracy in the handling of instrumental color is the final ingredient in a "background" album of a markedly different nature.

Stan Kenton: The Romantic Approach

Capitol ST 1533

This is not the first time that Kenton has channeled the power of his big band into ballad standards. If I recall, this is the first instance he has done so with the help of a brass instrument designed at his own request. The instrument is something called a mellophonium. It is neither a mellophone nor a French horn although it does resemble them. The mellophonium follows a straight line from mouthpiece to bell instead of describing the semi-circle that the others do. Its tonal range falls somewhere between the trumpet and the trombone. Kenton uses four of them, along with a tuba, to under-prop his already staunch brasses and reeds in ballads including *Once in a While*, *Fools Rush In*, and *Imagination*. Tempos are slow even when judged by the usual Kenton ballad style. Further solidity is contributed by Stan's well-forward piano. Some listeners may decide that a typical ballad doesn't deserve all the sonority Kenton gives it but a well-endowed stereo system will thrive on the lush sound.

Seductive Strings by Siravo

Time ✪ ST 2019

George Siravo is one of a host of arrangers now receiving conducting assignments from the newer labels. His work behind the scenes for Frank Sinatra and Doris Day established him in the field many years ago. In this album, he has an opportunity to plot out ideas for a large string orchestra that highlights the solo cornet of "Doc" Severinsen. The treatment of standard tunes such as *Star Dust*, *Poor Butterfly*, and *East of the Sun* is aimed quite frankly at the audience that enjoyed the

(Continued on page 88)

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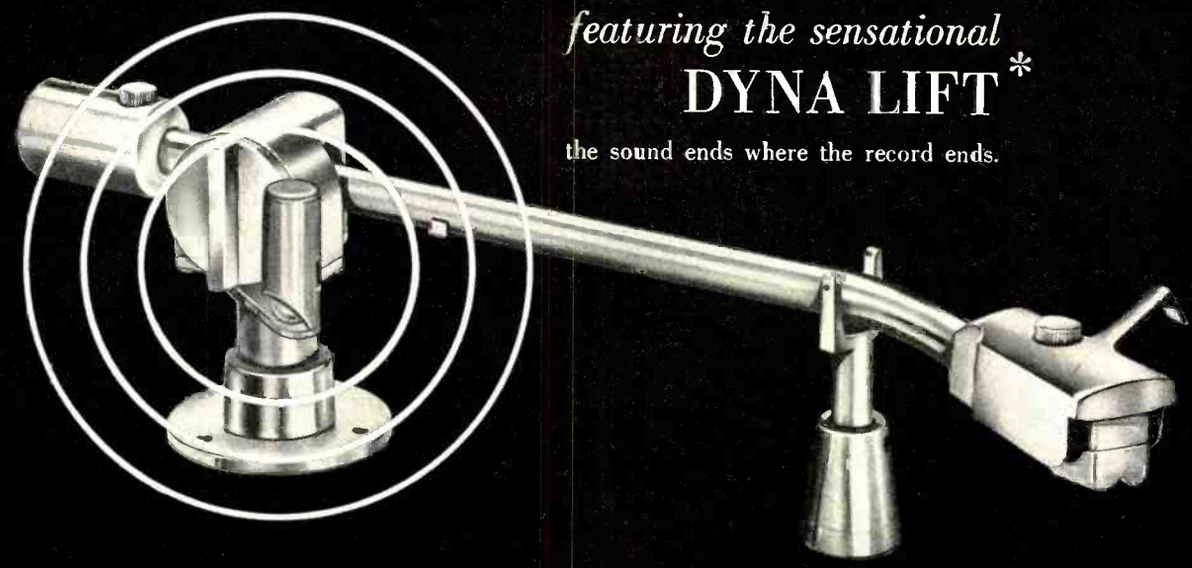

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AUDIO ETC.

Edward Tatnall Canby

TWO SMALL SPEAKERS

I'm always intrigued by new speaker sizes, especially small ones. I'm interested in the internal ingenuities of construction that go along with new sizes—as a result, or as the cause. One thing leads to another, and never so clearly as in the continued evolution of that composite whole called the speaker system. New sizes this year are a case in point. Two kinds, representing two developing lines of thought, experiment and practice. One is the "thinsy" speaker, only a few inches from back to front and easy to mount against a wall or, standing free, as a sort of small room divider. The other is a new generation of smaller "bookshelf" items, the smallest of which (like the Weathers babies that look like big books) will, at last actually fit into a normal bookcase! Even the larger models are significantly smaller than former styles, and therefore are significantly different in price, construction, and musical effect.

Some ten years ago I thought up a name for the thinking that goes into small speaker systems: the Space versus Bass Ratio. (Look out there, printer. Not Spass versus base.) How much bass can you get out of how little space (and at what cost)? How much do you lose by cutting down on speaker enclosure size, and/or on the speaker itself? More important, how much can you *regain* by ingenuity in design?

Here is where the ever-new interest springs up, year after year, in these highly practical designs. For there's no question about it, the bass-space ratio has continued to improve and still continues. I've made some quite dramatic comparisons recently, just to prove it to myself.

The R-J was the first enclosure to try for a deliberately and ingeniously upped bass-space ratio, in an unusually small (for them) speaker box. The AR came along with a more all-out arrangement and initiated the all-in-one complete speaker system trend that has grown with the "bookshelf" movement. After those two, practically everybody got onto the bookshelf bandwagon and the semi-trailers attached to it, bookshelf-type speaker systems that were merely new versions of ported, slotted, tubed enclosures in the old bass reflex family.

"Merely," I guess, is no longer the word. There is, to be sure, a technical difference and maybe a legal one between an all-enclosed, sealed box and one with holes in it, of whatever sort. I suppose even a leaky enclosure counts as unsealed and hence is a tuned enclosure of sorts, even if unintentionally! In practical fact, however, the gap in workable performance, in musical terms, has been astonishingly well smoothed over today between those speakers of high principle that really hit maximum-quality bottom bass, minus peaks, and those systems, making an easier and simpler compromise, that do not go down quite as low nor as smoothly yet manage to sound remarkably musical just the same.

The gap has departed to all intents and purposes because, as so often happens, multifariously ingenious modifications and improvements in and around a theoretically less-than-ideal enclosure principle have been cumulatively so constructive that the compromise which is left is reduced to a relatively minor factor. Dozens of smallish speaker systems today are no more than modified bass reflex systems in principle, loaded with slots, tubes, ports, tuned this way and that, matched to speakers of newly ingenious and versatile performance. The faults of the big old "boom box" are gone, for the hi-fi listener, at least. Hi-fi booms today are mild and unobtrusive, the bass is lowish and firm, if not as low as the ideal system might call for, nor as solid. The over-all sound is not perfect, but it is serviceably very good, especially at the lower prices that these ingenious compromises make possible.

The enclosures themselves, of course, are only the half of it. The new speakers count heavily, very heavily, both in the improved lower end, size for size, and in the smoother upper highs now available right down to the cheaper small speakers. I'd say that in these last ten years the most striking improvement in speaker quality has not been in the top-quality reproducers but among the low-cost small speaker lines, where there has been plenty of room for ingenious improvement at low expense. New cone materials and shapes, newly ingenious surrounds of extreme compliance, new long-throw mountings, better efficiency in the magnetic configurations—the gain in performance is really astonishing wherever the designers have been at work. I bow down respectfully before these speaker men, who have managed to wangle so much out of such a limited area of low cost operation.

Jensen X-10

Two new speakers that I have been trying out in pairs illustrate some facts of this development. Both pairs are low-priced, one type at rock-bottom level. Both are smaller than most familiar small types of the last few years, one of them very much smaller. Each speaker aims at its own particular set of desirabilities, its own special parameters, to meet a particular situation, a price range, a set of practicalities. Each has been designed with all the ingenuity that could be brought to bear, as of today, on the particular set-up involved. They are quite different, these two. Indeed, there's no real way to compare them.

One is Jensen's baby X-10, a not-too-cheap speaker box, around $30, that is the neatest, handiest little thing to carry around you ever saw. You want to pick it up and put it down again to look at. Its tiny size is somehow just right, of its sort—it invites easy portability and easy locating in the decor. Its proportions are somehow graceful—I can't think of a better word—like those of a New England colonial house, just right for the size. The front is nicely designed, the finish is satiny, the weight is negligible and you can cuddle the thing in your arms. You'll keep placing it here and there for effect, like a vase of flowers or an art book, just to see how it will look.

I have at least a thousand dollars' worth of speakers in my house, but the other day a couple walked in and in two minutes wanted to buy the Jensen X-10's, the pair of them sitting demurely in the bookshelves over my fireplace. That was the hi-fi *these* people were looking for, all right.

Size? Shoe box, more or less, a bit wider: 7¼ in. by 4⅝ in. by 13 in. I give you close measurements—I really should use sixteenths—because there must be something occult about the fractionally exact proportions, so right of their sort. 4-in. of the front panel at one end are paneled off in wood, fluted and emblazoned with the Jensen J and a white volume control. There's a 5-in. woofer (new long-throw type) and a tiny tweeter, upper middle. Really a handsome package, especially in pairs.

(But Jensen forgot one thing. Stereo symmetry. I keep one of the speakers upside down, so that the wood panelings will be at opposite ends of the two boxes, right and left. Looks nice and the upside down ornamental j makes an interesting backwards question mark, with its dot below it.ʃ)

The little speakers rate 6 watts each and make an astonishing amount of big sound (I was about to say noise, but that seems inappropriate). I gave them a rigorous and flattering test. No "extension" speakers for me—I hooked them straight up in place of my normal listening speakers, which cost ten times as much.

No, the results were not quite perfect. The high end, or maybe the lower-middle upper highs in the high crossover region, were mildly on the strident side when I blew up my stereo to full volume, virtually as loud as with my big speakers. The bass was of course weak—but I found that a solid bass boost on the amplifier controls restored the musical balance, with plenty of musical bottom and a reduction of the shrillness. This is the KLH Model Eight principle, a modified amplifier output curve, rigged to help the tiny speaker

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towards maximum low-end effectiveness. Under the circumstances, acting as replacements for top-quality speakers of much larger size, the X-10's did a good job. You'd be astonished at the volume they can turn out.

Jensen's idea is for these to be hooked up right across your regular speaker terminals, in parallel with the regular stereo speakers. That's one reason for the volume control on each speaker. But you can use them alone easily enough, and they'll take a lot more than six watts, I'd guess, judging from what I put into them without causing any damage. A huge sound for the size.

Oh yes, I forgot to say that these are more or less totally-enclosed speakers, not counting the leaks that probably occur around the back panel, which is rather casually fastened down via eight screws. The design verges upon the air-loaded principle and therefore this rates as the smallest separate speaker yet to come anywhere near that idea. Interesting. (The KLH Eight is smaller by a bit, but does not sell separately from its associated FM tuner.)

Cabinart

Most readers will remember the Cabinart name, which used to be attached to a vast array of low-cost hi-fi furniture, mostly in kit form and unfinished. For a number of years, Cabinart enclosures were practically taken for granted in every budget-conscious, kit-style, out-in-the-open home system, not to mention plenty that were painted and draped for fancy decor. Well, after a hiatus, Cabinart is back, and this time it's a new speaker line, in the Cabinart tradition of optimum low-cost value.

The Cabinart speaker system I have been trying out, in a pair for stereo, is really an astonishing piece of equipment at its price, which is an unbelievable fifteen bucks—speaker and enclosure, complete and integrated. It is a smallish bookshelf system, about three quarters conventional size, with an 8-in. speaker inside of quite extraordinary quality. There is a larger speaker system too, for a slightly larger sum of pennies, that I haven't tried.

I am really impressed—though I'm not exactly expecting this speaker to put the $250 models out of business. Impressed by the sound and by the simple ingenuity of the entire construction. Cabinart gets credit for choosing the unusually fine low-cost speaker mechanism that goes inside; but credit definitely goes, too, to Utah, the long-established speaker company that makes this little 8-in. unit. Let's say that it might cost you at maximum, audio-fan semi-net, the large sum of $5. More likely $3. At this price, it is an amazing piece of hi-fi machinery, to match an ingenious bit of enclosure cabinetry.

The economies in the Cabinart enclosure come via that company's long-time know-how in wood products. The stuff is wood all right—wood chips. A kind of marbleized composition, soft but solid, smooth, non-resonant, adequately rigid and quite good looking even without finish. You can

(*Continued on page 60*)

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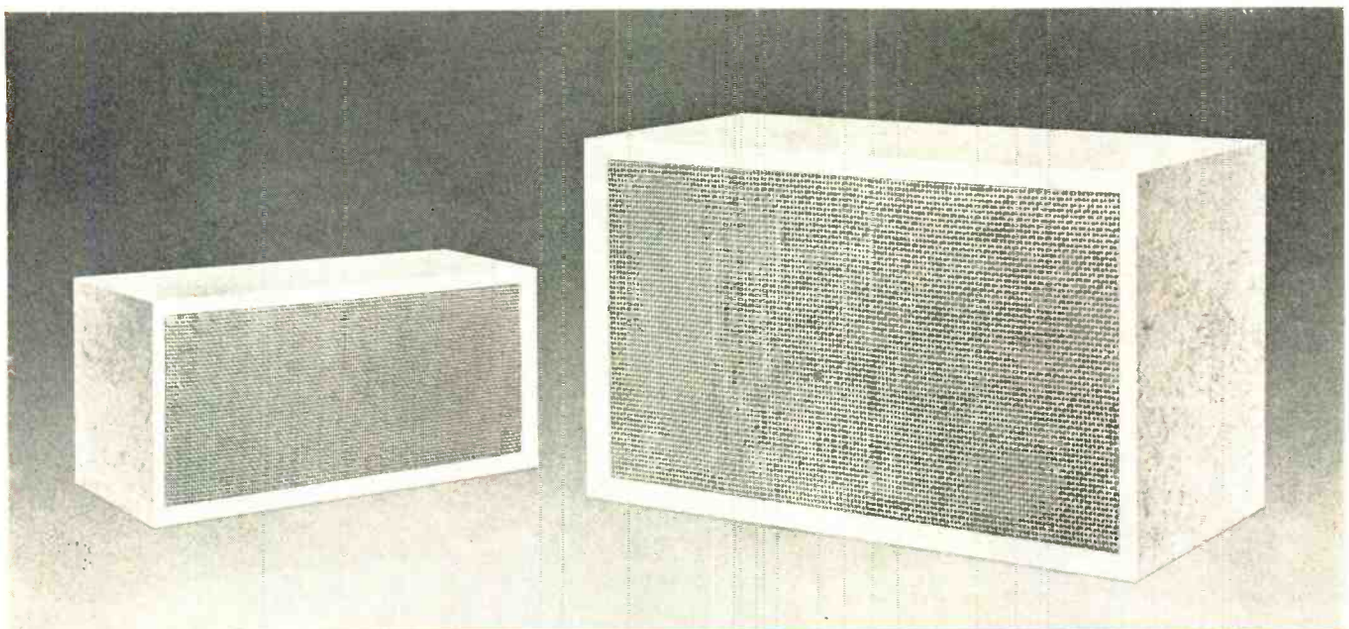

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EDITOR'S REVIEW

FM STEREO PROBLEMS

AS WITH ANY NEW DEVICE, there are likely to be some problems when it comes to the actual application of FM Stereo to the many types and makes of existing FM receivers and tuners. We have been "living with" the new service now for well over a month, and we have had many conversations with others who have jumped into the stereo melee amongst the first contingent. There are some problems, but none seems to be very serious.

In the first place, many tuners made in the early days of hoping for the arrival of multiplex were not designed for the proper coupling to the type of adapter required by the new system. Early multiplex adapters were predicated on receiving from the discriminator or ratio detector only those frequencies from about 20,000 cps upward, and the coupling capacitor used was in many instances as small as .001 μf. This worked perfectly well with the original idea of multiplexing, but is not satisfactory with the accepted system because the adapter must be fed with the complete spectrum from 20 to (at least) 53,000 cps. Above that upper limit the response may roll off, but for minimum distortion the transmission must be essentially flat to 53,000 cps. The reason for using a small capacitor was to minimize the loading on the discriminator or ratio detector circuit, and since only the high frequencies were needed, the small coupling capacitor was adequate. The cure is obvious—if you have a tuner in which the multiplex jack is fed from the discriminator by a small capacitor, simply replace it with one having a capacitance of not less than .01, and possibly as much as 0.1 μf.

Some tuners employed a fairly high value of *resistance* to isolate the adapter from the normal circuits. This resistor with the input capacitance of the adapter and the capacitance of the connecting cable serves as a low-pass filter, and may roll off the higher frequencies too greatly to allow for optimum performance from the adapter. Again, simply replace the resistor with a capacitor as suggested above. With most of the modern adapters, you are not going to use any of the circuitry in your present tuner after the discriminator or ratio detector even when listening to mono programs, since for simplified switching the mono signal derives from the adapter rather than from the tuner's normal circuit. Thus the isolation provided by either the small capacitor or the resistor is no longer needed.

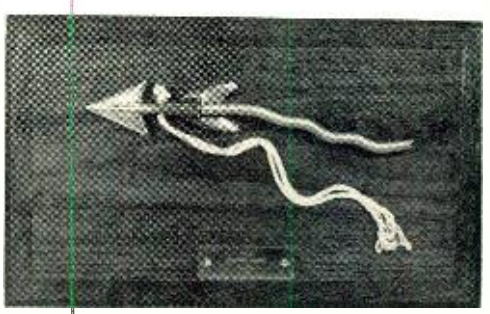
One other problem that has been mentioned by some readers is the presence of a squeal in the output of a tape recorder when the stereo signals are recorded and played back. This is due to the feed-through of the 38-kc subcarrier or the 19-kc pilot to the adapter output, showing up as 57 kc—the third harmonic of the pilot—or as 76 kc, which is the second harmonic of the subcarrier. The bias oscillator on the tape recorder is quite likely to operate in the vicinity of 80 kc on the better machines, and possibly around 60 kc on the less expensive units, and with the large amount of pre-emphasis required with the present standards for tape recording, any 57- or 76-kc present in the signal fed to the tape recorder is quite likely to beat with the bias oscillator frequency and be recorded as 3000 or 4000 cps. Again the cure is fairly obvious, although the hardware for doing it may be more complicated. What is required is one or more rejection filters at the critical frequencies. Some experimentation may be required, and we would welcome knowing of the steps taken by any readers who have solved specific problems. There are so many possible combinations of adapters and tape recorders that it would be an endless task for one person to work all of them out. We feel sure, however, that manufacturers are fully cognizant of these problems and that they will have them all licked before very long.

At least, we hope these comments may solve *some* of the problems our readers will encounter.

THE AES CONVENTION

The Audio Engineering Society has just completed its thirteenth Annual Convention, and an excellent one it was with fourteen sessions and over a hundred papers. At the annual banquet of the Society, John K. Hilliard of Altec received the John H. Potts Memorial Award, Roy Dally of General Electric was given the Emile Berliner Award, and Sherman Fairchild received the Society's own award for outstanding service to the Society.

Frank McIntosh received a special citation for his contributions in the design of high-quality, high-efficiency amplifying systems. Arthur G. Evans, Jr., of Radio Corporation of America, Indianapolis, received a Fellowship for his work in mass production of high-quality disc pressings.



C. J. LeBel, founder and "permanent" secretary of the Society has long been credited with using the "needle" on committee chairmen to get things done on time. As chairmen's hides became tougher, C.J. has had to resort to stronger medicine, and by his own admission he started this year to use a harpoon. Smarting, undoubtedly, from the repeated application of his harpoon, the Awards Committee apparently retrieved one of them, mounted it on a plaque, and presented it to C.J. The idea was so unusual, in our opinion, (though in past years we have had personal experience with the needle), that we reproduce the Harpoon award on this page. Congratulations, C.J., no man ever earned it more.

PICKERING & COMPANY INC. offers the stereo fluxvalve pickup in the following models: the Calibration Standard 381, the Collector's Series 380, the Pro-Standard Mark II and the Stereo 90. Priced from $16.50 to $60.00, available at audio specialists everywhere.

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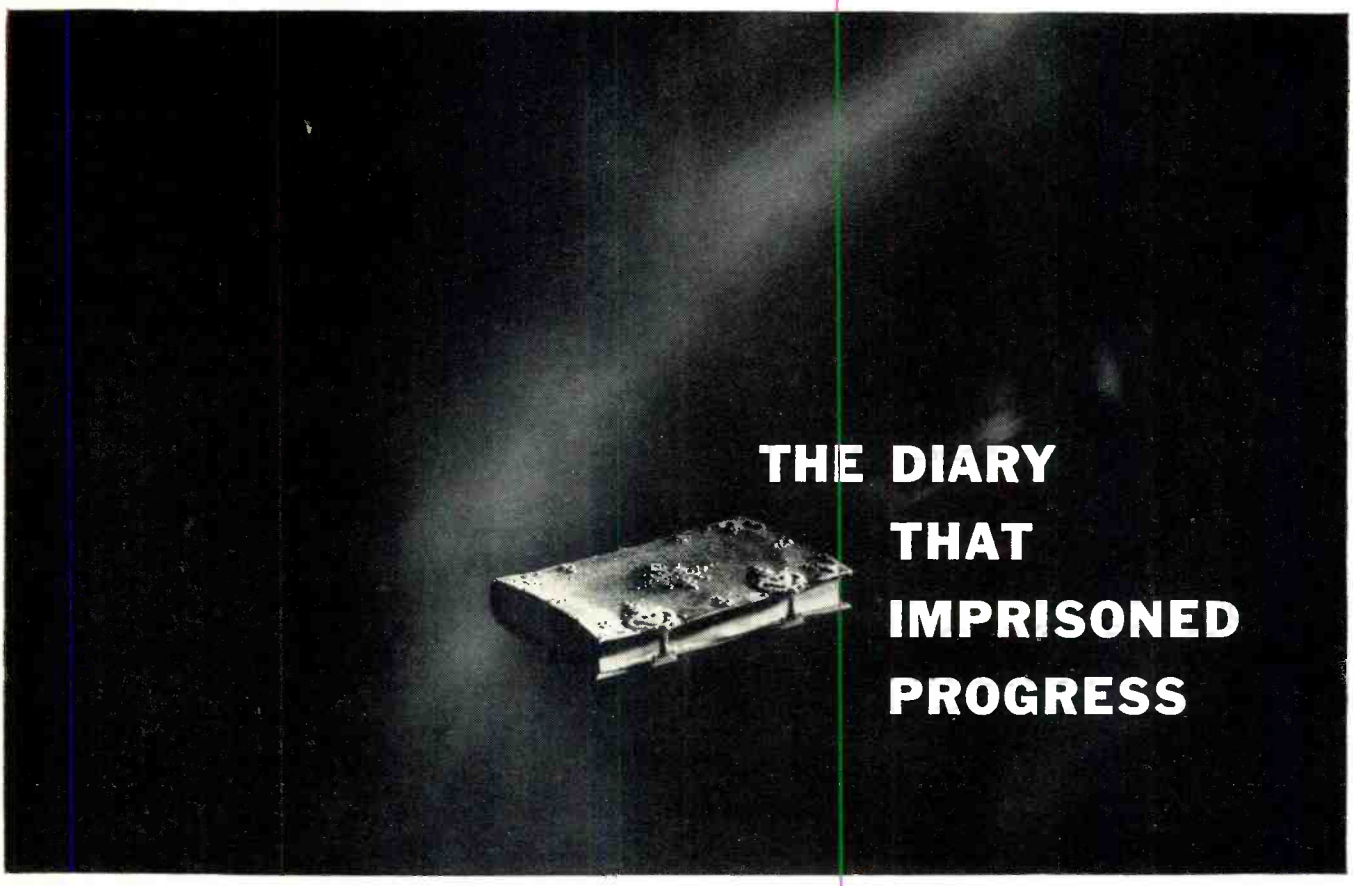

Nearly two centuries ago, Karl Gauss, "Prince of Mathematicians," kept a diary which was destined to become one of the most significant documents in the history of mathematics.

In his diary Gauss jotted down the results of elaborate calculations that had led him to fundamental discoveries in mathematics. But he never published these discoveries, and many of them remained undisclosed during his lifetime.

It wasn't until almost 50 years after Gauss's death that his diary was found and published. Much time and talent, meanwhile, had been spent in duplicating Gauss's efforts. Mathematical progress had been needlessly slowed.

In contrast, today's scientists and engineers are alert to the importance of sharing their findings through publication. In fact, the number of definitive papers published in a scientific or technological field has become a sure sign of the creative effort in that field.

Bell Laboratories scientists and engineers publish more than 800 papers a year, reporting new observations and new thinking in the arts and sciences that serve communications. They have also authored more than 50 technical books, many of which have become standard works of reference. The steady stream of new information that comes out of Bell Laboratories again reflects the scope and depth of the creativity that works to improve Bell System communications.

BELL TELEPHONE LABORATORIES

World center of communications research and development

Common-Bass Stereo Speaker System

FRANCIS F. CHEN*

One speaker can handle the bass of both stereo channels if the crossover frequency is low enough to avoid directionality.

THERE ARE TWO COMMON PROBLEMS that the hi-fi hobbyist often faces. One is that his good wife, understanding though she may be in other ways, objects to the "Laboratory Look" in her living room. The other is that his good wife, music-lover though she is, thinks that one-half of the family budget is too much to spend on electronics. Now everybody who reads this magazine knows that you can't get good music reproduction without a certain minimal outlay of cash or without a certain minimal number of components and interconnecting cables, which may not all look beautiful. And *nearly* everybody does not have the inexhaustible capital and engineering time necessary to build one of the "ultimate" systems that so often appear in print.

The more realistic problem of getting highest quality and versatility (important to the hobbyist) within the ever-present restrictions of cost and decor is a challenging one. To solve it, one must give careful thought as to what is important and what is superfluous. To be sure, in the present case the problem of cost was solved not only by "Doing-It-Myself" and by careful choice of components, but also to some extent by the Principle of Infinitesimal Accretion ("You don't mind, dear if I get a couple of EL-34's this week?"); but the latter ploy is at any rate a useful one for the hobbyist to have at his command.

The Common Woofer

The first problem considered was that of the most expensive part of a hi-fi system. Why do good speakers cost so much? The answer is that they do not, as long as one sticks to 8-in. speakers. It is only the 12- and 15-in. speakers that bear the disheartening price tag. It is, however, an inescapable fact that good bass requires large piston area and low resonance. The obvious solution, then, is to use three speakers: two matched 8-in. units for the mid-range and treble of the two channels, and a 15-in. woofer for the common bass. This costs considerably less than two 15-in. full-range units. The savings are partially offset by the need (to be explained later) for three amplifiers instead of two, and for a crossover unit. The latter can easily be constructed, however, using the two-tube circuit to be described later; and it turns out that three amplifiers, of which only one need handle the bass, do not necessarily cost more than two amplifiers, both of which must produce, say, 25 "clean" watts at 30 cps. Again the costliness of good bass has made itself apparent, this time in terms of the power handling capacity needed in the amplifier, and in particular in the amount of iron needed in the output transformer.

At this point I should note that in the choice of a woofer I considered using a battery of, say, 20 or 30 small, cheap speakers in a series-parallel array, instead of using a single 15-in. speaker. The piston area would indeed be large, and one might hope that the distortion would be small in spite of the cheapness of the magnets, because the cone excursion of each speaker would be small. However, besides being a somewhat clumsier arrangement, this method would also entail some risk in that the flimsy magnets may not properly damp the cone motions. Besides, 20 or 30 speakers are not exactly cheap. It was therefore decided to leave the multiple-speaker array to possible future experimentation, in spite of several favorable reports in the literature.

Crossover Frequency

The next problem to consider was the choice of a crossover frequency. Now it is a well-known physical principle that two signal sources cannot be distinguished directionally if they are separated by a distance of the order of magnitude of the wavelength emitted. Since the geometry of my living room requires the speakers to be about 13 feet apart, and since a wavelength of 13 feet corresponds to a frequency of 85 cps, it would appear that a crossover well below 100 cps would be necessary to avoid losing any stereophonic effect through the use of a single woofer for both channels. However, the dividing line is a fuzzy one: one cannot say that at 100 cps there is definitely no directional effect, while at 110 cps, or 150 cps, there definitely is. Aside from the vagueness of the physical principle cited above, the acoustics of the room and the psychology of hearing would also enter in; and indeed, common-bass stereo systems have been made with crossover well above 100 cps. The decision, therefore, was to make the crossover frequency as low as possible, consistent with other limitations.

In listening tests, it may sometimes appear that a low note, below 100 cps, has some directionality. This is probably due to the sudden onset of the note. This initial transient consists of higher frequency components and would be reproduced by the tweeter. For this reason, directionality should be tested only with steady tones.

The "other limitations" mentioned above are the ones imposed by the bass response of the 8-in. speakers. The units chosen were Wharfedale Super-8 FS/AL's, which have high flux density, good efficiency all the way to 15,000 cps, smooth response, and a soft suspension. The free-air resonance of these speakers is around 70 cps. Because of the decor of the living-room, these speakers had to be mounted in different types of cabinets; therefore, differences in cabinet resonances would cause the speakers to be mismatched in the low-frequency region. For this reason, it was felt that the crossover frequency should occur at least an octave above the free-air resonance of the speakers, and a frequency of 150 cps was chosen.

Type of Crossover

The usual type of crossover, an LC circuit inserted between the speaker and the amplifier, cannot easily be obtained at a frequency as low as 150 cps. The reason is that the capacitor has to be large—in the neighborhood of 100 μf. This would be most unwieldy unless one used an electrolytic. However,

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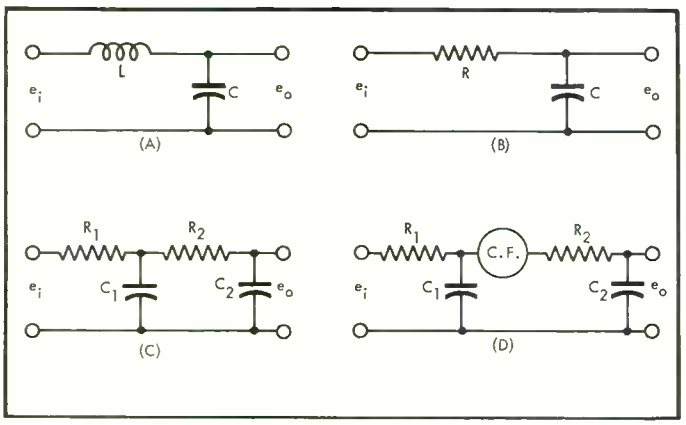

Fig. 1. Simple crossover networks. Only low-pass networks are shown: the corresponding high-pass networks would be similar with the elements interchanged.

electrolytics do not maintain their capacitance value very accurately and, moreover, would have to be used "back-to-back" (requiring double the capacitance in each) in order to "hold off" the a.c. voltage. When used this way the capacitance of the electrolytics can change suddenly in the middle of a loud passage! The inductor, of the order of 10 mh, would also be a large affair, since it would have to be wound with heavy wire to avoid a large insertion loss.

The alternative is to use an "electronic" crossover ahead of the amplifier, and this is the more sophisticated and the more soul-satisfying way of doing it. This would require a separate amplifier for each speaker, but, as mentioned before, this is not necessarily more expensive. By having separate amplifiers and speakers for the highs and the lows, one gains in addition a most attractive bonus: intermodulation distortion (except in the program source) is for all practical purposes completely eliminated!

An attenuation of 12 db per octave is generally recommended for the crossover network. One can achieve this by a half-section LC filter, as in (A) of *Fig.* 1, or by two simple RC filters, as in (C) or (D) of *Fig.* 1. The LC filter has a distinct advantage in that the phase shift is 0 deg. on one side of the crossover frequency and 180 deg. on the other. Thus one can bring the high- and low-frequency speakers into phase by merely reversing the leads on one speaker. However, the use of an inductor at the preamp level would be asking for trouble with hum pickup. This leaves the RC network, with its horrible phase shift characteristics, and leads us to a discussion of phase shift and frequency response in low-frequency RC crossovers.

The Two-Section RC Crossover

Consider first the one-section low-pass filter in (B) of *Fig.* 1, in which the resistor, R, and the capacitor, C, form a simple voltage divider (operating into infinite impedance) for the input signal, e_i. At any angular frequency, ω, the output voltage e_o will be given by

$$\left(\frac{e_o}{e_i}\right)_L = \frac{1}{j\omega C}\Big/\left(R+\frac{1}{j\omega C}\right) \qquad Eq.\ (1)$$

If we define the crossover frequency, ω_o as $1/RC$,

$$\left(\frac{e_o}{e_i}\right)_L = \left(1+\frac{j\omega}{\omega_o}\right)^{-1} \qquad Eq.\ (2)$$

The corresponding high-pass network, with R and C interchanged, would give

$$\left(\frac{e_o}{e_i}\right)_H = R\Big/\left(R+\frac{1}{j\omega C}\right) = \left(1+\frac{\omega_o}{j\omega}\right)^{-1} \qquad Eq.\ (3)$$

At frequencies which are low compared with ω_o, *Eq.* (2) shows that $(e_o)_L \approx (e_i)_L$, and at frequencies which are high compared with ω_o, *Eq.* (3) shows that $(e_o)_H \approx (e_i)_H$. At frequencies near ω_o, there is a phase shift, since there is a sizable imaginary part to *Eq.* (2) and (3); and the question arises as to how the outputs from the high- and low-pass networks are to be added.

If the two signals are added together first and then fed into the same speaker, the acoustic output would be found by adding *Eq.* (2) and (3) and then squaring the result:

$$\left[\left(\frac{e_o}{e_i}\right)_L+\left(\frac{e_o}{e_i}\right)_H\right]^2 = \left[\frac{1}{1+\frac{j\omega}{\omega_o}}+\frac{1}{1+\frac{\omega_o}{j\omega}}\right]^2 = 1 \qquad Eq.\ (4)$$

Even though the phase shift is 45 deg. in the critical region around $\omega = \omega_o$, the phases are such that the vector sum is always unity. Thus the frequency response is flat throughout. The same would be true, but not as exactly, if the two outputs were fed to two speakers right next to each other. However, if the two speakers were far apart and the crossover frequency fairly high, the total acoustic intensity would be the sum of those from each speaker; that is, the voltages would not add in phase and would have to be squared before adding:

$$\left(\frac{e_o}{e_i}\right)_L^2+\left(\frac{e_o}{e_i}\right)_H^2 = \frac{1}{1+\left(\frac{\omega}{\omega_o}\right)^2} + \frac{1}{1+\left(\frac{\omega_o}{\omega}\right)^2} = 1 \qquad Eq.\ (5)$$

This is also equal to *1*! From this standpoint, the single RC network is the ideal crossover; the frequency response is flat no matter how the signals are added.

Incidentally, you can easily see that for the LC circuit of (A) in *Fig.* 1, e_o/e_i is real, and there is no difficulty with phase shifts. However, just *because* e_o/e_i is real, the equations analogous to *Eq.* (4) and (5) cannot both be true; only *Eq.* (4) is true in the case of the LC circuit.

The trouble with the single RC section is, of course, that it rolls off at only 6 db per octave, which usually does not provide sufficient isolation of frequencies. In our particular case, with f_o at 150 cps, this means that the cabinet resonances of the 8-in. speakers at around 70 cps will be only 6 db down —not a very great difference to the ear. The next logical step would be to try two RC sections in cascade, as in (C) of *Fig.* 1. Here, if R_1 and C_1 are equal to R_2 and C_2, the first section would not be working into a large impedance and would not provide as fast a rolloff as it should. This can be improved if the second section is made higher in impedance than the first, or better yet, if the two sections are isolated by a cathode follower, as in (D) of *Fig.* 1.

In this case the response is found by applying *Eq.* (2) and (3) twice:

$$\left(\frac{e_o}{e_i}\right)_L = \left(1+\frac{j\omega}{\omega_o}\right)^{-1}\left(1+\frac{j\omega}{\omega_o}\right)^{-1} \qquad Eq.\ (6)$$

$$\left(\frac{e_o}{e_i}\right)_H = \left(1+\frac{\omega_o}{j\omega}\right)^{-1}\left(1+\frac{\omega_o}{j\omega}\right)^{-1} \qquad Eq.\ (7)$$

This has been written this way, without the exponent *2*, because by "squaring" we shall always mean multiplying a quantity by its complex conjugate, which

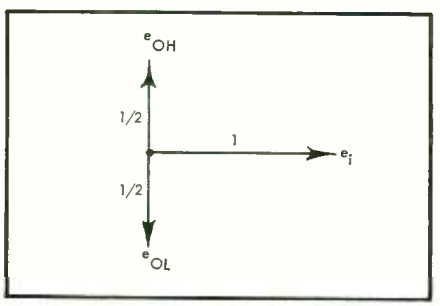

Fig. 2. Behavior of the dual RC network at the crossover frequency.

is not what is required here. Now if we square and then add, we will not get unity:

$$\left(\frac{e_o}{e_i}\right)_L^2 + \left(\frac{e_o}{e_i}\right)_H^2 = \left(1+\frac{\omega^2}{\omega_o^2}\right)^{-2} + \left(1+\frac{\omega_o^2}{\omega^2}\right)^{-2} \neq 1. \quad Eq.\ (8)$$

Moreover, the phase angle between the two signals will change with frequency. At the crossover frequency, $\omega = \omega_o$, each of the terms in the above equation is equal to ¼, so the total intensity is only ½ of what it should be.

Most previous designers have gotten around this either by negative feedback to lower e_i in the flat regions of the response curves or by using different ω_o's in the low-pass and the high-pass sections, so that at the actual crossover point, $(e_o/e_i)^2$ for each section is down only to ½. However, this still does not provide unity gain and zero phase shift at other frequencies. These considerations have been given in detail in two excellent articles by Norman Crowhurst[1,2], the latter of which, unfortunately, did not appear until my system was all finished. The point I want to make here, however, seems to have been missed in these articles, although Mr. Crowhurst touches on this in a more recent article[3] which begins to attack the most basic and difficult problems of stereophonic sound. And that point is, why should RC crossovers be designed so that the separate intensities of the two speakers add up to unity? Isn't it possible that under some circumstances the sound waves from the two speakers add in phase?

This depends on the frequency. At very high frequencies phasing cannot make any difference; there are so many reflections that phasing is all mixed up by the time the waves reach the ear anyway. At 6000 cps, the wavelength is only a couple of inches; and if phasing mattered, the cone of a tweeter would have to lie in the same plane as the cone of the midrange unit, within half an inch or so. This is impossible, since cones are deeper than that. In actual practice, I have been unable to tell the difference when the leads are reversed to a tweeter which crosses over at 8000 cps. At middle frequencies, which are important for the stereophonic effect, phasing makes a difference, but just how is a complicated business. Everyone knows, however, that if the phase were as much as 180 deg. off, the stereo effect is lost for two spatially separated speakers. Our interest now is in what happens near the crossover frequency to a midrange unit and a woofer which are not necessarily separated. In this case the effect of phasing is probably just as great, but easier to analyze. At very low frequencies, it seems to me, phasing must be correct and one must add the (complex) signals to the two speakers together first before squaring, as in *Eq.* (4) to get the total sound intensity. This must be true because the bass reflex principle is known to work; if only total intensity mattered, the back wave from the port of a reflex cabinet would add to the speaker resonance instead of reducing it.

If this is true, observe what the double RC crossover would do. If we add *Eq.* (6) and (7) without squaring them first, we would get (after multiplying numera-

1 N. Crowhurst, "The RC Crossover Compromise," AUDIO, July 1957.

2 N. Crowhurst, "Electronic Crossover Design," AUDIO, Sept. 1960.

3 N. Crowhurst, "Audio Matrixing," AUDIO, Nov. 1960.

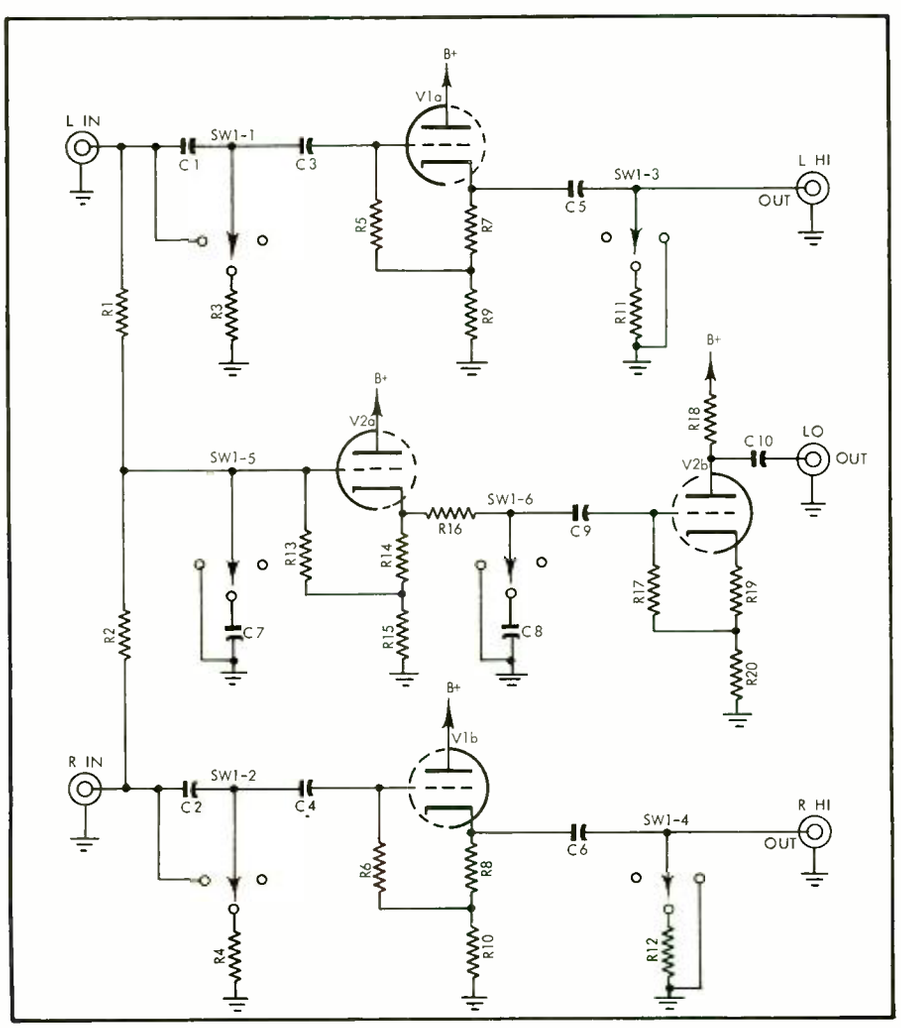

Fig. 3. Schematic diagram of the electronic crossover.

tor and denominator by ω_o^2 and $j^2\omega^2$ respectively),

$$\left(\frac{e_o}{e_i}\right)_L + \left(\frac{e_o}{e_i}\right)_H = \frac{\omega_o^2}{(\omega_o + j\omega)(\omega_o + j\omega)} + \frac{j^2\omega^2}{(j\omega + \omega_o)(j\omega + \omega_o)} \qquad Eq.\ (9)$$

Now let us reverse the leads to one speaker, so that the sign between the two terms becomes minus, thus cancelling the j^2, and then combine over the common denominator:

$$\left(\frac{e_o}{e_i}\right)_L + \left(\frac{e_o}{e_i}\right)_H = \frac{\omega_o^2 + \omega^2}{(\omega_o + j\omega)(\omega_o + j\omega)} \qquad Eq.\ (10)$$

Upon squaring, each factor in the denominator becomes $\omega_o^2 + \omega^2$, and we get unity. Voila! No shifting of crossover points with the resultant mess in phase shifts; no complicated alignment procedure to perfect a feedback circuit.

For those who like vectors, this is what happens at the crossover frequency (*Fig.* 2). The voltages from the high-pass and low-pass filters have magnitude ½ and are shifted ±90 deg. in phase relative to the incoming signal, so that they are 180 deg out of phase with each other. If we square each separately, each becomes ¼, and the sum is only ½. However, if we reverse the leads to one speaker to bring the high and low signals into phase and then add them before squaring, we get 1. Things work out equally nicely at all other frequencies, as long as such simple addition of phased signals occurs.

How low a frequency must one have before this occurs with actual acoustic signals? To determine this, a simple test was performed in the living room. Equal low-frequency signals were fed from an oscillator, through amplifiers, to two speakers. In this test the speakers were separated, but this is unimportant, since the assumption is that the crossover frequency is so low that there is no directionality. The intensity of the sound at the opposite end of the room was observed both by ear and by a microphone feeding an oscilloscope. As the leads to one speaker are reversed, the intensity should go from 0 (complete cancellation) to 4 times the intensity of one speaker alone, if the acoustic waves added in phase. Of course complete cancellation does not occur in actual practice, but at 100 cps, there was a large change in loudness as the leads were reversed. At 150 cps the change was much less pronounced. The conclusion was that the simple circuit in (D) of *Fig.* 1, with two identical RC sections in cascade, should be used with crossover frequencies below 100 cps, and that at our previously chosen crossover frequency of 150 cps, the frequency response of this circuit is only approximately flat but that it should be as good as that of the fancier circuits usually used.

The Two-Tube Stereo Crossover

Before building the circuit of *Fig.* 3, we considered the two electronic crossovers on the market. One, the Marantz, seemed to be carefully designed with feedback; but it was prohibitively expensive. The other, by Heathkit, was unnecessarily bulky for our purpose and seemed to have been designed to provide a peak at the crossover frequency.

The circuit of *Fig.* 3 serves the functions of dividing the frequencies above and below 150 cps for each channel and of adding the low frequencies from the two channels together. Cathode followers are used both to provide high input impedance and to isolate the two sections of the cascaded RC networks. Only two tubes, each a twin triode, are necessary; and the whole circuit can be enclosed in a 3-in. × 5-in. × 7-in. aluminum utility box, which also contains two octal sockets for distributing B+ and filament power to two preamps. A four-prong Jones plug receives power from the bass amplifier.

The circuit is exceedingly simple. In the left channel (the right channel is identical), C_1 and R_3 form one RC network with $\omega_o = 1000$, corresponding to a crossover frequency of about 150 cps. The cathode follower V_{1A} then lowers the impedance level so that the second RC section, consisting of C_5 and R_{11}, with the same ω_o, can be made of such low impedance elements that no output cathode follower is necessary to drive the cable to the amplifier. In the bass channel, R_1 and R_2 serve both to add the left and right signals together and to form the first RC section with C_7. The second RC section, R_{16} and C_8, follows the cathode follower V_{2A}. An amplifier stage, V_{2B}, with a gain of approximately 2 is necessary because the adding network cuts the bass gain by 2. R_{18} and R_{20} may be varied, keeping their sum constant, to change the gain of the bass channel, depending on the gain of the bass amplifier. Here the gain has been made slightly less than 2 because my bass amplifier has higher gain than the treble amplifiers. The final adjustment, of course, is to be made with the level controls on the amplifiers. When testing with a signal source in only one channel, be sure to short the other channel input to ground, or the adding network will not halve the bass gain the way it would in actual use.

The other two positions of the switch SW_1 provide crossover frequencies of 0 and ∞—that is, with the entire program going straight through to the tweeters alone or to the woofer alone. This frill may be omitted, if desired, but is quite useful for checking the system as well as for having music even when one of the speakers or amplifiers is temporarily out of commission. The impedances of the input RC sections have been chosen so that for any of the switch positions the preamps are not loaded by less than 0.5 megohm at any frequency below 20,000 cps. Such a high impedance level is possible only because of the high effective input impedance of the cathode followers. This is the reason, for instance, that the amplifier stage in the bass section cannot be the input stage. The 0.5-megohm input impedance allows the crossovers to be used with any preamp, including those, such as the Dynakit, which will not drive an impedance smaller than 0.5 megohm without internal modification. Several crossover frequencies can be incorporated and selected with the switch SW_1 if one wants to build a more versatile crossover. However, if one goes to a lower frequency than 150 cps by, say, increasing R_3, the input impedance of the cathode follower will no longer be negligible; and if one goes to a higher frequency, the ω_o's for the RC sections should be staggered to provide uniform frequency response, since the acoustic signals will no longer add in phase, according to our earlier discussion. In my unit I have incorporated crossovers at 300 and 600 cps in case the power handling capacities of the speakers have to be used to the fullest; however, the occasion has never arisen.

Precision resistors and capacitors can be used for the elements of the RC networks, but this expense is not necessary. It would be sufficiently accurate to use 20 per cent elements and then adjust R_3 and R_4 and, if necessary, C_1 and C_2 until all three sections gave an e_o/e_i of ½ at the same frequency. If an oscilloscope with a horizontal input is available, a slightly more sensitive method would be to put the input signal from an oscillator on one axis and the output from the crossover on the other and to find the crossover point by finding the frequency at which the Lissajous figure can be made into a circle. The adjustment can be made simply by adding different resistors in series or parallel with R_3 or R_4 until the crossover point occurs at the proper frequency. The exact frequency does not matter so much, of course, as the matching of the crossover frequency in the three sections.

Two warnings should be given to the constructor: first, do not turn the switch SW_1 when the loudspeakers are

on, since the discharging of the coupling capacitors will cause a loud pop. Second, be sure the B+ supply is sufficiently well filtered—the amplifier section is sensitive to hum. Although the circuit was designed to operate with a B+ of 300 v, at which the tube currents are 3 ma in the cathode follower sections and 6 ma in the amplifier section, I had to add several filter sections to my B+ source (the bass power amplifier), dropping the B + to 200 v, before the hum was eliminated. Both the crossover unit and my Dyna preamps, however, operate well at 200 v.

Alignment of the Speakers

In order to phase the three speakers properly, the following procedure was adopted. First a signal at the crossover frequency of 150 cps was fed into the woofer (on the left) and the right speaker, and the phase of the latter was adjusted to the position in which the signal sounded louder. Then the left and right speakers were brought into phase by using the white noise signal on the Audio Fidelity Test Record. White noise, I find, is the most unambiguous method to check phasing. The gain of the bass channel was then adjusted to get smooth response with the low-frequency glide tone on the *Popular Science* Test Record No. 1.

The Speakers

The other components in the system and the reasons for their choice will now be described, starting at the back end—the speakers. The cabinet for the woofer is a Karlson, built from ¾-in. plywood, veneered with walnut, and finished with boiled linseed oil (*Fig.* 4). The joints were both glued and screwed (using a total of 130 screws), and weatherstripping was used to provide an air tight seal on the back. The inside surfaces were shellacked, with Fiberglas damping material on the two recommended surfaces. The Karlson has a reputation for making a cheap speaker sound good, and indeed it sounded fine with my old $20 15-in. woofer in it. In one splurge, however, I acquired an Altec 803B, the least expensive of the first-rate woofers, and now the speaker is too good for the cabinet. This speaker resonates at 25 cps in free air, but its output at the lowest frequencies is limited by the cabinet, and, to some extent, by the size of the room. The Karlson also has a peak from 70 to 90 cps; fortunately, this peak is rather broad, presumably because of the exponential slot. Some day I may get around to mounting the 803B in an exponential horn or an infinite baffle, although I would hate to part with my first veneering job, which turned out rather well.

The midrange-tweeter speakers are both Wharfedale Super 8's, but mounted differently. The left unit is housed in a small matching cabinet on top of the Karlson, as shown in *Fig.* 4. The back of the cabinet is open, covered only with a grill cloth to keep out the dust.

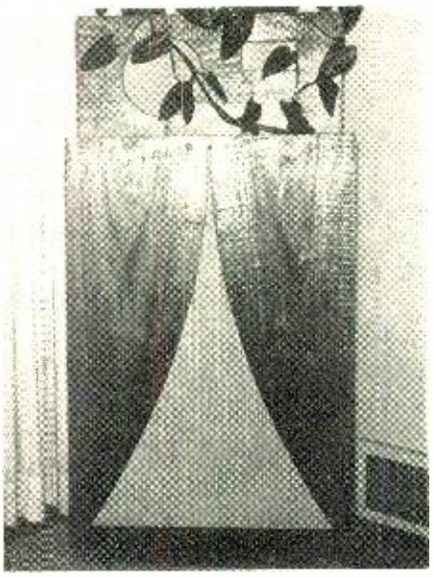

Fig. 4. The woofer and left speaker.

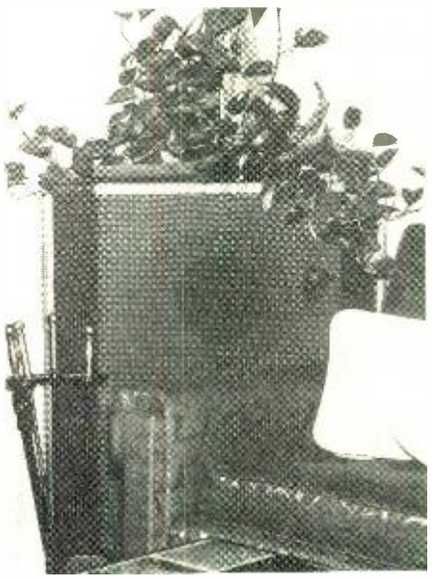

Fig. 5. The right speaker.

This arrangement was my solution in the monophonic days to the problem of wanting to mount the midrange unit open-backed, but not having provision for it within the Karlson. The fact that the two cabinets are physically separate also allows for flexibility in arrangement of the furniture. The small rectangular opening in the open-back cabinet is not a port but a mounting hole for a University 4401 tweeter. This was originally added to the Super 8 with a crossover at 8000 cps, but it has since been disconnected since the Super 8 was found to need no help at all at the highest frequencies, and the tweeter merely served to unbalance the left and right channels.

The right speaker, as shown in *Fig.* 5, is mounted in an old corner bass reflex cabinet originally built for a cheap 12-in. speaker. Fortunately, the resonance of the Super 8 (a little below 70 cps), is close to that of the original 12-in. speaker, and no retuning of the port was necessary. Moreover, the Super 8 is not being used as a full-range speaker anyway. There was some worry that the difference in cabinetry for the left and right speakers, necessitated by considerations of decor, would unbalance the two channels. However, this did not turn out to be the case. The relative positions of the speakers are shown in *Fig.* 6. The chair between them is of course not the one used for listening, but the balance is so good that even from this chair one can hear a soloist apparently standing in the middle of the opposite wall and staying there.

You have no doubt noted the extreme separation of the speakers—some 13 feet—and the fact that they are "beamed" toward the center of the room. This means that there is only one really good listening position. However, this has not turned out to be a great disadvantage, since I have found that all serious listening has to be done alone anyway. When there is a crowd,

Fig. 6. Placement of the speakers.

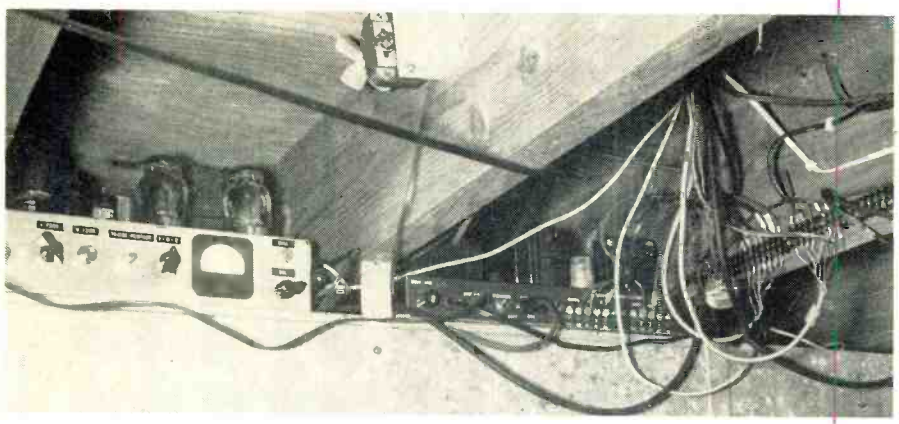

Fig. 7. The amplifiers.

there is always conversation. In spite of the speaker separation, there is absolutely no "hole-in-the-middle." On monophonic sources, the sound comes out of the middle of the wall between the two speakers. If a program has been recorded with too much separation, a turn of the blend switch fills in the hole to any degree desired.

The Super 8's seem to have presence peaks around 2000 and 5000 cps, which are accentuated by the sensitivity of the ear in this frequency range. A broadband RLC filter, constructed with a hand-wound choke, and centered around 4000 cps, was inserted in the speaker circuit to attenuate these peaks and provide a smoother apparent frequency response curve. However, most music did not sound as good with this filter in place as without, mainly because solo instruments would sound muffled and far away. With the filter in, the sound was more nearly like that from "colorless" speaker systems such as the acoustic Research series, but on A-B comparison I almost always prefer the Super 8's as they come. The filtering action of my wife's plants fortunately seems to have a negligible effect.

Amplifiers

The amplifiers, shown in *Fig.* 7, are located on top of a heating duct in the basement. Also visible are the connecting cables going through a hole in the floor to the living room, a patch panel for distributing speaker leads to different parts of the house, and a fan for cooling the output tubes of the bass amplifier. The emphasis, it should be quite apparent, has been on accessibility rather than neatness. The amplifiers are actually so close to the preamps that the standard length cables supplied with the preamps could be used.

The homemade bass amplifier, which also supplies all the preamp and crossover power, employs a modified Dynakit circuit. An ammeter has been added to check the current in the output tubes, the bias and balance being independently adjustable. Controls have also been added for independent adjustment of current and voltage feedback, and for changing from ultralinear to triode operation. These switches have since been found to be unnecessary, the damping being already optimal in the original design.

The treble amplifier is an Eico HF-86 dual 14-watter. This amount of power is entirely adequate for the efficient Super 8's, particularly since the amplifier does not need to supply any bass. With the wife and children safely out of the house, it is possible to turn the volume up to almost the threshold of pain without any sign of distortion.

The bass amplifier will deliver up to 50 watts. Since it is used only for the region below 150 cps, this is more power than is necessary for ordinary program material. However, if there are power peaks in the program sufficiently large to produce distortion, these peaks will occur in the bass, simply because such a large peak in the midrange would be painfully loud. Moreover, running the bass amplifier way below its power rating would practically eliminate harmonic distortion at the lowest frequencies.

Preamps and Control Circuits

The preamps are Dynakit PAM-1's and a DSC-1 stereo control. These were chosen for their versatility, desirable combination and arrangement of controls, and well thought out and sophisticated circuitry, as well as for the distortionless and humless reproduction they are known for. I have had only two complaints with the Dynakits: first, the master volume control had to be changed several times (at Dyna's expense) before one was found that tracked reasonably accurately; second, there is no provision for having both a tape head and a second RIAA input. I believe the latter has been fixed in the PAS-2, which came out after I had bought my preamps. The PAS-2 has several advantages over the PAM-1 plus DSC-1 combination, particularly in cost, but does not have quite the versatility. I still think the volume control should have been changed to a stepped one, even if only 20 per cent resistors are used.

The control panel is shown in *Fig.* 8. Under the Dynakits are two homemade chassis with etched brass panels and knobs to match the preamps. The unit on the left contains the speaker controls, phase reversal switches for the three speakers, a switch for inserting the presence filter mentioned before, and a switch for connecting the left amplifier to the remote outlets, to either an 8-ohm or a 4-ohm extension speaker or to both an 8-ohm speaker and the normal left speaker. The knob marked "VU meter" will be explained later. The unit on the right, under the end of the preamps which are insensitive to hum, contains three relays. Power to the entire system is turned on through a holding relay. This relay can be released, thus turning everything off, either manually or automatically at the end of a tape or record, as selected by the center switch. There is also provision for plugging in a timer to turn the system on and off, for recording radio programs *in absentia*. One of the a.c. switches on the preamps may be used to turn off the amplifiers alone; the other, for turning off the program sources alone.

The Program Sources

The preamps and program sources

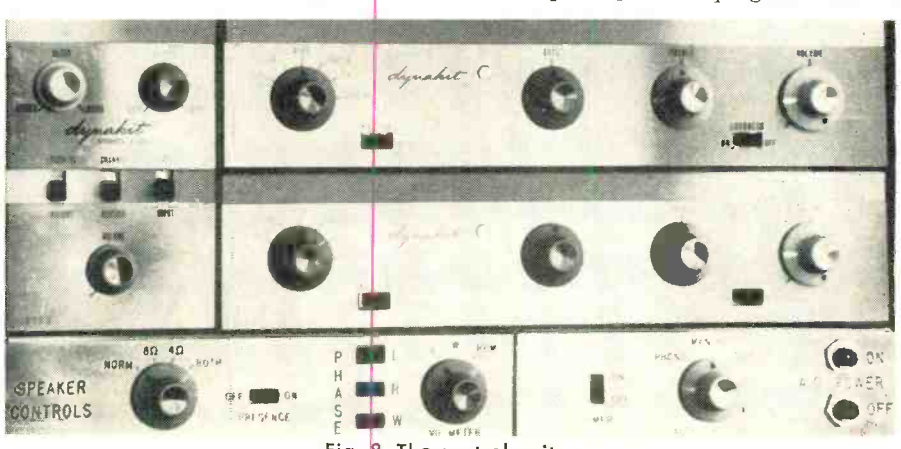

Fig. 8. The control units.

THE ONLY TURNTABLE/CHANGER BETTER THAN THE DUAL-1006 ...IS THE DUAL-CUSTOM.

But they look the same? Naturally. All the changes and refinements are underneath. Where it counts. No added frills or chrome. Only improvements—on a machine that offers honest, outstanding performance—performance and operating features that any other unit would give its eyeteeth for.

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are shown in *Fig.* 9. The cabinet was a floor sample picked up for $10, to which lucite doors and my wife's artistic design have been added. The electronic crossover can be seen under the cabinet, together with the seemingly unavoidable mess of cables. Records are stored in the lower part of the cabinet, and tapes on the small shelf in the adjoining bookcase on the right. The tuner is a Bogen R660, the only component left from the first incarnation of this system and the first one due to be replaced, although it still works quite well.

The enclosures in the cabinet are only about 13-in. × 17-in. × 15-in. deep and originally housed only a Miracord XS-200 changer with a GE GC-7 cartridge. It was obvious that no ordinary turntable or tape recorder could fit in such a space, and that expanding to a larger cabinet would raise howls from you-know-who. Fortunately, there are two components of high quality which do not take up any more room than necessary. They are also very reasonably priced.

The turntable is a Weathers KL-1 kit, mounted on an aluminum plate suspended above a wooden base. The cartridge and arm chosen is the B & O TA-12 combination. In the turntable base are mounted an hour-counter to keep track of the stylus wear, and a Realistic dual VU meter. The latter is connected across the 32-ohm taps of the Eico dual amplifier to give a little more gain in monitoring the signal actually arriving at the speakers. By means of a switch on the speaker control panel, the left meter can also be put across the woofer or an external speaker. The turntable is lighted by a 6-watt fluorescent lamp at the top front of the cabinet. The light also serves as a strobe lamp. To reduce hum, the ballast and starter for the lamp are located in the basement. The lamp is switched by one of the unused loudness switches on the PAM-1's.

The tape deck is a Viking Stereo Compact RMQ quarter-track machine with two built-in recording amplifiers. This and the Tandberg 6 were the two high-calibre decks which would fit in my cabinet, and, unfortunately, the difference in price was a factor of 2. The Viking is an excellent deck, with a .00009-in.-gap playback head and a separate wide-gap record head, making slow-speed quarter-track recording a reality. I find that with sufficient treble boost, the loss in quality at 3¾ ips is quite acceptable for most music, except when there are high-pitched percussion instruments, and I now do most of the recording off the radio at 3¾ ips, getting 6 hours of music on a single 1800-ft. reel. The Viking is made for hobbyists like myself, and between the Viking and the Dyna preamps, versatility is virtually unlimited. At the moment I do not have playback preamps on the tape deck, and the playback heads are connected directly to the "special" input of the Dynakits, so that the tape-monitor switch cannot be used. However, because of the great flexibility, I can still monitor monophonic recordings by using one preamp for the program source and the other for tape playback, and using the channel reverse switch as a monitor switch. The VU meters on the recording amplifiers are very useful; however, they do not light up, and I had to add pilot lights to show when the amplifiers are on.

I now tape all of my new stereo records, using a slightly greater than normal stylus force, and play the records only on special occasions. Aside from reducing record wear, this practice also eliminates the necessity of meticulously dusting the record each time and of changing records every 20 minutes.

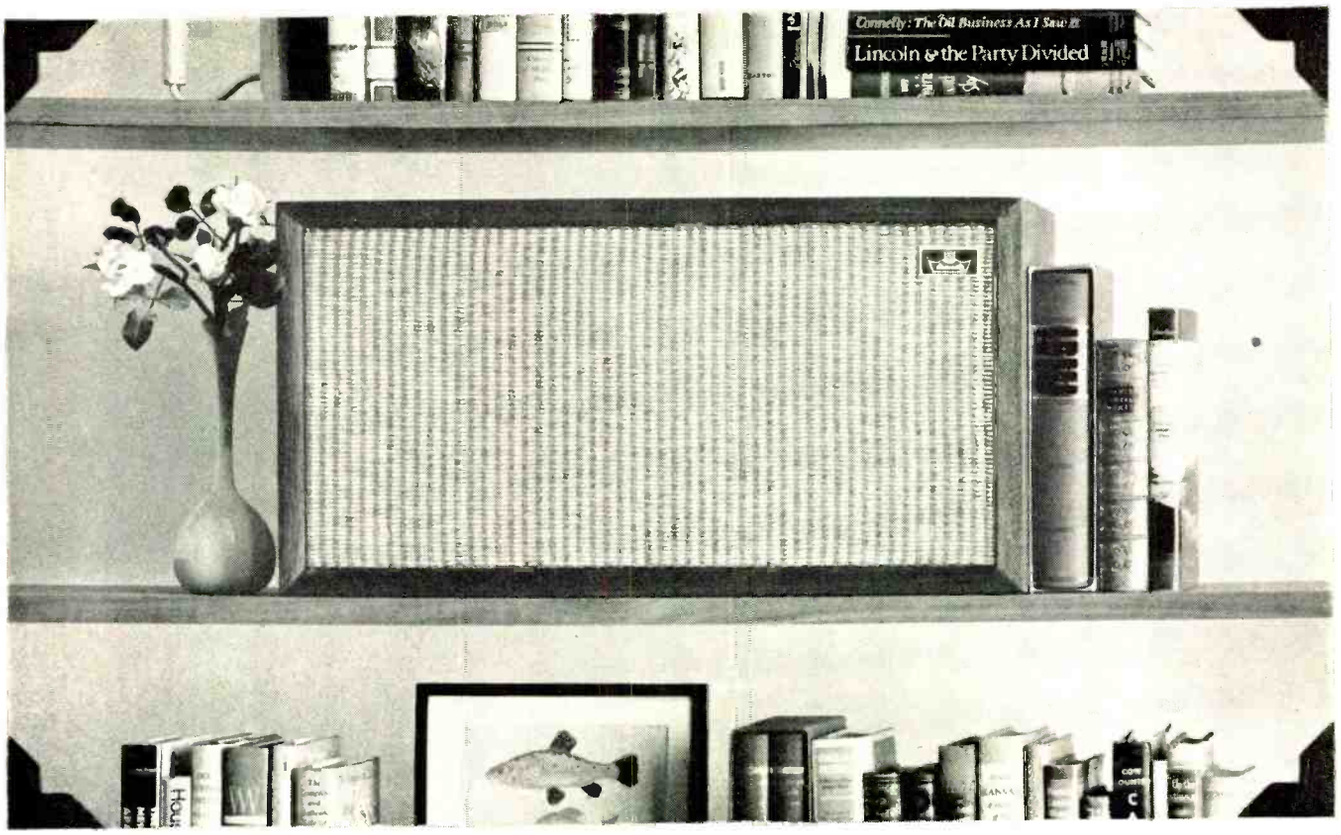
After writing this article, I got up the courage to add up the cost of this system. I came to the conclusion that, exclusive of the tape deck, it can be reproduced for less than $500, plus an awful lot of work. For $550 to $600, one can probably buy a "standard" system of similar quality, but without the versatility and luxury features of this system. Although I would hesitate to recommend this common-bass speaker system to the average music listener, I think it deserves consideration by audio hobbyists. The common-bass speaker system is particularly useful when the woofer can be mounted in a wall, using a closet, a garage, or another room as an infinite baffle. The location of the woofer in the room would be immaterial because of the low crossover frequency, and the Super 8's would require very little room. If the Super 8's were properly baffled as full-range units[4], the crossover could be reduced to below 100 cps; then our assumptions of in-phase addition of acoustic signals and of non-directionality of the bass would hold much more accurately. The common-bass system would also be useful to those who have "full-range" speaker systems which have insufficient output below 60 cps, and who wish to add a single woofer to supplement the extreme bass. **AE**

Fig. 9. The home-decorated equipment cabinet.

PARTS LIST

$R_1, R_2, R_5, R_6, R_{13}$	1 megohm
R_3, R_4	2 megohms
R_7, R_8, R_{14}	2200 ohms
R_9, R_{10}, R_{15}	47,000 ohms, 1 watt
R_{11}, R_{12}	20,000 ohms
R_{16}	10,000 ohms
R_{17}	470,000 ohms
R_{18}	18,000 ohms, 1 watt
R_{19}	1000 ohms
R_{20}	8200 ohms, 1 watt
C_1, C_2	500 pf
$C_3, C_4, C_8, C_9, C_{10}$	0.1 μf
C_5, C_6	0.05 μf
C_7	0.002 μf
V_1, V_2	12AU7
SW_1	6-pole, 3-position

[4] J. L. Grauer, "#4, 80 Pounds, a Super 8, and the Shim Method," AUDIO, Jan. 1961.



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cursion virtually eliminates distortion and significantly lowers power demands on the amplifier. Result: the best available performance with a minimum loss of efficiency. Result to *you:* incredible sound that can be amply amplified by any amplifier with 10 clean watts.

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And both systems include a 'brilliance' control to permit precise adjustment of tonal balance to your particular room acoustics.

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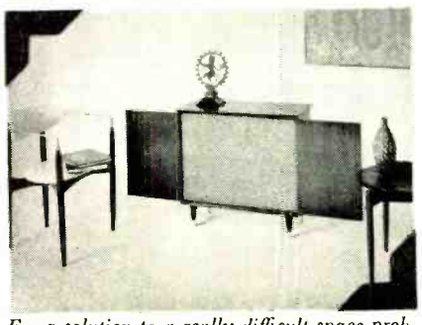

For a solution to a really difficult space problem, investigate the TMS-2 single cabinet stereo speaker system.

RRL-12 prices start at $114.95. RRL-8 prices from $95.50.

For complete information about all of University's "best quality for the price" speaker systems, write: Desk R-11, University Loudspeakers, Inc., White Plains, New York.

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TIMELESS BEAUTY AND THE SOUND OF REALITY

Stereo-Plus-Center To Two Recording Channels

A center bridging amplifier with metering circuitry

HAROLD REED*

ONCE UPON A TIME, as we look back, an audio system was a relatively simple arrangement—an input transducer, an amplifier, and an output transducer. Later came mixing—more input transducers, more output transducers, and the amplifier. Along came stereo—more of everything, in fact two times everything. Now, with stereo-plus-center we have three times everything. Each step has resulted in more realistic sound reproduction but at a great increase in cost and space requirements.

* *3917 Madison St., Hyattsville, Md.*

The Circuit

The circuit shown in *Fig.* 1 was designed to provide for some center pickup in a two-channel stereo system, while holding to a minimum the equipment needed for recording and reproduction. (See also block diagram, *Fig.* 2.) Here, the output of two center microphones and their preamplifiers is mixed and fed to a center sub-master control and then to the input transformer of the center amplifier. A 12AY7 tube is used in the first two stages which is followed by a 12AX7 serving as two cathode followers. The output trans-

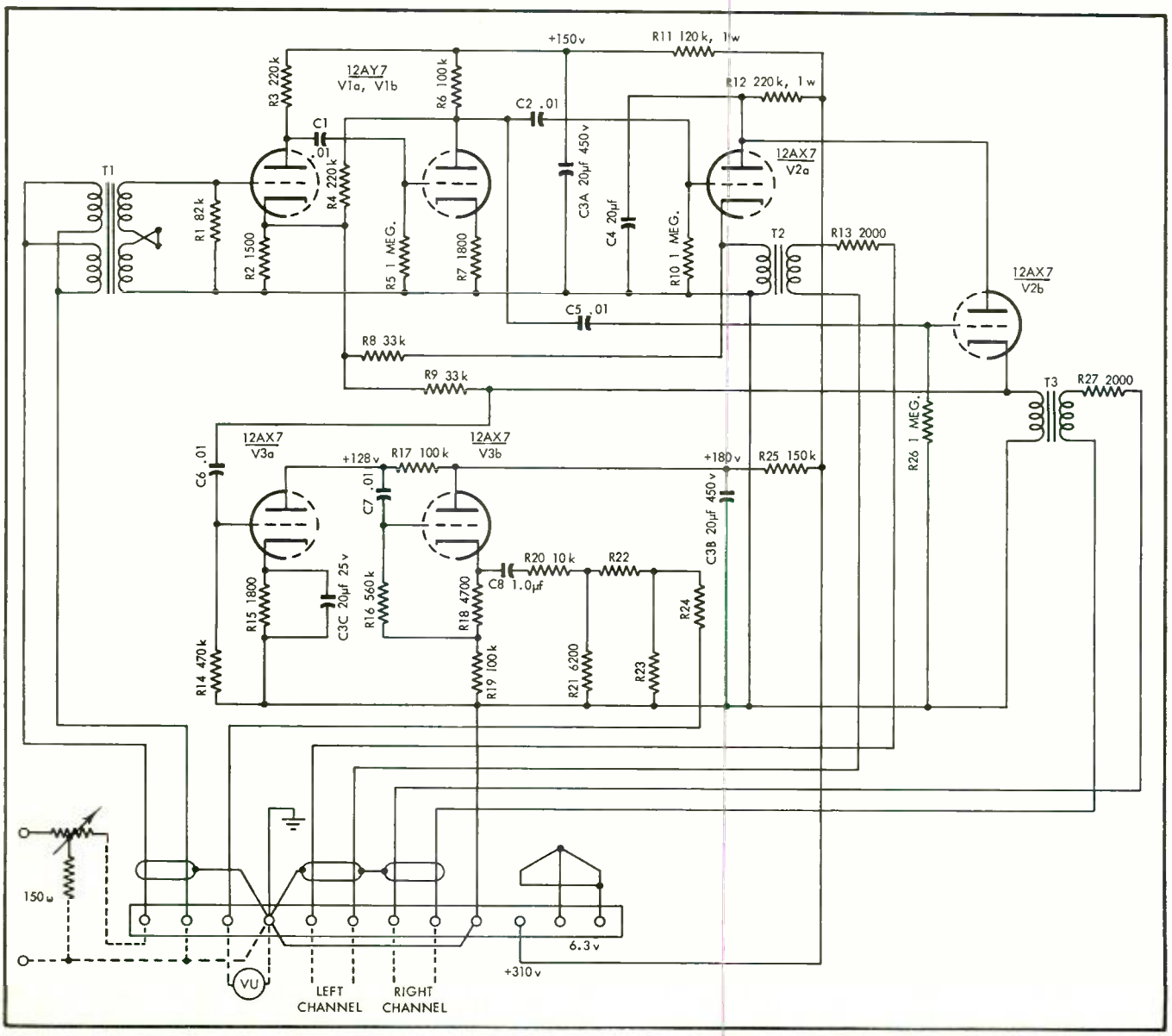

Fig. 1. Schematic diagram of center bridging amplifier.

WE TAKE OUR TEXT FROM *Nikita Khrushchev*

"A Communist," he has said in a report to the Central Committee, "has no right to be a mere onlooker."

The free world may deplore the methods used in the U.S.S.R. to insure the participation of its citizens in the plans of the Kremlin. But no one can deny that Khrushchev, after all, has put his finger on one of the strengths of dictatorship—and one of the weaknesses of democracy.

In our democratic society, you have the freedom of choice to be either active or passive, a doer or an onlooker, as you please. You may choose simply to stand and watch the world go by. That is your privilege, and no one can penalize you.

But if there is no law compelling you to be active, no dictator telling you that you must take your place in the ranks — and sending you to Siberia if you don't — is there not at least an implied moral obligation to be a participant rather than simply a spectator — a moral obligation with a force far greater than a dictator's rule? By definition, democracy is the rule of the people, and there is no rule when the people shirk their responsibilities.

Remember the sense of common purpose that we all shared in World War II, whether we were fighting or doing defense work or helping the Red Cross or planting a victory garden? In wartime, most of us accept the necessity for action — and act. But when the necessity grows less urgent, we tend to forget how stimulating it is to be active in a worthwhile cause, how satisfying the resulting sense of fulfillment. Instead, we fall back into the old habit of letting George do it.

Occasionally, a Presidential election stirs us out of our apathy, and we work for the party and the candidates we favor — or at least take the trouble to vote. But after it's over, too many of us slip back into the complacent role of the onlooker.

There are many Americans who regard citizenship as a sinecure, reluctantly paying taxes but making no attempt to influence what is happening in the government and the community. Others are too fastidious or too phlegmatic to espouse a cause and work for it. Still others fear involvement and prefer to stay on the surface of things, shunning commitment but reserving the right to criticize. They are living phantom lives, wasting both the unique opportunities for action afforded by our democracy and their own potentialities as human beings.

They willingly pay lip service to the two principles of conduct that motivated our founding fathers — *do your part* and *do your best*—forgetting that the operative word in each case is *do*. Intention, resolution, decision, determination—these are not enough. No one will take the thought for the deed. There is no credit — and very little satisfaction — in standing on the sidelines. Participation is what counts — participation in the service of whatever cause is closest to your heart, whatever purpose appeals most strongly to your intelligence.

Work to improve your local school or library or hospital. Collect to help conquer the diseases that now conquer men. Teach English to newcomers, read to the blind, join a church project. Run for public office — or work for someone else who is running. Further a cause you believe in by organizing a group to support it — or at least by taking pen in hand. As Ecclesiastes put it: "Whatsoever thy hand findeth to do, do it with thy might."

We citizens of this democracy cannot allow ourselves simply to stand by in a world where no Communist has the right to be a mere onlooker. We must bestir ourselves, accept both the responsibility and the opportunity for service to community and country, find our respective causes and serve them with a will.

As Oliver Wendell Holmes, Jr., said back in 1884:

As life is action and passion, it is required of a man that he should share the passion and action of his time, at the peril of being judged not to have lived.

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formers are inserted directly in the cathode circuits of this tube.

As shown in the block diagram, *Fig.* 2, one center amplifier output is bridged across the input of the left stereo channel amplifier and the other output is bridged across the right stereo channel amplifier input. Resistors R_{19} and R_{27} of *Fig.* 1, 2000 ohms in value, are used to increase the bridging impedance, which results in negligible loading of the left and right stereo channel circuits.

The center amplifier output transformers have an impedance ratio of 10,000/2000 or 5. Considering the cathode-follower output impedance to be

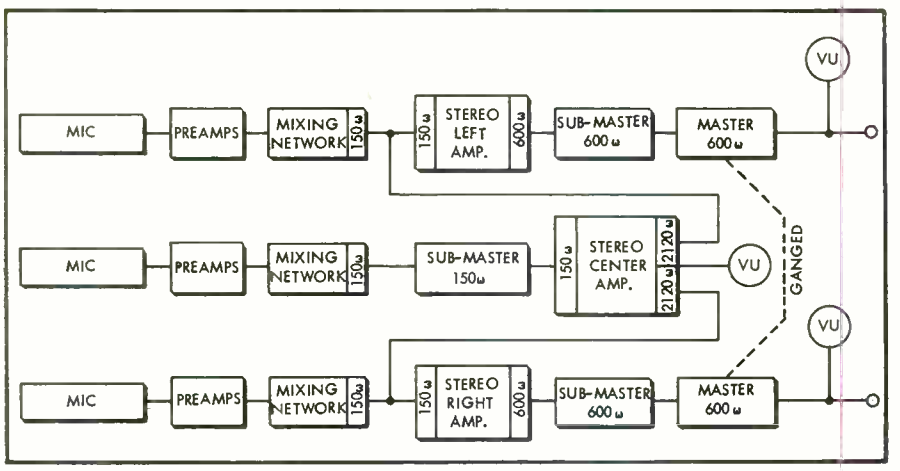


Fig. 2. Block diagram.

600 ohms, the reflected impedance to the secondary winding is 1/5 of this value or 120 ohms. This, in series with the 2000-ohm resistor results in a bridging impedance of 2120 ohms across 75 ohms which is the terminated 150-ohm input impedance of the channel amplifiers. This is similar to the conventional 15,000-to-20,000-ohm bridging of terminated 600-ohm lines.

To provide for proper balance between left, right, and center, and for monitoring, a VU metering system is included in the center amplifier circuitry. This consists of a 12AX7 voltage amplifier and cathode follower. Signal voltage for the meter circuit is taken from the cathode circuit of the cathode follower feeding the right stereo channel although this could just as well be taken from the follower feeding the left channel.

The VU meter itself is connected to the cathode follower output through a standard VU meter attenuator and series resistor, R_{20}. For proper dynamic operation, the meter should be connected across a 3900-ohm impedance source. The standard meter attenuator will not present this impedance to the meter unless correctly terminated on the input side. On the other hand, the cathode follower should work into a higher impedance, at least 10,000 ohms. In the circuit as shown, the 3900-ohm attenuator termination is taken care of by shunt resistor R_{21} in parallel with R_{20}, and in series with the follower output. Thus, $(6200 \times 10{,}600)/(6200 + 10{,}600) = 3912$ ohms. The desired cathode follower loading is handled by R_{20} in series with the parallel combination of R_{21} and the meter attenuator network and provides an impedance of approximately 12,000 ohms.

No resistor values are given in the schematic diagram for the meter attenuator network composed of R_{22}, R_{23} and R_{24} since these values will depend on the signal levels in any given stereo system. In their meter data sheets, manufacturers of well known VU meters publish meter attenuator information giving in table form the resistance values needed for any commonly required attenuator loss in 1 db steps. This saves the trouble of having to calculate them.

The audio system in which this center amplifier was used provided a signal level to the input in the order of minus 60 dbm due to considerable mixing losses. Because of this, a high-quality well-shielded input transformer was selected. The latter would not be necessary where a higher signal voltage is available. The output transformers are relatively inexpensive but gave a good account of themselves in this service.

The center amplifier as described was assembled in a custom-built stereo recording console which contained a common power supply. A power source of 300 to 350 volts is satisfactory and the current drain is less than 5 ma making it possible to use almost any already existing power supply. The heater current drain is 0.9 amperes. If the available power supply will not handle this additional current a separate heater transformer can be employed. Excluding the power supply, the amplifier can be assembled on a chassis as small as 4-in. × 12-in.

Specifications

The center amplifier was designed to meet the following specifications: Harmonic distortion 1 per cent or less over the band of 30 to 15,000 cps. Hum and noise at least 60 db below + 8 dbm output established with a − 60 dbm input signal. Frequency response within 1 db from 30 to 15,000 cps.

The over-all gain of the center amplifier from the input transformer to the output of the 2000-ohm bridging resistor is 55 db.

Although as shown in *Fig.* 2, impedances of both 150 and 600 ohms are employed which were considered desirable for the particular installation in which the center amplifier was used, the amplifier may be set up in other stereo circuitry using 600-ohm impedances throughout. For instance, the same input transformer can be strapped for 600-ohm input and if the left and right channel amplifiers have 600-ohm inputs the center amplifier bridging resistors can be increased to about 15,000 ohms to retain the same negligible loading conditions on these channels. Æ

PARTS LIST

R_1	82,000 ohms, ½ W
R_2	1500 ohms, ½ W
R_3, R_4	220,000 ohms, ½ W
R_5, R_{10}, R_{26}	1 megohm, ½ W
R_6, R_{17}, R_{19}	100,000 ohms, ½ W
R_7, R_{15}	1800 ohms, ½ W
R_8, R_9	33,000 ohms, ½ W
R_{11}	120,000 ohms, 1 W
R_{12}	220,000 ohms, 1 W
R_{13}, R_{27}	2000 ohms, ½ W
R_{14}	470,000 ohms, ½ W
R_{16}	560,000 ohms, ½ W
R_{18}	4700 ohms, ½ W
R_{20}	10,000 ohms, ½ W
R_{21}	6200 ohms, ½ W
R_{22}, R_{23}, R_{24}	see text
R_{25}	150,000 ohms, ½ W
C_1, C_2, C_3, C_4, C_7	.01 µf, 400 V, paper
C_5	20/20/20 µf, 450/450/25 V, electrolytic
C_6	20 µf, 450 V, electrolytic
C_8	1 µf, 200 V, electrolytic
T_1	Input transformer, UTC LS-12X
T_2, T_3	Output transformer, UTC A-15
V_1	12AY7
V_2, V_3	12AX7

HERMAN BURSTEIN*

Tape Erasure

Q. I have a tape playback machine incorporating a playback amplifier but not a record amplifier. On one of my prerecorded tapes there is a very noticeable dropout on one channel for about two minutes which I don't believe was there when I first played it. Could this be due to a shorting of the ground and signal-carrying wires? Will this erase the tape?

A. I don't see how erasure could result from shorting of the ground and hot leads. A magnetized playback head will tend to erase, but the erasure is mostly of high frequencies and is not very pronounced. Assuming that through some misadventure a substantial amount of current were fed to the playback head, erasure might take place.

Head Magnetization

Q. Do playback heads become magnetized purely as the result of playing tapes? I am not referring to heads which are used for both recording and playback.

A. Playback heads do become magnetized as the result of playing tapes. The asymmetrical waveforms presented to the head in effect contain a d.c. component, which results in gradual head magnetization.

Q. If the cable from a playback head to the playback amplifier is frequently plugged in and out of the amplifier, would this magnetize the head?

A. A playback head can become magnetized as the result of a current surge. While there may be a trivial amount of voltage across the head when it is connected to an amplifier, I don't think that this voltage is enough to cause the kind of surge we are talking about if you suddenly plug in or plug out.

Dip in Response

Q. My tape recorder exhibits a dip in response of about 5 or 6 db in the region of 60 to 70 cps, and then it comes back to nearly flat response around 30 cps. What is the reason for this, and what might I do about it?

A. The dip in response is probably due to the fact that at very low frequencies the wavelength recorded on the tape approaches the magnitude of the head itself, so that the head as a whole and not merely the gap tends to react to the signal on the tape. As a result, there are "interference effects," namely accentuation of some frequencies and partial cancellation of others. Possibly, these interference effects can be mitigated by slightly rotating the head in a horizontal plane—if the mechanical design of your tape machine permits you to do this—so that the tape wrap about the head is not symmetrical. That is, the tape should contact more of the head surface on one side of the gap than on the other side.

280 Twin Lane E., Wantagh, N.Y.

Playback Equalization

Q. In using a tape transport for playback, can I plug the output of the tape head directly into the mike input of my audio preamp?

A. Plugging the output of the tape playback head into the mike input jack of a preamp will probably provide sufficient amplification of the weak tape signal. But it will provide none of the required playback equalization. For example, a large amount of bass boost is required to play back a tape recorded according to the NAB curve.

*Q. I checked the playback and record equalization of my **** tape recorder at 7.5 ips and found these to be apparently unsatisfactory. Whereas the NAB playback curve calls for a 26 db drop between 30 and 1000 cps, I measured a drop of only 16 db. There is also supposed to be a drop of 10 db between 1000 cps and 15,000 cps, but I measured only 7 db. Can you suggest the reasons for this difference? Is it possible that the amplifier of the **** tape recorder was not designed to follow the NAB curve? This machine was designed before the NAB curve was widely adopted by the industry for use at 7.5 ips.*

A. One or more of the following factors may account for your failure to obtain the NAB playback curve in checking the equalization of your tape recorder: 1. It is quite possible that at 7.5 ips your tape machine employs what is sometimes called the "modified NAB curve." This consists of bass boost commencing at 1590 cps instead of 3180 cps. Accordingly, the total rise between 15,000 and 30 cps is about 30 db instead of 36 db. Relative to 1000 cps, this is about 24 db bass boost and about 6 db treble cut. Hence your measurements would be indicative of only 1 db error in terms of treble cut, although they still indicate an *apparent* deficiency of 8 db in bass boost. 2. Playback heads frequently exhibit a rising characteristic in the low bass region, sometimes reaching as much as 6 db. Therefore the standard NAB playback curve must be tailored to reflect whatever amount of bass boost occurs in a specific machine owing to the particular head used there. If the head in your machine happens to produce as much as 6 db rise at the very low end, this would explain a substantial amount of the apparent deficiency in bass playback equalization. 3. The NAB standard permits response to be down as much as 4 db at 50 cps, which means about 7 db down by the time you get to 30 cps. Here again is a substantial accounting for the apparent insufficiently of bass boost. 4. The NAB standard permits a slight amount of bass boost in recording, reaching 3 db at 50 cps and increasing at still lower frequencies. Thus your tape recorder quite possibly supplies part of the required bass boost in recording.

Taking all the foregoing into consideration, it is desirable to make a true check of playback response not merely by measuring equalization but further by checking output when playing a standard test tape.

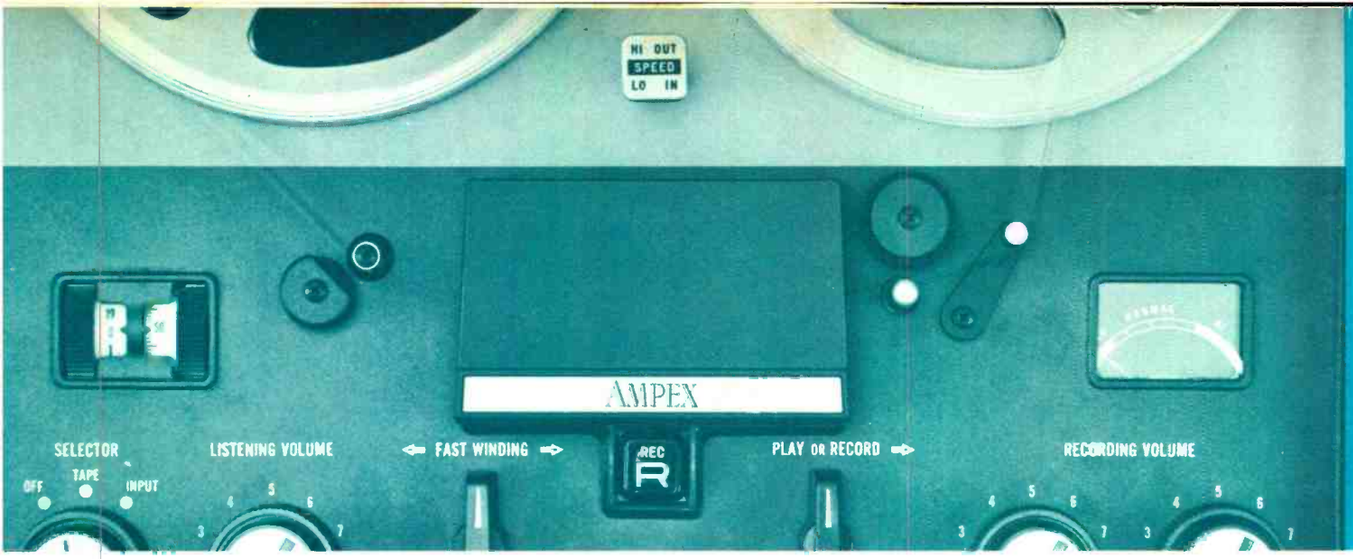
Tape Head Gap

Q. How narrow should the gap of a tape head be?

A. First, we have to differentiate between heads used for recording and those used for playback. A narrow gap is of importance only in playback. For treble response virtually flat to 15,000 cps, the gap of the playback head should not exceed .00025-in. (250 micro-inches) at 7.5 ips, .00012-in. (120 micro-inches) at 3¾ ips, and .00006-in. (60 micro-inches) at 1⅞ ips. Modern playback heads found in home tape machines generally have gaps between .00009-in. and .00012-in. Gaps as narrow as .00006-in. are not found in home tape machines because the treble losses in *recording* at 1⅞ ips are so formidable that, as yet, it is no use building heads to play frequencies that are not on the tape.

In recording, a head with a narrow gap can be used quite satisfactorily. However, because of magnetic and electrical factors, the optimum tends to be a relatively wide gap, about .0005-in. (500 micro-inches). As the gap is narrowed, losses occur because the electromagnetic field of the head tends to jump across the gap instead of flowing through the tape. Moreover, a relatively wide gap lowers the inductance of the head; this reduces the head's impedance to current flow, and therefore it becomes easier to pump audio signal and bias current through the record head.

It is vital that the edges of the gap be as straight and sharp as possible. If the edges are not linear and sharp, cancellation of the high frequencies takes place in playback. Hence a gap of 120 micro-inches might very well achieve better treble response than a less linear gap of 90 micro-inches. In recording, gap linearity is more important than gap width. The magnetic signal impressed on the tape depends on the magnetic condition of the tape at the instant it leaves the trailing edge of the gap, namely the last edge contacted by the tape. A well-defined trailing edge is essential for a well-defined recording. Æ



AMPEX

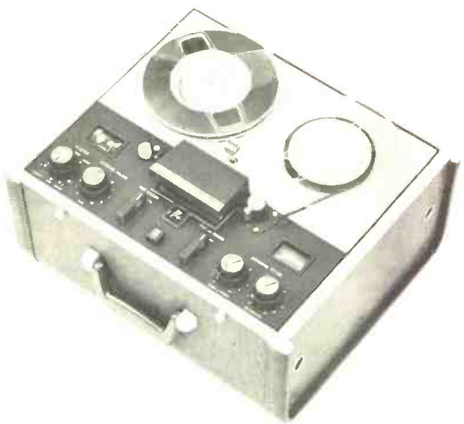
IT TAKES MORE THAN ADDING A 4-TRACK RECORD HEAD TO MAKE A 4-TRACK RECORDER

With 100% more recorded information on the same width of tape, the alignment of 4-track tape is critical. This alignment is the result of meeting two basic requirements:

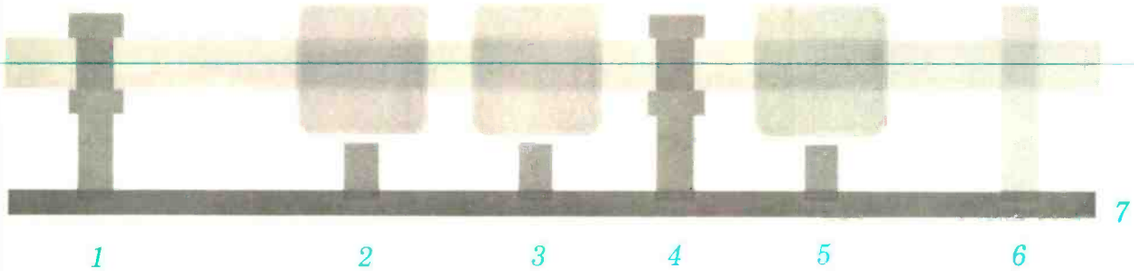
1. **Precision heads that permit narrow-track recording without loss of performance of normal, wide-track recording.**
2. **Precision "tracking" of the tape across these heads.**

Even the slightest variation (the thickness of this piece of paper, for example) represents enough misalignment to noticeably reduce frequency response and signal-to-noise ratio, and induce crosstalk between tracks — all unsuitable for true high fidelity recording and reproduction. The "4-track recorders" of non-professional design either lack this precision or can quickly lose it in simple transporting or jarring.

Two years in development, the new 1200 Series incorporates many of the precision tracking and narrow-track head techniques of Ampex Professional and Instrumentation recorders. The new 1200 Series makes possible the convenience and economy of 4-track recording/reproduction with full professional quality previously attainable only in 2-track.



FINE-LINE *alignment — the first high fidelity adaptation of tracking techniques and tape guidance principles used in computer and instrumentation tape equipment.* **FINE-LINE** *alignment on the 1200 Series provides full frequency response by keeping the tape track width (.043") in precision alignment with the channel width (.043") of the record and playback heads. This alignment starts the moment the tape leaves the supply reel and continues past: (1) the constant-tension holdback; (2) the new 4-track selective erase head; (3) the new 4-track record head; (4) the micro-adjusted tape guide; (5) the 4-track playback head; (6) the capstan, until the tape reaches the take-up reel. All are precision mounted on (7) a professional, micro-milled die cast frame to guarantee fine line alignment throughout the life of the recorder.*

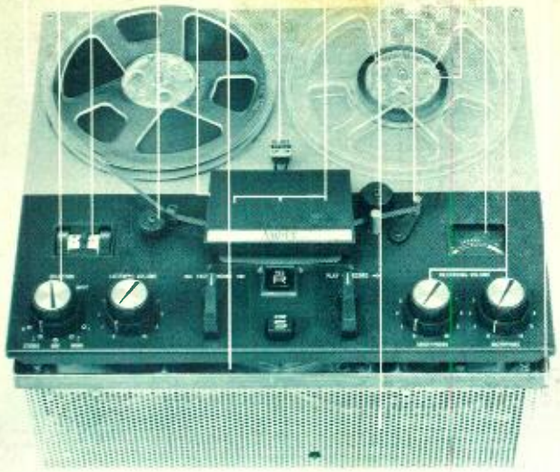


THE FINE LINE AMPEX 1200

NEW PRECISION TAPE TRACKING in the 1200 Series required tracking techniques in the tape guidance system previously used and associated only with professional recorders and multi-track instrumentation tape equipment. The key to these techniques is providing perfect alignment of the tape from the time it leaves the "supply" reel until it reaches the "takeup" reel. This is lost in most 4-track recorder construction when the stamped metal plate (conventionally used in home-recorder construction) strains or warps out of alignment from the weight of the motor, clutches, flywheel, and other mechanical assemblies that hang from this top plate. The kind of alignment necessary for narrow-track recording requires the stability of a professional-type, die cast frame — micro-milled in one operation so that the tape guidance system and head assembly are mounted on the same reference plane. And that's exactly what Ampex has done in the 1200 Series. We call it **FINE-LINE** alignment. You can see it by looking under the top plate. You can hear it when you record and playback 2- and 4-track stereo tape or 4-track monophonic tape. It costs slightly more, but is lower cost in the long run. On the average, Ampex-built recorders outlive lower-cost machines two to three times.

3 NEW PRECISION HEADS — not only a 4-track **record** head, but a 4-track **playback** and a new selective **erase** head (essential to monophonic recording on any **one** track) have been added to the Ampex 1200 Series. To eliminate any possibility of track interference, all three of these new heads now have narrower channels (.043") to precisely match the track-width of the tape, while maintaining the famous wide recording range and longer life characteristic of Ampex recorders.

AMPEX



THE FINE LINE
AMPEX 1200

PRESENTS

The New 1200 Series includes over 170 changes in design to provide highest performance and trouble-free operation. Among the major feature and construction advantages are:

(A) Exclusive, automatic tape take-up — eliminates the annoying problems of hand threading.

(B) Built-in mixer — 4 inputs (2 mic, 2 line) for professional recording techniques.

(C) Master selector switch — permits **simple** changes from stereo to mono, choice of individual track, A-B comparison of original and recorded program, sound-on-sound, automatic shut-off.

(D) Constant holdback tension — provides equal tension throughout reel of tape.

(E) Selective Erase Head — permits increased monophonic flexibility with sound-on-sound, language study, etc.

(F) Precision recording level meter — for accurate, professional quality recording, reads both channels by simple switching — provides easy comparison and balancing of recording levels.

(G) Exclusive "Auto-Set" shut-off — offers choice of 2 automatic shut-off positions for unattended recording or playback.

(H) Convenient speed change (3¾-7½) — rugged, dependable.

(I) Professional recording electronics — (similar to Ampex 351 series broadcast recorder) insures professional recording quality.

(J) Directional selective braking — provides quick, positive stops without stretching thin-base tapes.

(K) Heads — separate erase, record, playback for optimum performance in each function.

(L) Tape transport — a precision **system** of constant-holdback tension, powerful 4-pole uniform-speed motor, and capstan assembly provide mechanical specifications (wow & flutter) comparable to broadcast recorders.

(M) Die cast frame.

(N) Tape position indicator.

SPECIFICATIONS

The Ampex 1200 incorporates the widest range of abilities ever built into a single unit:

RECORDS 4-track stereophonic
4-track monophonic

PLAYS 4-track stereophonic
2-track stereophonic
4-track monophonic

SPEEDS **records and plays at 3¾ and 7½ ips with up to 8 hours, 32 minutes of monophonic recording or playing.**

RECORDING INPUTS: High impedance inputs (radio—phono—TV—auxiliary). Approximately 0.25 v rms for maximum normal recording level; high impedance (600μv) microphone inputs.

PLAYBACK OUTPUTS: Approximately 0.75 volts rms from cathode follower with tapes recorded to maximum normal recording level.

FREQUENCY RESPONSE: 50-15,000 cps ±2 db at 7½ ips; 50-8,000 cps ±2 db at 3¾ ips.

SIGNAL-TO-NOISE RATIO: Better than 55 db at 7½ ips; Better than 50 db at 3¾ ips.

FLUTTER AND WOW: Under 0.2% rms at 7½ ips; Under 0.3% rms at 3¾ ips. (Measured according to American Standards Association.)

TIMING ACCURACY: Perfection of pitch to within ⅓ of a half-tone.

HEADS:
Manufactured to the same standards of precision that exist in Ampex broadcast and recording studio equipment. Surfaces are lapped flat within 10 millionths of an inch, resulting in uniform performance characteristics throughout the life of the head. Stereo head gap alignment: the one head gap in the stack with respect to the other is held within 20 seconds of arc, equivalent to less than 10 millionths of an inch — a degree of precision achieved through use of a unique process involving micro-accurate optical measurements within a controlled environment. Head gap length is 90 millionths of an inch.

DIMENSIONS: Portable cases 9" x 15" x 17½". Unmounted recorder 13" x 6⅛" depth below top plate, 1⅜" above. Recorder weight 36 pounds.

POWER REQUIREMENTS: 117 volts, 0.9 amperes, 60 cps (recorder); 117 volts, 0.5 amperes, 60 cps (amplifier-speaker).

SPECIFICATIONS STANDARDS:

(1) These technical specifications accurately reflect the true performance of every unit off the production line, not a hand-picked sample.

(2) These are professional specifications, measured by professional equipment standards and instruments and are comparable to those used in broadcast and recording industry.

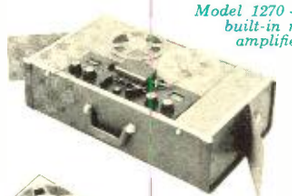
As such, most of these ratings are conservative and individual units may be found to exceed these published specifications. These specifications are not comparable to "sales literature specifications" often used in consumer recorder merchandising.

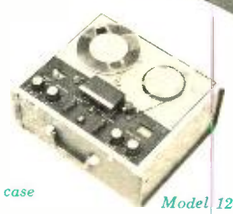
THE FINE LINE
AMPEX 1200

Ampex adds a major contribution to 4-track recording and reproduction with the introduction of FINE-LINE alignment in the 1200 series 2- and 4-track stereophonic and 4-track monophonic tape recorder/reproducers

Model 1260 with pair of matching Ampex Amplifier-Speakers (2010)

Model 1270 — Portable with built-in matched pair of amplifier-speakers





Model 1250 — Without case (not shown)

Model 1260 — Portable

AMPEX AUDIO COMPANY • Sunnyvale, California

AMPEX
THE FINE LINE
AMPEX 1200

The Electronic Organ—A High Fidelity Musical Instrument

DAVID WOLKOV*

The electronic organ has been called, "A high-fidelity system with a keyboard." Here is a simple introduction to the electronic organ plus a listing of most of the currently available models.

THE MELODIOUS VOICE of the organ is once more being heard throughout the land; not through wheezing air pipes, but through high fidelity speakers. This music is being played and enjoyed by the audio fan himself, and is not reproduced music.

In 1959, $232,000,000[1] of electronic organs were sold; for this money, 750,000 were of the Johnny-one-note type; and 125,000 were of the console type. 1960 statistics are now being compiled.

An air organ is not complete unless there are 1300 to 1600 pipes. In addition, there must be blowers, wind chests and swell shutter mechanisms. In contrast, an electronic organ uses 100 tubes or transistors, usually all contained within the console, with only the amplifiers and speaker systems external to the console. Not only does it take less space, but it avoids tearing up walls for the pipe installation. Also, the electronic organ costs only a fraction of the comparable air organ.

The 14–18th Century air organ, and also the more recent air organs, were designed to produce four different families of voices. The distinctive organ sound of air sighing through the pipes is known as diapason. The three other classes are the reed, the flute, and the string.

As long ago as 1929, three Bell Laboratory researchers, L. J. Sivian, H. K. Dunn, and S. D. White found out what the makeup of a musical note was. Their findings are learnedly reported in the January, 1931, issue of the *Journal of the Acoustical Society of America*. They showed that music is more than the note, its harmonics, and the decay curve. As described in the Formant Theory, the characteristic voice of an instrument is determined by certain fixed frequencies (harmonics), always associated with the instrument.

The University of Oklahoma conducted a study concerning the voicing of air organs, and the electronic organ was on its way. Vacuum-tube oscillators and filters simulated the air organ voices. Then came high fidelity with clean, high powered amplifiers and associated speakers; and with these, the opportunity for tremendous and magnificant organ sound.

How and why have these electronic devices been able to move in on what was once the most specialized of musical instruments? There are many contributing reasons, but principally it is because the organ is one of the easiest instruments to play.

This does not mean there are no variations in skill and artistry, but rather that the learner can easily learn to produce pleasant, listenable music. Unlike pianos, whose tones build up and die away, organs will sustain a sound as long as the key is pressed. Even when the tune is slowly picked out, note by note, the melody will move along smoothly.

Playing an electronic organ is made easier by another characteristic that distinguishes it from other keyboard instruments. The keys are electric switches, not levers controlling hammers. This means that the sound is not affected by uneven fingering. Years of practice required for developing "touch" are not required for adding expression to music. Percussion or legato, soft or loud, all are at your command at the movement of a switch.

These easy-play advantages are common to most electronic organs. Music publishers have devised various kinds of "picture music," "pointer systems," and other self-teaching methods such as the Russel Ames series. While any musical instrument when mastered is a source of joy and satisfaction, mastering the organ is considerably more like mastering an orchestra.

The conventional musical instrument may take years to master—and so does the organ. The learner on a violin will sound indescribably horrible, but the

* *10 Sunbeam Road, Plainview, L.I., N.Y.*

[1] *Electronics*, Nov. 11, 1960, p. 40.

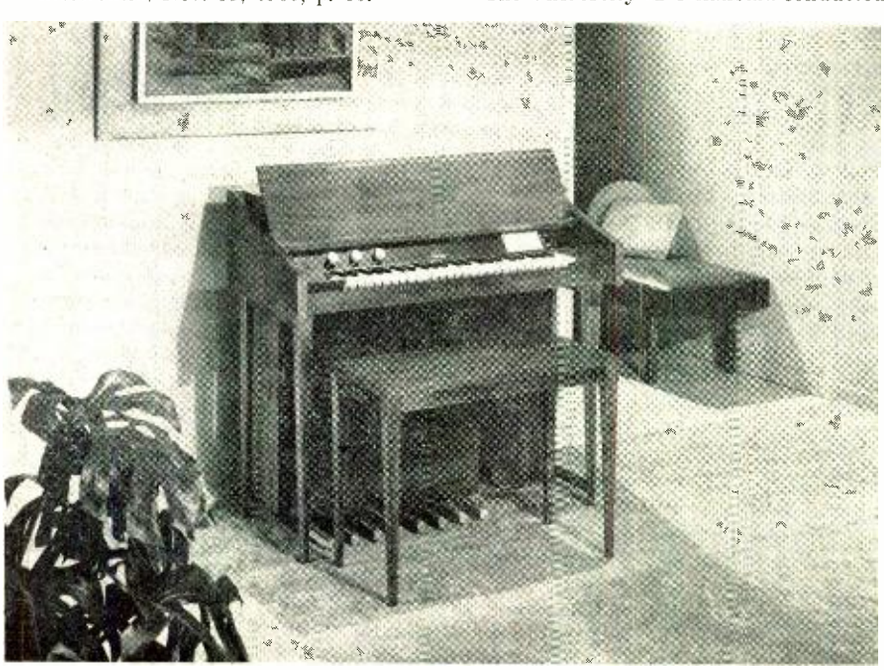


Fig. 1. Electro-Voice "Baron" chord organ.

Fig. 2. Schober "Concert" organ.

learner of the organ can smother his sound with powerful electronic assists. These give the music character and quality. No other instrument can produce "music" for the novice so readily.

A second contribution to the popularity of the electronic organ is "high fidelity". From 16 cps up to 20,000 cps the high-fidelity system is at its best and, consequently, so is the electric organ.

The electronic organ usually has many, many oscillators associated with the keyboard. It also has filter networks for modifying the harmonic content of the audio wave. There are also means for shaping the rise and decay of the wave. Usually, couplers are provided for criss-crossing the filters. The combined, mixed output is fed to your preamp (mono or stereo) and then on to a broad-band amplifier and from there to the speaker systems.

How are you going to determine the electronic organ best suited to your needs? First, you should know what kinds of organ are available. Second, you should decide whether you would want to build your own or purchase a factory-built unit. If you have enjoyed building your high fidelity installation from kits, you can do the same with an electronic organ.

Types of Electronic Organs

The "Johnny-one-Note" organ is distinguished by a construction that allows but one note to be played at a time similar to simple piano playing. The somewhat more sophisticated units have chord buttons which permit a chord accompaniment to be played along with the solo. These are really not musical instruments.

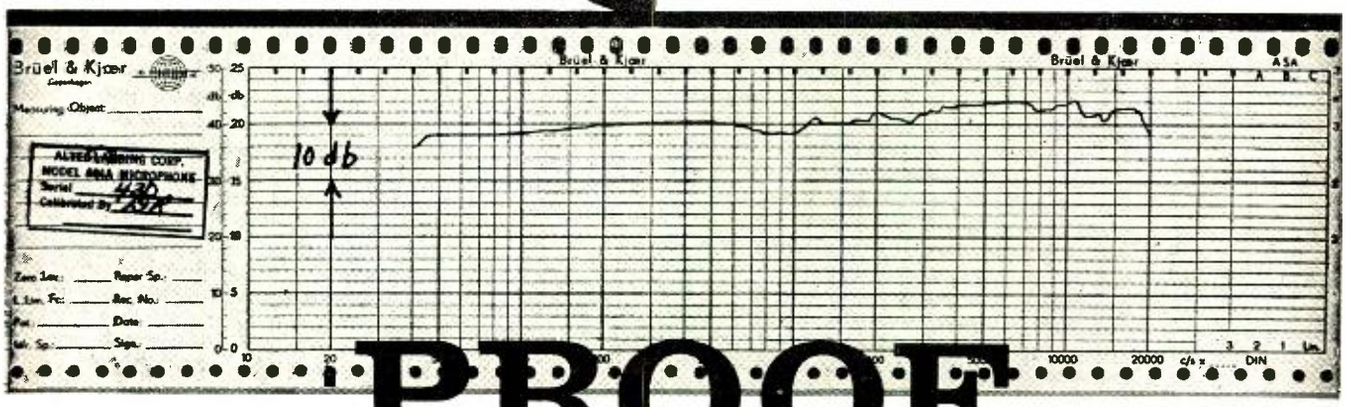
The accompanying chart (*Fig. 5*) lists most of the organs available today which are classed as musical instruments. Even simple instruments, such as the Hammond chord organ, employ tone shaping filters (stops) which can be keyed-in so that the fundamental tone is altered. When several stops are depressed simultaneously, interesting choral effects are obtained.

A single manual restricts the usefulness of the spinet. The suitable accompaniment to a melody requires that the keyboard be in two sections. One is for melody and the other for the accompaniment, with separate stops for each. Formal organ music especially demands more than one manual for majestic and exciting voicing. Popular music, too, requires an organ that has a base keyboard which is played with the foot.

Fig. 3. Artisan "Class IV" organ.

Fig. 4. Allen "T-12A" organ.

Frequency Response: 35 to 20,000 cycles
Output Impedance: 30/50, 150/250 and 20,000 ohms (selection by connections in microphone cable plug)
Output Level: −55 dbm/10 dynes/cm²
Hum: −120 db (Ref.: 10^{-9} Gauss)
Dimensions: 1⅛" diameter at top (1½" largest diameter) 7½" long not including plug
Weight: 8 oz. (not including cable & plug)
Finish: Two-tone baked enamel, black and dark green
Mounting: Separate "Slip-On" adapter No. 13338 furnished. Adapter has standard ⅝" −27 thread.



PROOF

Concrete visual proof of performance is now supplied by ALTEC with each 684A Omnidirectional Dynamic Studio Microphone. This proof—a soundly scientific and coldly unemotional statement of exact performance capabilities—is an individual certified calibration curve that you receive free with each 684A Omnidirectional Dynamic Microphone.

The calibration curve is so precise that the ALTEC 684A is a completely reliable secondary standard for comparison measurement of other microphones. Can you, if you are a professional multi-microphone user, safely operate without such a control standard in your studio?

The ALTEC 684A Professional Microphone shown is a production model chosen at random. Its calibration curve is actual and unretouched. It offers dramatic proof that the exclusive new ALTEC design, incorporating the highly sensitive ALTEC "Golden Diaphragm" of Mylar®, results in an omnidirectional dynamic microphone of remarkable superiority. This superiority will be maintained, year after year, by the exclusive ALTEC sintered bronze filter that positively bars the entry of iron dust and foreign matter. And, as proof of superior value, consider the price: the ALTEC 684A costs only $81.00 net!

SUPERIOR PERFORMANCE, SUPERIOR VALUE – THE ALTEC DYNAMIC MICROPHONE LINE:

ALTEC 681A—$36.00 net—Inexpensive general purpose omnidirectional microphone with smooth, uniform frequency response from 50 to 18,000 cycles. Includes the new ALTEC "Golden Diaphragm" of indestructible Mylar®. Available with 150/250 or 20,000 ohms output impedance.

ALTEC 682A—$49.50 net—Featuring uniform frequency response from 45 to 20,000 cycles, the 682A Omnidirectional Microphone incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter. Output impedances of 30/50, 150/250, and 20,000 ohms easily selected in microphone plug.

683A DYNAMIC CARDIOID—$66.00 net—Uniform response from 45 to 15,000 cycles with average front-to-back discrimination of 20 db. Design incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter. Output impedance of 30/50, 150/250, and 20,000 ohms selectable at cable plug.

ALTEC 685A STUDIO CARDIOID—$96.00 net—This dynamic microphone offers flat frontal response from 40 to 16,000 cycles with average front-to-back discrimination of 20 db. Design incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter. Output impedances of 30/50, 150/250, and 20,000 ohms selectable at cable plug. Individual certified calibration curve is supplied with this model.

ALTEC 686A LAVALIER – $54.00 net – Unobtrusive 3-ounce Omnidirectional Lavalier Microphone. Incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter for an exceptionally smooth frequency response from 70 to 20,000 cycles, equalized for chest position. Selectable 30/50 and 150/250 ohm impedances.

For specific engineering details, call your nearest ALTEC Distributor (listed in your Yellow Pages) or write Dept. A-11-M.

ALTEC LANSING CORPORATION

A SUBSIDIARY OF LING-TEMCO ELECTRONICS, INC.
1515 South Manchester Avenue, Anaheim, California

NEW YORK
LOS ANGELES

ALTEC LANSING CORPORATION

Complete line of accessories includes: desk and floor stands, switches, wall mounts, boom and shock mounts.

MANUFACTURER'S NAME AND ADDRESS	MODEL DESIGNATION	TYPE	SWELL STOPS	GREAT STOPS	PEDAL STOPS	PEDAL NOTES	COUPLERS	A. G. O. STANDARDS	TONE SOURCE	TONE CABINET AVAILABILITY	CHIMES AND OTHER ACCESSORIES	EXPRESSION PEDALS	NOTES
ALLEN ORGAN CO. MACUNGIE, PA.	ORGANETTE	SPINET	17	5	3	13	3		TRANSISTOR	YES	YES	1	14
	TC-1	CONSOLE	YES	YES	YES	32	YES		TRANSISTOR	YES	YES	1	12
	TC-4	CONSOLE	YES	YES	YES	32	YES	YES	TRANSISTOR	YES	YES	2	12
	TC-6	CONSOLE	YES	YES	2	32	YES	YES	TRANSISTOR	YES	YES	3	12
	T-12 A & B	CONSOLE	15	9	2	25	YES		TRANSISTOR	B	YES	1	12
	T-15 A & B	CONSOLE	15	16	7	32	YES		TRANSISTOR	B	YES	1	12
THE BALDWIN PIANO CO. 1801 GILBERT AVENUE CINCINNATI 2, OHIO	ORGA-SONIC 51	SPINET	8	6	4	13	1		VACUUM TUBE	YES	YES	1	7, 8
	ORGA-SONIC 61	SPINET	8	4	3	13	1		VACUUM TUBE	YES	YES	1	14
	45 C, 45 H	CONSOLE	10	6	4	25	2		VACUUM TUBE	YES	YES	1	12
	5 A	CONSOLE	12	8	6	32	6	YES	VACUUM TUBE	YES	YES	2	12
	10 A	CONSOLE	14	11	7	32	10	YES	VACUUM TUBE	YES	YES	3	4, 5, 12
CONN ORGAN CORP. ELKHART, INDIANA	CAPRICE	SPINET	5	4	2	13	4		VACUUM TUBE		YES	1	6
	MINUET	SPINET	5	5	3	13	7		VACUUM TUBE		YES	1	7
	RHAPSODY	CONSOLE	7	6	3	25	8		VACUUM TUBE			1	8
	SERENADE	CONSOLE	9	7	3	25	12		VACUUM TUBE		YES	1	11
	ARTIST	CONSOLE	9	8	4	25	8		VACUUM TUBE	YES	YES	1	11
	CLASSIC	CONSOLE	8	8	4	32	12		VACUUM TUBE	YES	YES	2	12
ELECTRO-VOICE, INC. BUCHANAN, MICHIGAN	BARONESS	SPINET-CHORD	6						VACUUM TUBE				9
	BARON	SPINET-CHORD	6			13			VACUUM TUBE			1	9
	D-20	CONSOLE	13	7	5	32	5	YES	ELECTRO-MECH.	YES		1	12
ELECTRONIC ORGAN ARTS, INC. 4949 YORK BLVD. LOS ANGELES 42, CALIF.	THEATRE, CLASS III	CONSOLE	9	9	6	25	15		VACUUM TUBE	YES	YES	2	12
	CLASS IV	CONSOLE	8	8	6	32	24	YES	VACUUM TUBE	YES	YES	4	1, 2, 12
	CLASS V	CONSOLE	12	17	12	32	8	YES	VACUUM TUBE	YES	YES	4	1, 3, 12
	CLASS VI	CONSOLE	14	13	6	32	29	YES	VACUUM TUBE	YES	YES	4	12
ESTEY ELECTRONICS, INC. 2133 DOMINIQUEZ STREET TORRANCE, CALIF.	5980	SPINET	14	5		13			VACUUM TUBE AND NEON RELAXATION OSCILLATORS	YES		1	7
	PATRICIAN	SPINET	14	5		13				YES		1	7
GULBRANSEN CO. 2050 N. RUBY STREET MELROSE PARK, ILL.	MODEL G-1	SPINET	10	4	13	13			TRANSISTOR	YES	YES	1	7
	MODEL 8-2	SPINET	12	6	4	13			TRANSISTOR	YES	YES	1	7
	THE RIALTO	CONSOLE	47			25	7		TRANSISTOR		YES	1	12, 15
	MODEL E	CONSOLE	16	13	5	25			TRANSISTOR	YES	YES	1	12
HAMMOND ORGAN CO. 4200 W. DIVERSEY CHICAGO, ILL.	CHORD	SPINET	YES						VACUUM TUBE	YES		1	8
	HOME	CONSOLE	YES	YES	YES	25			SYNCHRONOUS	YES		1	12
	CHURCH	CONSOLE	YES	YES	YES	25	YES		MOTOR TONE	YES		1	12
	CONCERT	CONSOLE	YES	YES	YES	32	YES	YES	GENERATORS	YES		1	12
KINSMAN MFG. CO. LACONIA, N. H.	THE COUNTESS	CONSOLE	8		3	13						1	11
	THE PRINCESS	SPINET	16	7	5	13			NEON TUBE			1	7
	THE CROWN PRINCE	CONSOLE	18	2	3	13			OSCILLATORS			1	12
	THE EMPRESS	CONSOLE	16	8	4	25	4					1	12
LOWRY ORGAN COMPANY 7373 N. CICERO LINCOLNWOOD, ILL.	HOLIDAY	SPINET	8	4	2	13	YES		VACUUM TUBE			1	7
	HOLIDAY DUO	SPINET	8	4	2	13	YES		VACUUM TUBE			1	7 13
	CHAPEL	SPINET	8	4	2	13	YES		VACUUM TUBE			1	7
	HERITAGE	SPINET	13	8	2	13	YES		VACUUM TUBE			1	7
	BRENTWOOD	SPINET	10	7	2	13	1		VACUUM TUBE			1	7
	CORONATION	SPINET	15	13	2	25	2		VACUUM TUBE			1	12
	FESTIVAL	SPINET	15	13	2	25	2		VACUUM TUBE			1	12
	CHURCH	CONSOLE	15	13	2	25	2		VACUUM TUBE			1	12
MINSHALL ORGAN, INC. BRATTLEBORO, VERMONT	OLYMPIA	CONSOLE	YES	YES	YES	25	YES		VACUUM TUBE	YES			
	BENNINGTON	CONSOLE	YES	YES					VACUUM TUBE	YES			
SCHOBER ORGAN CORP. 43 W. 61 STREET NEW YORK, NEW YORK	CONSOLETTE	SPINET	11	7	4	13			VACUUM TUBE			1	12
	CONCERT	CONSOLE	9	7	3	32	6	YES	VACUUM TUBE			1	12
THOMAS ORGAN CO. 8345 HAYVENHURST AVE. SEPULVEDA, CALIF.	ORGAN-STEREO	SPINET	5			13			VACUUM TUBE	YES		1	8 (1 MANUAL)
	SONATA	SPINET	6	4		13			TRANSISTOR	YES		1	10
	CHORALE	SPINET	8	6	2	25			TRANSISTOR	YES		1	9 (2 MANUAL)
	SERENADE	SPINET	10	8	2	18			TRANSISTOR	YES		1	7
WURLITZER CO. DE KALB, ILL.		SPINET	YES	YES	YES	YES	YES		VIBRATING REED	YES	YES	1	8
	4600	CONSOLE	25		YES	25	2		VIBRATING REED	YES	YES	1	12
	4602	CONSOLE	12	10	5	32	2		VIBRATING REED	YES	YES	1	12
	4800	CONSOLE	12	10	8	32	1 SET	YES	VIBRATING REED	YES	YES	2	12

NOTES
1. 3 MANUAL ORGAN
2. 8 STOPS IN THIRD MANUAL
3. 12 STOPS IN THIRD MANUAL
4. INCLUDES 2 TREMELOS
5. INCLUDES 1 TREMELO
6. 32 NOTE KEYBOARDS
7. 44 NOTE KEYBOARDS
8. 49 NOTE KEYBOARDS
9. 32 NOTE KEYBOARDS
10. 37 NOTE KEYBOARDS
11. 56 NOTE KEYBOARDS
12. 61 NOTE KEYBOARDS
13. SAME AS HOLIDAY WITH CHORD FEATURE ADDED
14. 41 NOTE KEYBOARDS
15. TOTAL NUMBER OF STOPS IS 47

Fig. 5. Chart of electronic organ characteristics.

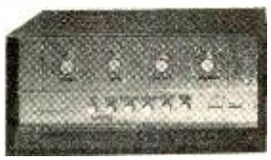
Further up the price and sophistication scale we find instruments of two manuals with separate stops for each manual as well as for the bass. Couplers are provided which permit voices from one manual to be coupled with the second manual.

Usual pedal-playing techniques associated with organ playing (alternately using the heel and toe) are not possible in the smaller organ. The pedal boards are hinged only at the organ case and not on a frame as on the larger organs. In a smaller organ, the pedals can only be pushed down and thus the tones are separated. Usually, only one pedal note can be sounded at one time. Normal legato (connected) playing, thus, is not possible.

Although these abbreviated organs are less expensive and smaller than larger organs, they are more difficult to master. Skill is needed to make up for the fewer number of keys and pedals.

If you really enjoy music then you really want

RAVENSWOOD



A-1000-B

A-1000-B

Stereo Pre-Amp/Amplifier

A complete control center and power amplifier on one compact chassis that requires only 5" depth for mounting. All controls easily accessible up front on the handsome gold escutcheon. Knobs for treble, bass, balance, and loudness. Pushbuttons for Tape/TV, AM-FM tuner, Monaural, Channel Reverse, Scratch and Rumble Filters. Music Power Output: 14 watts per channel. Frequency Response: 20-20,000 cycles ± 1 db. Distortion: less than .5% at listening levels. Hum: —58 db on phono inputs. Output: 4, 8, 16 ohms. Size: 13" wide x 5" high x 4½" deep. Price includes separate power supply chassis (12⅞" wide x 4⅜" high x 2¾" deep) that can be separately mounted in any convenient location near the amplifier. Case extra. $99.95**

T-1000

AM-FM Stereo Tuner

Modern design produces outstanding AM or FM reception plus unusual mounting flexibility. Separate AM and FM circuits for AM-FM stereo or in addition FM stereo. Sensitivity is 1.8 mv for 20 db quieting. Less than .5% distortion at 100% modulation. Features a high "Q" ferrite loop AM antenna. Pushbuttons for AM-Broad reception and FM AFC. Individual knobs for AM and FM tuning. Bar-Type tuning eye for FM. Designed for use with the A-1000-B Amplifier. Case extra. $99.95**

NEW

TCC-2000

Stereo Pre-Amp and AM-FM Tuner

All control functions, plus AM-FM tuning or FM stereo tuning on a single compact chassis that requires only 5" depth for mounting. Performance specifications are outstanding. Frequency range is 20-20,000 cps ± 1 db. Distortion is .1%. Hum level: 60 db below rated output on phono inputs. FM sensitivity: 1.8 mv for 20 db quieting. Includes control knobs for bass, treble, balance, selector and volume/loudness. Separate tuning knobs for AM and FM. Pushbuttons for AC power On-Off, rumble filter, scratch filter, loudness, monaural, channel reverse, AM Broad and FM AFC. Handsomely styled in gold. Designed for use with the PA-2000 or PA-3000 amplifiers. Case extra.
$249.95**

PA-2000

Stereo Power Amplifier

Power-packed basic amplifier delivers 30 watts per channel (Music Power). Exceptionally clean, low noise output. Distortion less than .5% and hum level is 90 db below rated output. Frequency response: 20-20,000 cps ± 1 db. Uses four 7189 output tubes.
$99.95**

PA-3000

Stereo Power Amplifier

65 watts per channel (Music Power) provide outstanding performance with exceptional reserve power capacity. Distortion is less than .5%. Hum level is 90 db below rated output. Frequency response is 20-20,000 ± 1 db. Uses four EL-34 output tubes.
$199.95**

UNSTEREOTYPED STEREO

"Reflection Coupler" Speaker Systems*

Exclusive with RAVENSWOOD, "Reflection Coupler" speaker systems have brought a radically new, exciting method of music reproduction to the music lover. All of the speaker systems are "Reflection Coupler" Systems.

M-50

Ultra-compact, this two-speaker system delivers a range that is hard to believe. Power handling capacity is 35 watts of program material. With 2 systems in tandem for stereo, dispersion (with reflectors) is 180°. Full crossover network. Impedance: 16 ohms. Size: 20" wide x 16" high x 6" deep. Available in utility form (flat black) or finished in oiled walnut. **Utility $44.95** Oil. Wal. $54.95****

M-500

A complete three-speaker system (12" woofer, 8" midrange and 3" tweeter), this model covers the audible range with fullness and accuracy. Power handling capacity is 50 watts of program material. With two systems in tandem for stereo, dispersion (with reflectors) is 180°. Impedance is 16 ohms. Full crossover network. Size: 24" wide x 16" high x 6½" deep. Available in utility form (flat black) or finished in oiled walnut. **Utility $74.95** Oil. Wal. $94.95****

M-5000

Luxurious performance, completely without compromise, this model combines the very best of components (12" woofer, 8" midrange and 3" tweeter) to satisfy the most critical listener. Power handling capacity is 70 watts of program material. With two systems used in tandem for stereo, dispersion (with reflectors) is 180°. Full crossover network. Impedance: 16 ohms. Size: 28½" wide x 16" high x 7" deep. Available in utility form (flat black) or finished in oiled walnut. **Utility $124.95** Oil. Wal. $144.95****

M 2-22

A three-way speaker system (12" woofer, 8" midrange, and 3" tweeter) designed to reproduce the full range of audible frequencies with minimal distortions. Power handling capacity is 50 watts of program material. With two systems in tandem for stereo, dispersion (with reflectors) is 180°. Full crossover network. Impedance is 16 ohms. Size: 32" wide x 8" high x 16" deep. Available in utility form (finish flat black). **Utility $74.95****

M 2-38

This 3-way speaker system (12" woofer, 8" midrange and 3" tweeter) leaves nothing to be desired in a fine speaker system. Power handling capacity is 70 watts of program material. With two systems in tandem for stereo, dispersion (with reflectors) is 180°. Full crossover network. Impedance: 16 ohms. Size: 38" wide x 8" high x 16" deep. Available in utility form. Flat black finish. **Utility $124.95****

** Patent applied for*
*** all prices are Zone 1*

Ravenswood

A DIVISION OF ANNAPOLIS ELECTROACOUSTIC CORPORATION
241 West St., Annapolis, Md.

Manuals, Stops, and Couplers

Manuals are given historic names: the upper manual is called the Great Manual, the lower manual Swell, and the bass is called Pedal. Frequently for church use, or for brilliant theatrical voicing, there may be a third manual called Accompaniment, and even a fourth manual called Solo. Organs of a multi-manual design may cost considerably more than $10,000.

Stops are also given historic and poetic names. This is a typical list for a medium sized organ:

Great Division	*Swell Division*	*Pedal Division*
Horn Diapason	Bass Flute	Bourdon
Flute	Bassoon	Lieblich Gedecht
Dulciana	Trumpet	Quint
Flute	French Horn	
Violina	Salicional	
	Clarinet	
	Oboe	
	Nazard	
	Piccolo	
	Tierce	

The American Guild of Organists[2] publishes specifications on organ console dimensions. An AGO organ is the grand piano of organs; particularly, it specifies a full pedal division of 32 notes for heel and toe playing.

For serious music or for musical education of children, an instrument conforming to AGO specifications or reasonably close conformance is preferred. Price is not necessarily a criterion for this specification. Some organs built to AGO specifications cost less than others not built to those standards. In addition to the familiar volume control, larger organs have another foot operated expression pedal called Crescendo Control. This permits the organist to pick up stops and couplers in a predetermined fashion without ever having his hands leave the keys.

Other controls are the couplers which transfer stops to other manuals. This is a typical list of couplers for a medium sized organ:

Great to Great 4′ (an octave higher)
Swell to Great 16′ (an octave lower)
Swell to Great
Swell to Great 16′
Swell to Swell 4′
Swell to Pedal
Swell to Pedal 4′
Great to Pedal
Great to Pedal 4′

Organs have percussion controls, manual balance switches, and separate volume controls for stereo or three channel systems. Coupled with these controls, there are vibrato and tremulo controls. Frequently these are electronic and sometimes mechanical. In the Allen organ, the entire speaker assembly is rotated slowly to obtain a slow rhythmic phase shift or tremulo effect.

[2] 630 Fifth Avenue, New York 20, N. Y.

Tone Generation

Several important schools of design exist on tone generation. One, exemplified by the Baldwin and the Schober Organs, generates saw-tooth wave forms. Such wave forms are rich in harmonics so that desired voicing can be created by selective filtering through the electrical addition of different filter outputs.

The Hammond Organ generates essentially a sine wave and then, through additive techniques, permits the player to add harmonics. Thus, the player controls the voicing to his personal taste. The Estey, Gulbransen, and some models of the Wurlitzer also incorporate this principal.

The sounds produced through these design approaches are different and may affect your selection of an organ. The technique of tone simulation by selective filtering is based on the Formant Theory mentioned earlier. Brighter tones such as trumpet and violin are produced when there is a minimum of filtering and a maximum of harmonics. With a Formant type organ, it is possible to secure a wide range of tonal color. The Allen, Conn, Estey, Kinsman, Lowry, Minshall and Thomas organs also incorporate the Formant principal.

Every conceivable and imaginable oscillator technique has been utilized for tone generation; photo-electric (Kimball), synchronized magnetic coupling (Hammond), vibrating reeds (Wurlitzer), stabilized LC circuits—(Baldwin, Artisan, Schober), and relaxation neon tube oscillators (Estey, Kinsman).

Owners of adequately powered amplifier systems may wish to avoid added costs in amplifiers and speakers. They should ascertain whether electromechanical or electronic vibrato is furnished. Electromechanical tremulo cannot be accomplished through conventional audio systems; phase shift (electronic) vibrato can be accomplished without changing your system. However, many excellent organ installations play directly through monophonic or stereo hi-fi systems. Over stereo systems, each manual can be heard separately.

The speaker systems should be remote from the player so that sound can reverberate before the player hears the sound. Hammond, Artisan, and others provide long audio columns arranged to obtain time delays. Various systems of artificial reverberation are utilized—the most popular being the Hammond "spring" unit.

Any of the following books can be a valuable source of additional information on the design and construction of electronic organs.

1. Alan Douglas, "*The Electronic Musical Instrument Manual.*" Pitman and Sons, London 1954.

2. *Organ Builders' Manual.* Electronic Organ Arts

3. Richard H. Dorf, "*Electronic Musical Instruments,*" Schober Organ Corp., New York, 1959.

Selecting the Organ

You are now prepared to visit the organ showrooms. Sellers of organs are extremely capable, sometimes over-enthusiastic individuals. Incidentally, many hi-fi dealers are now selling electronic organs. Since the organ is fairly expensive, sales-people are accustomed to a leisurely interview. They also know that you will want to go home and mull over their sales promotion efforts.

In looking and listening to an electronic organ, it is desirable to listen to a simple scale passage or melody played with different stops and couplers. The stops and couplers are without meaning, if discernible differences in tone are not apparent with each stop or coupler keying. An organ's sound cannot be judged well when the music is fast and spectacular. Highly colorful playing may obscure sounds that may not be acceptable to you. The voicing of individual organs may differ so that the Diapason or Flute may well sound different when played on organs of different make.

Concentrate on the extent of tonal variety between smooth, bland, flute sounds and sharp biting reeds and strings. The number of stops is not necessarily and indication of the useful tone colors available. Particularly, pay attention to key clicking or thumping in the speaker as keys are depressed. Inadequate key filtering or poor circuit design can cause extreme annoyances. Inspect the interior of the organ for workmanship and component selection.

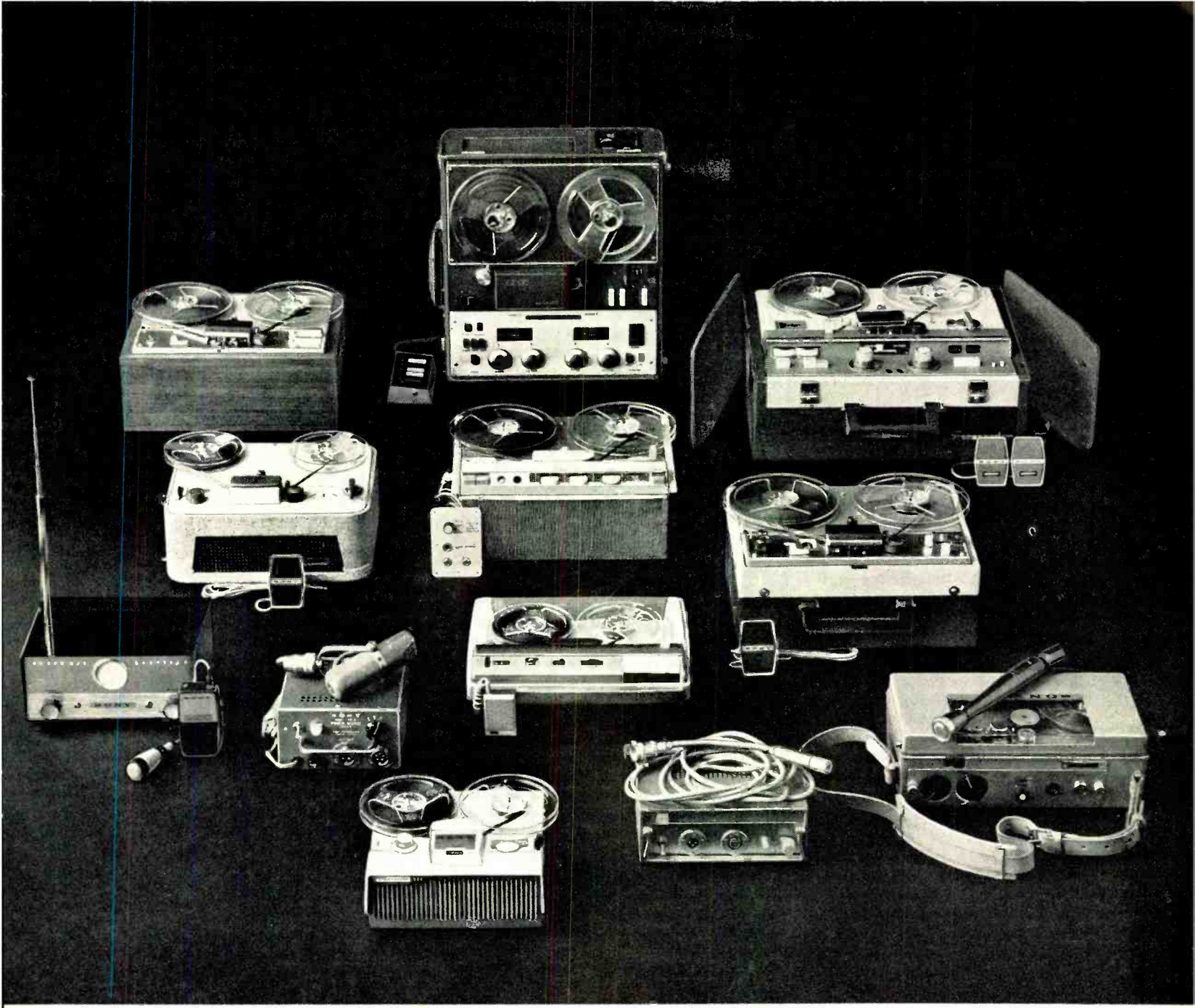
Two manufacturers of electronic organs furnish electronic kits and cabinetry. They are:

a. Schober Organ Corp., 43 West 61st Street, New York, N. Y.

b. Electronic Organ Arts, Inc., 4949 York Blvd., Los Angeles 42, Calif.

The Schober Organ Company supplies kits for just two organs. The Consolette model is a two manual organ with a full range of stops and abbreviated Pedal Division. The Concert model meets AGO specifications and is suitable for most serious organ music. Both of these units are designed to play through existing hi-fi setups. Schober modestly estimates that your labor will contribute half of

(*Continued on page 95*)



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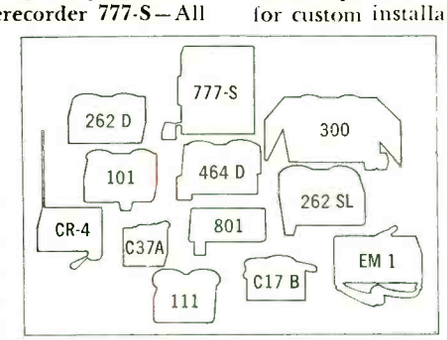

For additional literature and name of nearest franchised dealer write Superscope, Inc., Dept. 7 Sun Valley, California

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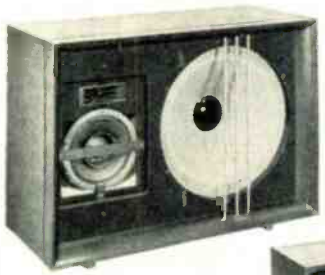

ROYAL 400


PRINCESS


REGAL 300

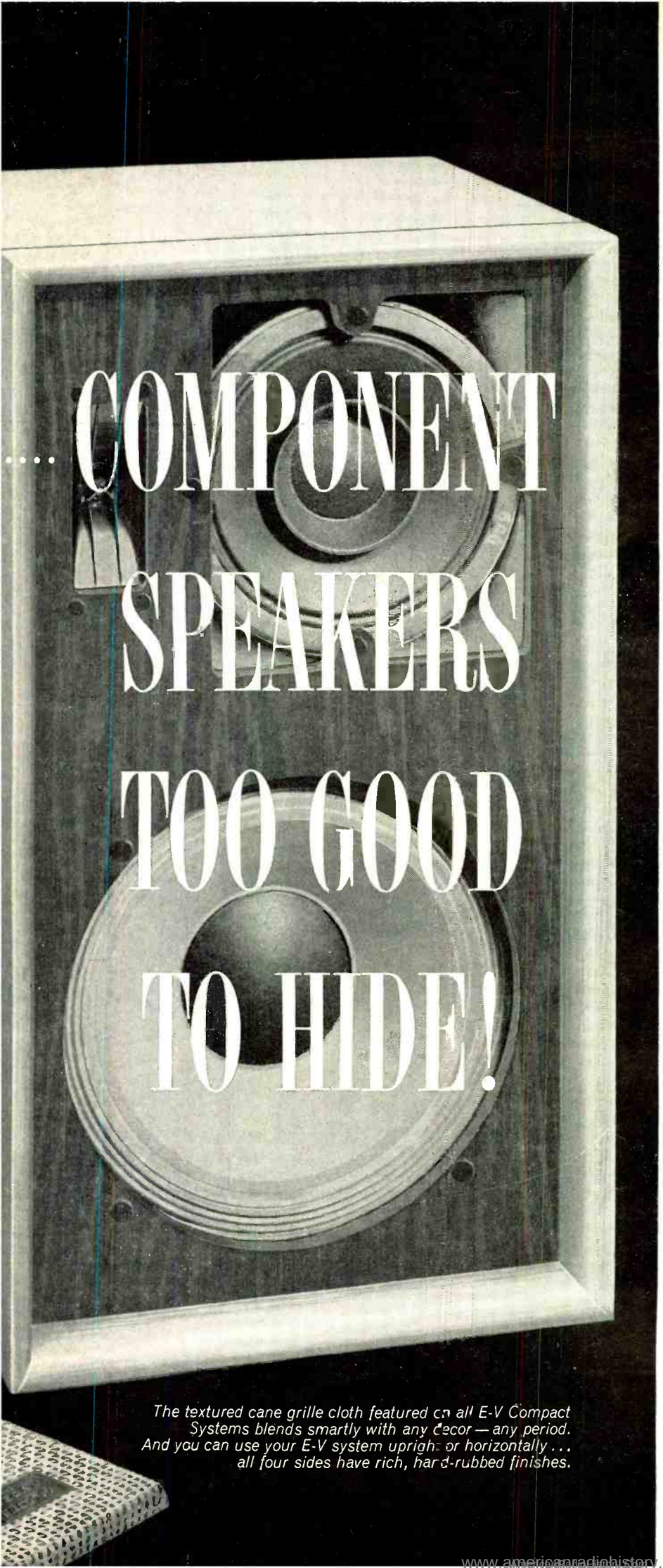
To the uninitiated buyer, all compact systems may look much alike. But inside there's a big difference — a difference that can spell either lasting satisfaction or eventual disappointment.

That's why we invite you to look closely at the inside components of any E-V compact system . . . at the design and construction of every single speaker in every system. No mystery . . . no mumbo-jumbo. E-V compact systems feature top-quality components throughout, to guarantee the finest original sound plus years of trouble-free performance.

Check the specs . . . check the features! Then choose the E-V compact system that meets your every requirement of appearance, price, quality . . . the system that will bring your favorite music "back to life."

USE THIS HANDY SPECIFICATION CHART TO CHOOSE YOUR E-V COMPACT SPEAKER SYSTEM

Model	Royal 400	Regal 300	Esquire 200A	Leyton	Princess	Regal 300 Kit	Esquire 200 Kit
Frequency Response	30-19,000 cps	35-19,000 cps	40-19,000 cps	50-15,000 cps	60-15,000 cps	35-19,000 cps	40-19,000 cps
Power Handling, Program	70 Watts	70 Watts	30 Watts	25 Watts	20 Watts	70 Watts	70 Watts
Level Controls	Two	Two	Two	One	None	Two	Two
Crossover Frequencies	200, 3500 cps	200, 3500 cps	800, 3500 cps	2000 cps	2000 cps	200, 3500 cps	200, 3500 cps
Speaker Types	18" foam-cone woofer, 8" cone mid-range, diffraction-horn tweeter	12" foam-cone woofer, 8" cone mid-range, diffraction-horn tweeter	10" woofer, 5" cone mid-range, diffraction-horn tweeter	10" woofer, 5" cone tweeter	8" x 12" woofer, 5" cone tweeter	12" foam-cone woofer, 8" cone mid-range, diffraction-horn tweeter	12" woofer, 8" cone mid-range, diffraction-horn tweeter
Impedance	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
Finishes Available	Walnut, Mahogany Unfinished Hardwood	Walnut, Mahogany Unfinished Hardwood	Walnut, Mahogany Unfinished Hardwood	Walnut, Mahogany	Walnut	Unfinished Hardwood	Unfinished Hardwood
Size: (Finished Model) (Unfinished Model)	23½"H, 32"W, 14¾"D 22"H, 31½"W, 11¾"D	14"H, 25"W, 13½"D 14"H, 23½"W, 12"D	14"H, 25"W, 13½"D 14"H, 23½"W, 12"D	14"H, 25"W 12"D —	10⅝"H, 19½"W, 8½"D —	(Assembled) 14"H, 23½"W, 12"D	(Assembled) 14"H, 23½"W, 12"D
Shipping Weight	103 lbs.	67 lbs.	30 lbs.	29 lbs.	15 lbs.	63 lbs.	52 lbs.
Price, Finished Unfinished	$249.00 $199.00	$179.00 $149.00	$133.00 $107.50	$84.50 —	$49.50 —	— $125.00	— $93.00



The textured cane grille cloth featured on all E-V Compact Systems blends smartly with any decor — any period. And you can use your E-V system upright or horizontally . . . all four sides have rich, hand-rubbed finishes.

HERE'S PROOF E-V BUILDS QUALITY CLEAR THROUGH!

All E-V bass speakers, for example, utilize a high-compliance suspension, long-throw voice coil and a high-mass moving system to extend low-frequency response with minimum efficiency loss . . . minimum distortion. Mid-range and high-frequency speakers provide peak-free, wide-angle response balanced to the bass speaker. Crossover points, too, are chosen meticulously to satisfy the strictest engineering and musical requirements. And all mid-range and high-frequency components are isolated from other speakers to eliminate interaction, cut distortion.

In E-V compact systems, too, you'll find such features as edgewise-wound voice coils for 18% more efficiency . . . while high-efficiency magnetic circuits and viscous-damped cloth suspensions maintain this efficiency. Rigid steel or diecast speaker frames assure perfect alignment and unvarying performance. Excellent dispersion of highs for greater freedom in stereo speaker placement results from E-V exclusive diffraction horns or new flat-cone tweeters.

These features are wedded by skillful E-V design and engineering know-how to bring you a sound that can best be described as "transparent"— you feel the deepest bass, enjoy the crisp clarity of the treble and literally delight in the brilliance of even the highest overtones!

ROYAL 400 Finest low-resonance system available. Uses giant 18" foam-cone woofer, yet cabinet is only 23-1/2" high, 32" wide, 14-3/4" deep. Features effortless handling of deepest bass plus balanced response throughout entire range. Superbly finished in Mahogany or Walnut. Net each $249.50. Unfinished utility model, net each $199.00.

REGAL 300 Premium-quality bookshelf-sized three-way system. Deluxe components throughout. Two level controls. Hand-rubbed Walnut or Mahogany finish. Net each $179.00. Unfinished utility model, net each $149.00.

ESQUIRE 200A Completely redesigned with speakers specially built for compact use. Three-way system includes 10" woofer, 5" mid-range and diffraction-horn tweeter. Richly-grained Walnut or Mahogany finish. Net each $133.00. Unfinished utility model, $107.50.

LEYTON Value leader in the E-V compact line. New two-way system uses 10" woofer, 5" wide-range tweeter. Lowest cost full-size book-shelf system in line. Walnut or Mahogany finish. Net each $84.50.

PRINCESS Newest, smallest two-way system in the E-V family of compact systems. Ideal for low-cost stereo . . . just $99.00 for a pair! Unusual 8" x 12" woofer provides response to 60 cps. Walnut finish. Net each $49.50.

MONEY-SAVING COMPACT KITS
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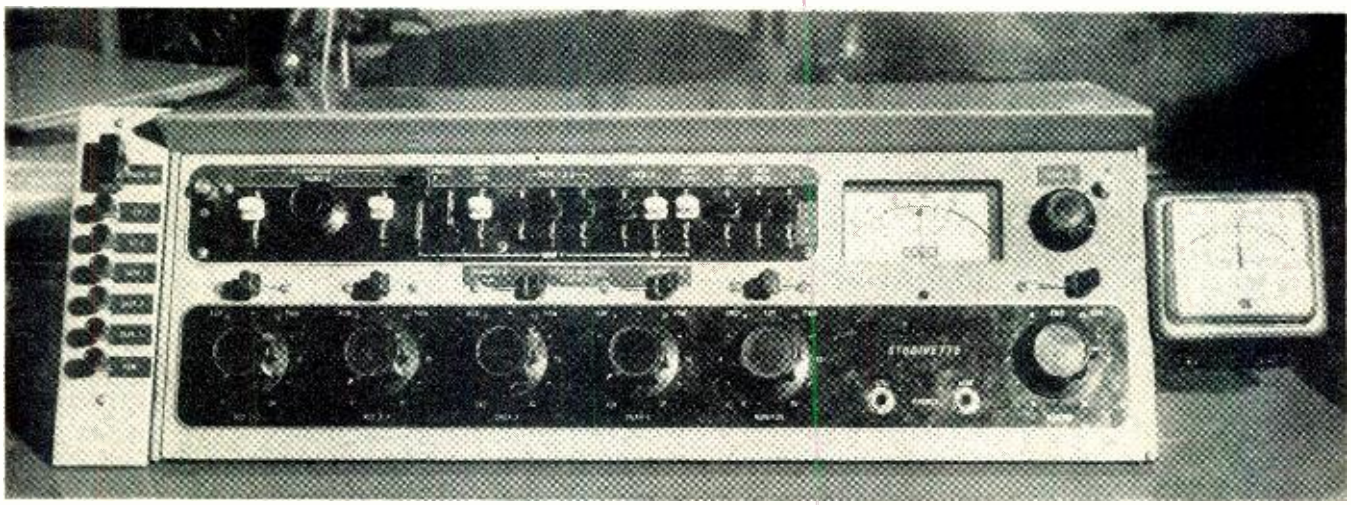


Fig. 1. The modified Gates "Studioette" in use at WLIR.

Low-Cost Stereo Conversion for Studio Console

C. G. McPROUD

While the main expense in converting to FM-Stereo may appear to be the cost of the generator, there is always the need to change a monophonic studio console over to acceptably convenient two-channel operation, and the required modifications to turntables and tape machines.

When an FM station decides to convert to stereo, the first thought likely to enter the mind of the owner(s) is, "How much will it cost?" The largest single item and the one most apparent to the casual glance is that of the stereo generator itself—a cost likely to range between $1000 and $2500. The lower figure may be high if the studio engineering personnel is proficient enough to design and build the device and chase it through FCC approval, but if time is at all important this sort of development work is out of the question.

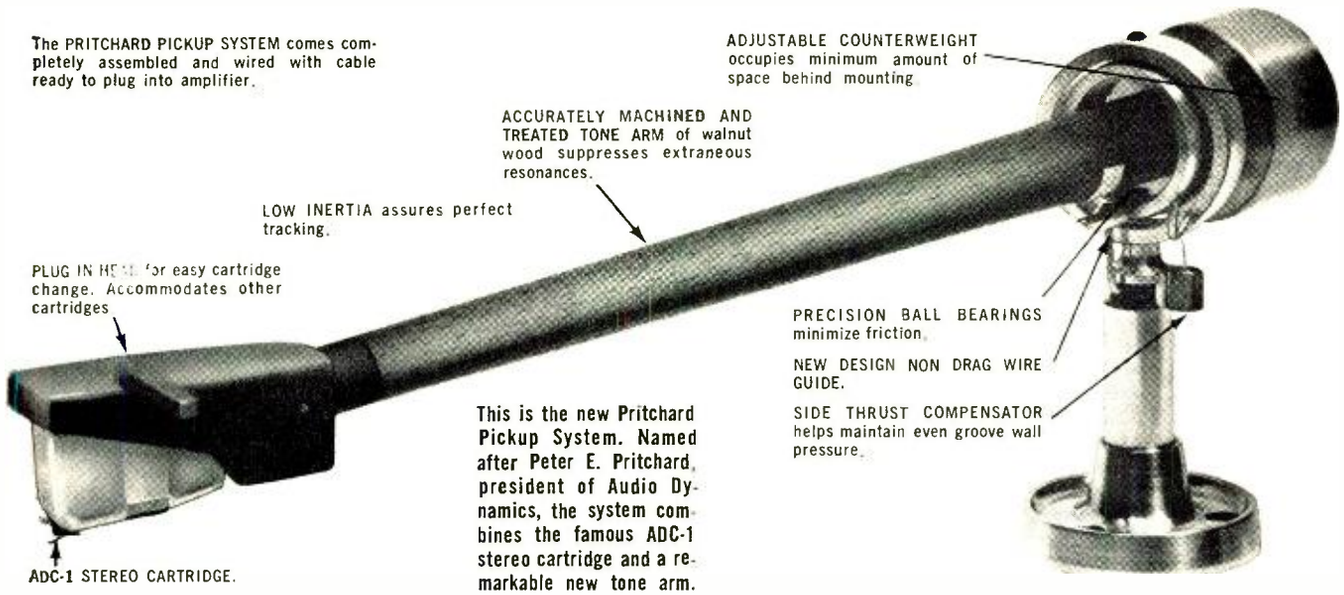
But the cost of the stereo generator is not the whole figure by any means. The studio facilities must be modified to handle two channels conveniently, the turntable pickups must be changed to stereo, modifications must be made to the tape recorders, and—possibly—the station may feel that another limiter amplifier is necessary for the second channel. If, however, it is possible for station personnel to modify the present studio console so that it will perform satisfactorily, the cost of a new console can be eliminated from the estimate, or at least most of the cost. The changes to the input facilities would have to be made in any case, and a peculiarity of the required stereo signal may be sufficient to prelude the necessity for a second limiter.

When WLIR, in Garden City, New York—practically in Audio's backyard—decided to make the conversion, we suggested that the studio console could be modified without a great expense. Having thus opened our big mouth, we were invited to do it.

The console in use was—and is—a Gates "Studioette," model M5381. It is completely adequate for a small station without a multiplicity of remotes and without much live programming, and many of them are in use throughout the country. This console has the usual program and audition circuits, a master gain control for the program amplifier, a monitor booster and a monitor amplifier which can serve as an emergency program amplifier, a self-contained power supply, and fairly flexible switching for normal station operation. We reasoned that the program and audition channels could serve as left and right program busses, respectively, and for complete symmetry the two channels should be made identical following the program/audition bus circuits. Since WLIR is presently programming stereo only from 6:00 p.m. to 11:00 p.m. every evening, with mono being used exclusively from 8:00 a.m. to 6:00 p.m. and after 11:00 p.m. until sign-off, it was necessary to provide to a quick change from one mode to the other. In addition, one modification was desired that was not normally incorporated in the console—that of talk-back operation to a second studio without using the audition channel, whether on mono or stereo.

Basic Modifications

The over-all stereo modification was based on: (1) the use of an external pushbutton switch to control the inputs; (2) replacing the monitor booster and monitor amplifiers with a second program amplifier; (3) adding an external monitor amplifier of a conventional hi-fi type together with a second speaker; and (4), adding a differential VU meter. *Figure* 1 shows the completed console after modification, with the pushbutton switch affixed to the left side and the differential VU meter on the right. The principal concession to stereo was the replacement of the original master gain



This is the new Pritchard Pickup System. Named after Peter E. Pritchard, president of Audio Dynamics, the system combines the famous ADC-1 stereo cartridge and a remarkable new tone arm.

REMARKABLE NEW SYSTEM TRACKS AT 3/4 GRAM!

Audio Dynamics presents an entirely new concept in pickup design that marks a new era in record playing performance by guaranteeing the five essentials of stereo reproduction.

In designing a cartridge for high quality tone arms, Audio Dynamics engineers perfected the highly compliant ADC-1. This cartridge made it possible for the first time to achieve the five essentials of true stereophonic reproduction.

Now Audio Dynamics has gone a step further... they have designed a remarkable tone arm and combined it with the ADC-1 in an entirely new pickup system. Results? The five essentials of true stereo reproduction are guaranteed!

Although the ADC-1 raised stereo reproduction to levels never before possible, this highly compliant cartridge has to be combined with a quality tone arm. The combination must enable the cartridge to track at a force low enough to eliminate distortions and record wear, and also preserve the linearity of the stylus tip suspension. Selecting the proper tone arm was a problem for the buyer. The new Pritchard Pickup System eliminated guesswork. It combines the ADC-1 and a newly designed tone arm that is compatible with this outstanding cartridge.

The Pritchard Pickup System gives you a true, dynamically balanced tone arm. Unlike other systems, the heavy adjustable counterweight occupies a minimal amount of space behind the pivot. To adjust stylus tracking you simply move the counterweight until the arm is in perfect balance. Fine adjustment allows the system to track at the precise force required by the cartridge design.

Because of its low inertia the system will track each side of the groove perfectly even if the record is warped. To stabilize the force created between the disc and the arm, a side-thrust compensator permits the stylus to maintain even pressure on both groove walls. Precision single ball bearings in gimbals minimize vertical and lateral friction.

If you are an owner of an ADC-1 stereo cartridge all you need for a major improvement in your system is a Pritchard tone arm. If you do not possess the ADC-1 and are searching for some way of upgrading your present set of components, visit your dealer and hear how the Pritchard Pickup System makes records sound better than you thought possible. Once you have, you will not settle for less.

For descriptive literature on the Pritchard Pickup System by Audio Dynamics, write to us today.

Pritchard Pickup System Model ADC-85 **$85.00**
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Here are the five essentials of true stereo reproduction. They are yours with an ADC cartridge.

Essential #1—Highs free from peaks and distortion . . . by lowering stylus mass and eliminating heavy damping.

Essential #2—Clean and well rounded bass tones . . . by increasing compliance, lowering tone arm resonance.

Essential #3—Record compatibility . . . through lowered tracking force.

Essential #4—Proper channel separation . . . by removing resonances from the audible range.

Essential #5—Reduced surface noise . . . by eliminating resonances and using super-polished diamond styli selected from perfect crystals.

ADC-1 cartridge for high quality tone arms. $49.50

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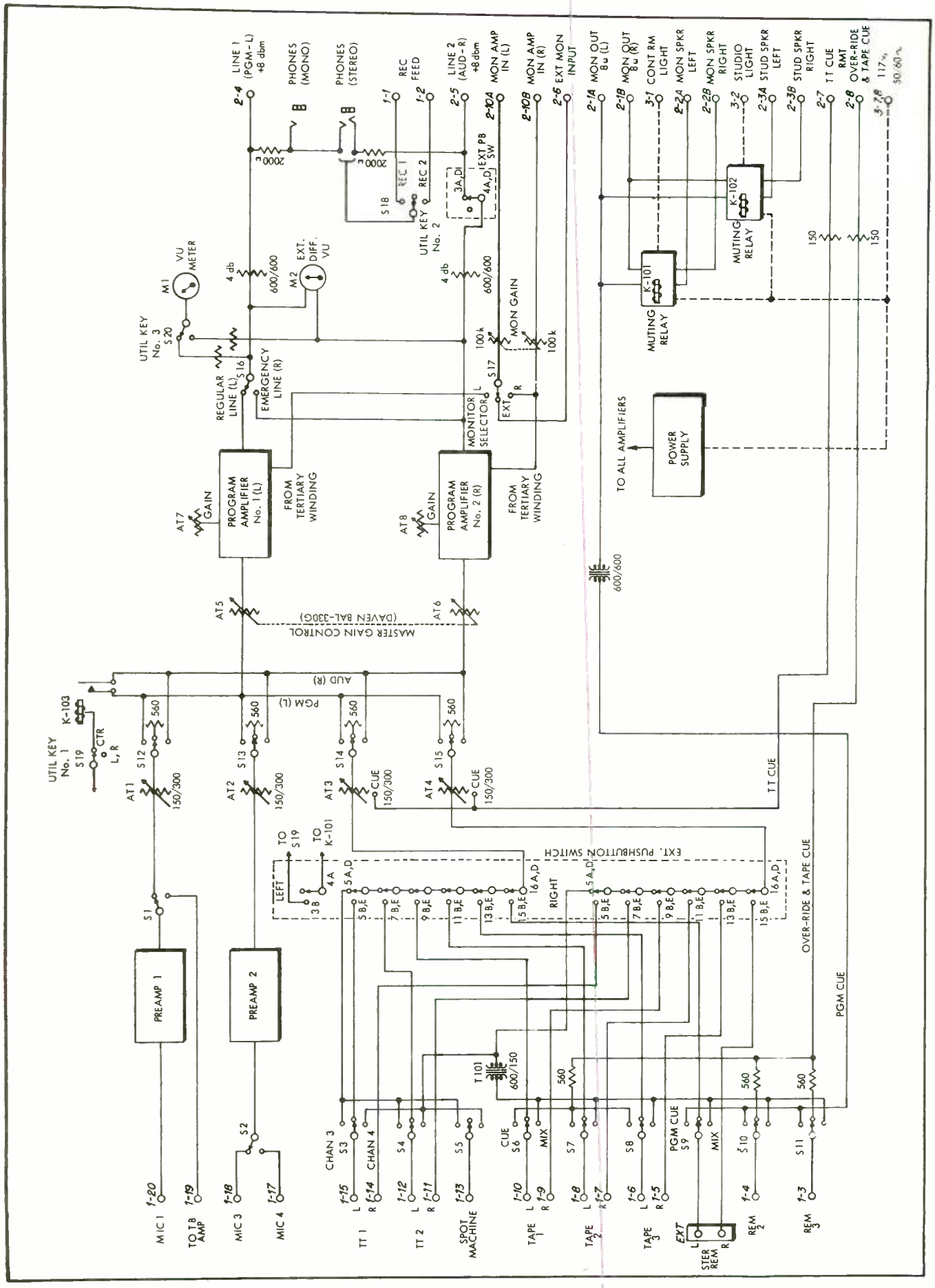


Fig. 2. Block schematic of the modified-for-stereo Studioette.

Found only on University MODULAR MICROPHONES†

Features that make a University microphone better than most. Better in quality and utility for applications requiring the ultimate in pickup. Better to answer every exacting need with unswerving performance, flexibility and durability.

Let's see why.

Electro-formed Filter: Actually, **two** screens are used, one of silk, the other of electromesh–a type of metal screening so fine that it can be formed only by a selective plating process—ensuring positive deterrence against airborne particles. The unique mating of the two screens is also most effective in preventing annoying wind noise and breath pops.

Exclusive Unilar† Diaphragm: Why Unilar? Because it possesses conflicting properties—lightness **and** great rigidity—which permit the microphone diaphragm to mirror perfectly every subtlety of the original performance. And Unilar has astonishing immunity to both high and low temperature extremes, humidity and many corrosive elements. Beyond this, Unilar can withstand extreme physical stress. For example, if deformed by extreme high intensity sound pressures, it springs right back to its original shape! Thus Unilar is your assurance of constancy of performance.

†TRADEMARK

Gold Plated Connector Points: University has made certain—to the nth degree—that no obscure malfunctions shall be permitted to mar the final performance of any microphone. To this end, gold plated push-on connectors and pins are employed on all modules and adapters. The mechanical integrity of the push-on connectors is such as to assure **perfect** electrical contact without annoying crackle noises due to corrosion.

Shock Mounting: University's unique integral shock mounting gives more widespread benefits than ordinary shock mountings, which are limited to the isolation of the microphone from vibrations transmitted through the stand. University actually 'floats' the cartridge element in a specially-designed foam rubber bed, thus isolating it not only from floor vibrations, but **also from** spurious sounds **originating at the microphone case itself**—such as when a performer handles the microphone or when it is being passed around.

For **more** exclusive features, and descriptions of the entire line of University **modular microphones,** write: Desk R-11M, University Loudspeakers, Inc., White Plains, N.Y.

UNIVERSITY

A Division of Ling-Temco-Vought, Inc.

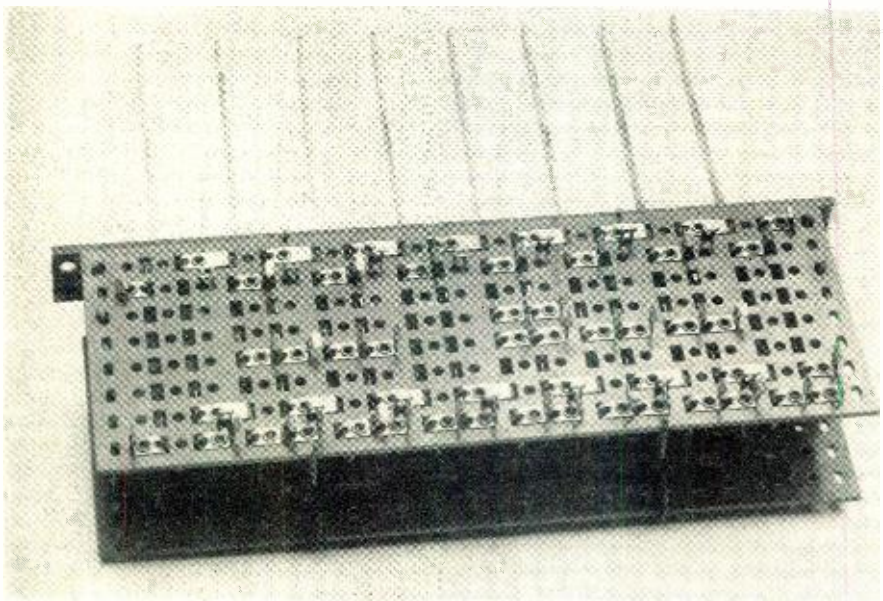


Fig. 3. The eight-pushbutton switch used for the main stereo-mono selector switch.

control—which was a dual grid pot between the first and second stages and between the second and third stages of the program amplifier—with a step-type dual ladder attenuator, and removing the existing master gain control from its old position to a new location to the right of the VU meter and adding the second one between the two microphone selector keys.

New relays were required, and the elimination of the high-current monitor amplifier necessitated some changes in the power supply. *Figure* 2 is a complete schematic of the modified console.

Two of the specific changes may require some explanation. First is the method of paralleling the two channels when the announce microphone is actuated so that the announcer usually appears to be in the center; second is the talk-back modification.

In stereo, it may not always be advantageous for the announcer to appear in the left speaker—it is usually preferable that he be in the center, but possibly he should be in the right at times. A relay, K-103 in the schematic, was added in parallel with the speaker muting relay, and operative only in the stereo position. When the announcer operated his microphone key, this relay connected the two busses in parallel, thus feeding the output of the microphone preamplifier equally to both channels. One of the utility keys was wired in the relay coil circuit so that the announcer could make K-103 inoperative if he wished, and by operating his key to PGM, he could talk from the left, or to AUD where he could talk from the right.

The talkback modification consisted of placing the MIC 1/MIC 2 selector key following the microphone preamp and wiring it so that in the normal position it fed the program circuits and in the operated position it fed the output of the microphone preamp to terminals connected to an external talkback amplifier—which also served as the TT CUE amplifier.

Stereo-Mono Switch

The "heart" of the switching modification consisted of an externally mounted pushbutton switch. The one used was picked up in surplus at a cost of something less than a dollar, and it works satisfactorily. For a more elegant switch, a telephone type—such as those available from General Controls or from Ercona Corporation—would undoubtedly be better. For the six stereo inputs required, four-pole double-throw switching was needed, together with a seventh four-pole double-throw switch for the mono position, an eighth switch (single-pole, single-throw, normally closed) was needed to open the channel-paralleling relay circuit. The switch used is shown in *Fig.* 3, with *Fig.* 4 indicating the connections by letter and number as shown in *Fig.* 2.

It was originally planned to switch the two channel busses to stereo operation, but the complexity of the wiring and the terminating resistances for the four mixer pots seemed too complicated to disturb. As it is, the six stereo inputs —two turntables, three tape machines, and a remote facility—are switched, one at a time, to mixer pots three and four, and their respective keys are thrown to PGM (left) and AUD (right) for stereo operation. When returning to mono operation, the top button is depressed, restoring the system to its normal functioning. In any stereo position, the individual keys for turntables and tape machines must be in the center, or normally off, position. The third turntable key remained connected to the

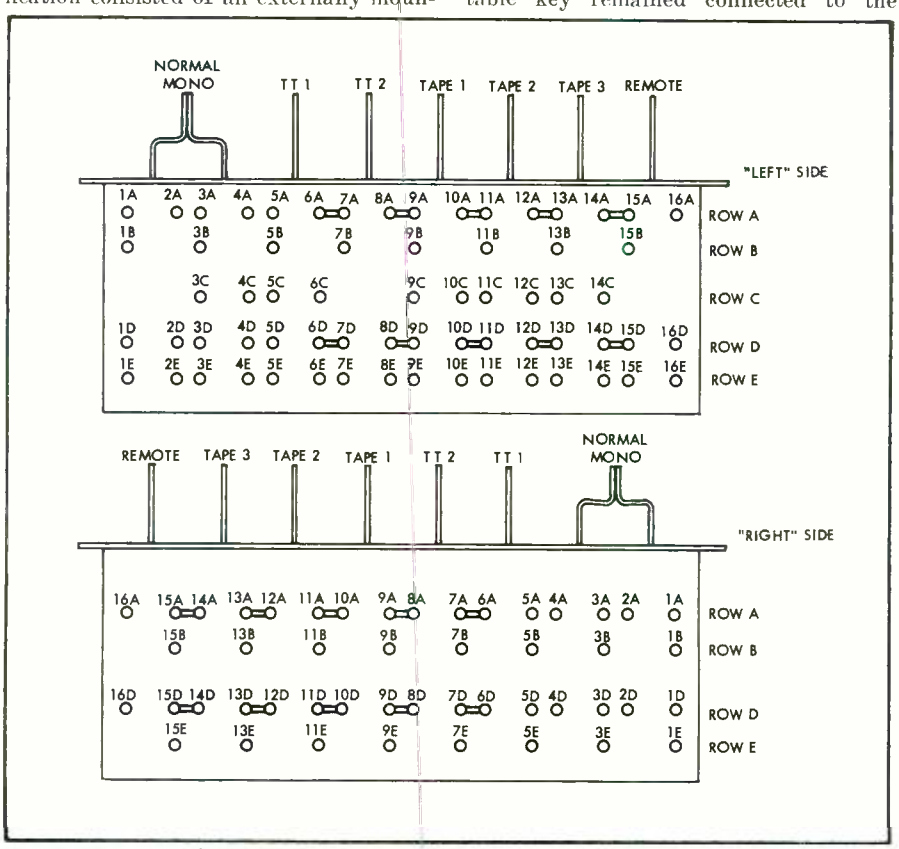
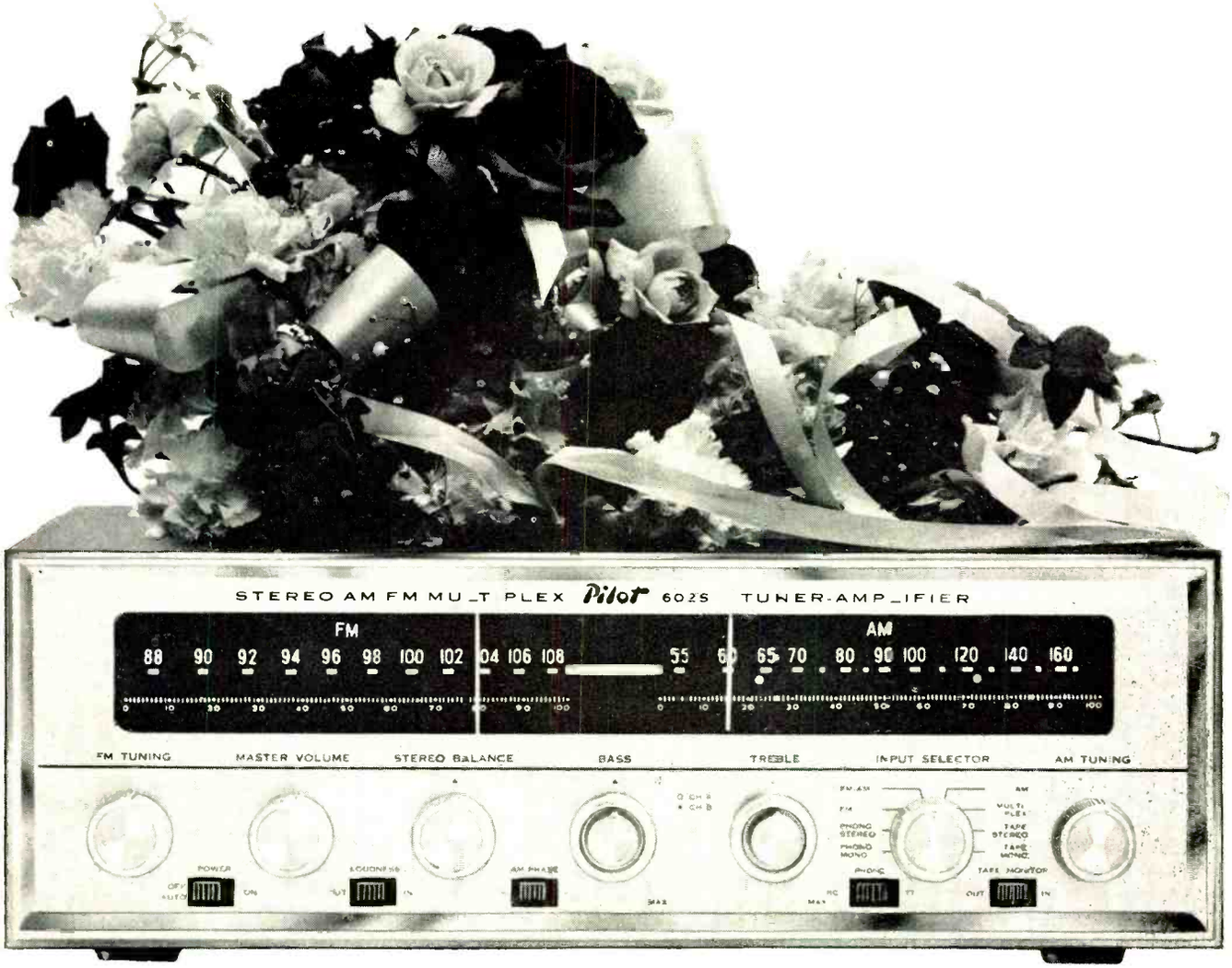


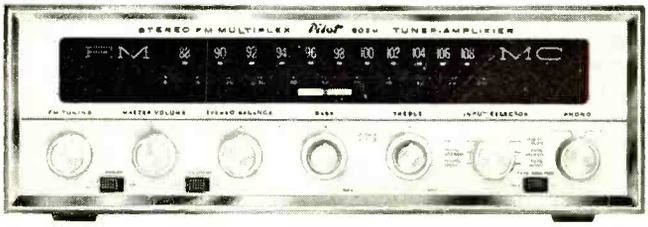
Fig. 4. Diagram of terminal positions on the pushbutton switch corresponding with the designations in Fig. 2.



Just Married

To share a chassis: the PILOT 602 Stereo receiver and Multiplex!

America's most popular Stereo receiver—the PILOT 602—now available with built-in Multiplex. The new PILOT 602S (S for Stereo) is the perfect instrument for any system. The 14 control Stereo preamplifier insures complete flexibility in reproducing radio, records or tape. The 30 watts delivered by the Stereo amplifier is more than enough to drive any speaker system. An FM/AM tuner and the most advanced Multiplexer yet designed give you FM or AM Monaural reception, FM/AM Stereo reception *and* FM Stereo reception. And, all of this in one single instrument that is still the most compact, coolest operating unit available. UL listed, too. Simply add a pair of speakers and a record changer or turntable and you're ready to enjoy music at its finest. PILOT 602S complete with cover... **$299.50**



PILOT 602M FM Multiplex Stereo receiver. For those who want all of the features and power of the 602S but do not require AM reception, the PILOT 602M represents the greatest value ever offered. PILOT 602M complete with cover, **$249.50**

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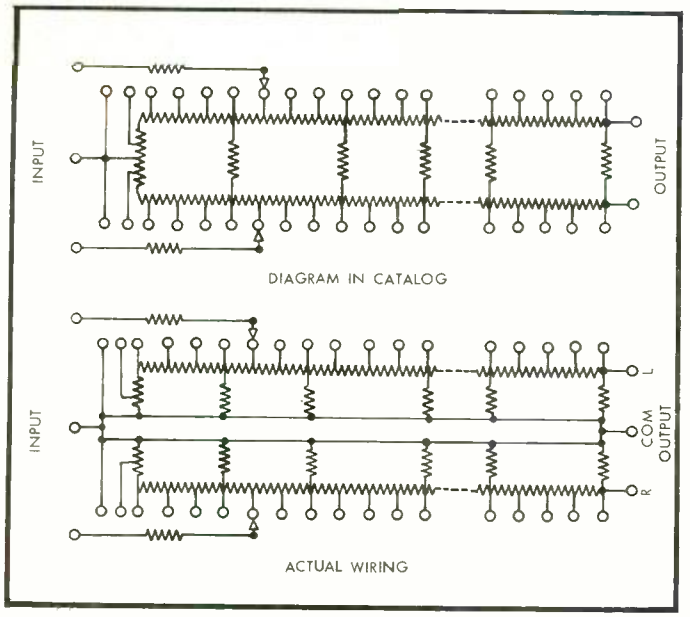


Fig. 5. Balanced ladder attenuator (above) as shown in the Daven Catalog, and (below) as actually wired.

Gates Spot Machine, mono only, and the third remote key was left permanently connected to the "beeperphone" circuit for telephone recording, always in mono and usually on the AUD bus. The REM 1 position is the only one used for stereo, and the terminals for these two circuits are on an external Jones strip mounted on the outside of the console case behind the pushbutton switch.

The switch mounts on a panel attached to the left side of the console case in the same plane as the main panel. Before mounting the switch, shielded pairs were connected to the indicated terminals and the other ends identified temporarily with tapes. The switch was then mounted and the cable of pairs brought through a hole in the side, and routed to appropriate areas in the console.

Note that the terminal strip on the rear of the console has been changed appreciably. While the "left" pairs to the switch are connected to the keys relating to the sources, the "right" pairs are connected directly to the terminal strip. Thus for mono, only the "left" pairs are used; for stereo both are required, of course. The switch shown is the progressive type, with any button breaking the feed-through circuit. The mono button—two of the levers being bent together as shown in *Fig.* 4 and actuated by a bar-type knob—restores any stereo button that may have been depressed and feeds the circuit through to the same connection used in the normal console. The four-pole switch actuated by the mono button opens the "right" program circuit completely, so that there is no "right" signal fed to the stereo generator circuit.

A rearrangement of the source key buttons was made so that all of the stereo circuits now have red buttons; black and white are used for mono circuits.

Program Amplifier

The monitor booster and monitor amplifiers in the Gates Studioette happen to be exactly the same length (together) and width as the program amplifier, so that it is a simple operation to put the second program amplifier in the place formerly occupied by the monitor units. The dual interstage gain control for the existing program amplifier was moved to a new location to the right of the VU meter, which requires no change in the cabling. Unless specifically ordered with it, the program amplifier will not be furnished with a gain control, nor with the hold-down strips that keep it in place on the chassis. The old strips can be made to work with a little filing, however, and the gain control is a dual 100-k linear pot. To accommodate the new master gain control's impedance, both input transformers were wired with blue and brown leads to the input terminals. To provide stereo headphone monitoring readily—as well as to provide a balanced ground on the program circuits, the center taps of the output transformer secondaries were grounded. The channel-paralleling connections were made to the "hot" input terminals, with single shielded wires leading to the new relay, K-103.

The stereo gain control, AT-5 and AT-6, presented some problems in the early stages. In the first place, there is not room enough behind the panel for a tandem attenuator, and it was felt that only a broadcast-type attenuator would be satisfactory for the use it would get. In normal mono operation, the master gain control—the dual interstage grid pot—is rarely moved, with the four attenuators AT-1 to AT-4 being used for level adjusting. For stereo, however, it was felt that the two individual channel pots, AT-3 and AT-4, would normally be used for balancing, and to fade in or out a stereo record a dual master would be needed.

A thorough study of the Daven catalog originated the idea that a balanced ladder attenuator could be used as a dual pot if it were possible to center-tap the "rungs" of the ladder. The schematic in the catalog was like the upper diagram in *Fig.* 5. Now, we reasoned, we are sufficiently dextrous to be able to remove the "rungs" and replace each of them with two half-watt carbon resistors totalling the same value, grounding the center taps, and we would have two unbalanced ladder attenuators of half the impedance of the original.

The attenuator—Daven BAL-330-G—was obtained and removed from its case. Instead of being built like the

(*Continued on page 91*)

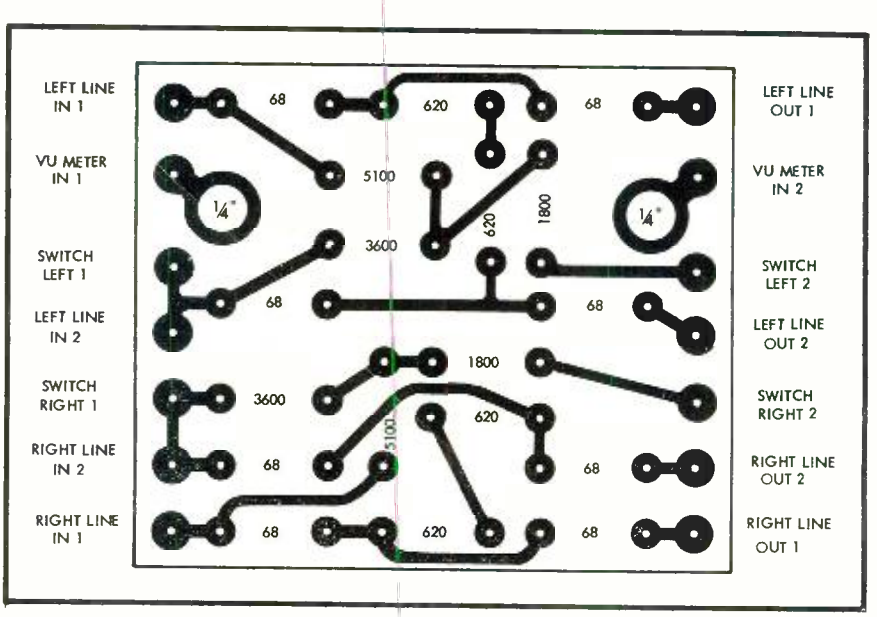


Fig. 6. Full-size diagram of etched-circuit panel used for line pads and meter attenuator. This panel mounts directly on the meter terminls.

YOU—ALONE WITH THE MUSIC

You, like thousands of visitors to the New York High Fidelity Show, will be amazed by the unique qualities of stereo through headphones. AKG's **K 50** dynamic headphones will put you in a world apart — alone in the concert hall with conductor and musicians, thrilled by the new sense of realism and immediacy inherent in the **K 50.**

Only with binaural hearing through fine headphones can you eliminate every environmental influence outside the recording hall —

Only with K 50 can you hear, without degradation or coloration, the full range of musical sound created by the orchestra, with every subtlety and shade of tone heard by the microphone — only with **K 50**'s three featherlight ounces can you listen for hours without discomfort.

The finest recordings are made with AKG microphones. **Any** recording, mono or stereo, sounds best through AKG's **K 50** phones. Designed and handcrafted in Vienna, "the Home Town of Music," **K-50** costs you only $22.50. Heft and hear them at your audio dealer — name on request. Electronic Applications, Inc. / Stamford / Connecticut / (203) DAvis 5-1574.

AKG

"Sineward" Distortion in High-Fidelity Amplifiers

JOHN W. CAMPBELL, JR.*

The ear hears music as wave forms rather than sine waves according to this author, a science-fiction editor. Whether science or science fiction, the argument is thought provoking.

MY WIFE IS A MUSICIAN; my background is physics, so when it came to hi-fi amplifier design, things got a little difficult. I have a fairly complete electronics hobby shop, and my newest design tested out absolutely perfect . . . but she said "It sounds razzy."

The worst part of that sort of non-technical criticism is that the critic never defines the term. What, I demanded, does "razzy" mean?

"I don't know—its just razzy. It's worst on pianos, but it's all razzy.

The test instruments showed the amplifier was absolutely flat, within the limits of measurement, from 10 cps to 35,000 cps and within about 1 db up to 55,000 cps. There was no measureable second or third harmonic distortion at 25 watts. Intermodulation distortion could not be detected with a sensitive meter. The unit was perfect . . . and she said it was some undefined and undetectable-to-my-ears thing she called "razzy"!

The worst kind of problem to try to lick is one that you yourself can't sense or detect but that someone else can. The solution becomes more difficult when that "someone" has neither the technical knowledge needed to define it, nor the technical ability to work on it. It took nearly two weeks to locate the nature of the problem; eventually I pinned it down—and the musician was correct. The amplifier *was* razzy. And in all electronic engineering, there is no term to define the particular type of distortion that my wife's acute trained hearing had detected! There is no term for it—because electronic engineers have never considered that that particular kind of distortion *was* distortion.

Before I got through, however, I'd learned how to make an absolutely horrendously "razzy" amplifier—one so bad that it made a piano, sax, and violin sound alike. And yet, that amplifier *passes every one of the tests I mentioned above!*

* *1457 Orchard Rd., Mountainside, N. J.*

It is an amplifier that has the following provable characteristics:

1. Flat response, plus-or-minus nothing, from 10 cps to 35,000 cps.
2. No measurable harmonic distortion at 25 watts.
3. No intermodulation distortion.
4. Extremely low-noise level.
5. No instability.

But . . . it makes a garbled hash out of music.

The reason is simple; it's a perfect sine-wave amplifier. And that's the only kind of wave-form it will amplify perfectly!

Now it does *not* have response-peaks; it's *flat*. It turns square waves or saw-tooths into beautiful sine-waves—but it does *not* have poor high-frequency response. I can show that the response is within 3 db at 70 cps. And it doesn't have poor low-frequency response; it's within 3 db at 5 cps.

"Razzy" turned out to be my musician-wife's home-made term for the term electronics doesn't have—*sineward* distortion. An amplifier that tends to distort any input wave toward a pure sine—sineward—*without* amplitude distortion at any frequency within the audio and ultrasonic spectrum.

That little discovery made me do some real analysis of the problem of what hi-fi amplifiers are supposed to do. Heretofore I'd thought of their purpose as "to amplify without distortion all the frequencies of music and/or speech." Something, evidently, was wrong with that.

Music in the Home

I suggest that we have to go back a bit, drop the theory, and state the case more simply: to reproduce *music* without distortion. "Frequencies" is a physicist's *theory* of what music is—*and the theory is wrong.*

The effort toward music-in-the-home didn't start with hi-fi amplifiers; it began a couple of centuries ago, and even the phonograph is a late-comer to the race.

Three main branches of the effort toward music-at-home can be defined: First, there was an effort to reproduce the *production* of music. This lead to the player-piano—a mechanically played instrument. In the 1890's the "juke box" wasn't available, but there was quite a few "combos" that were strictly robot—even if the term robot wasn't invented until a few decades later. They had combinations of player-pianos, player-violins, and player-drums, plus some other oddments.

This was an effort to reproduce the *production* of music.

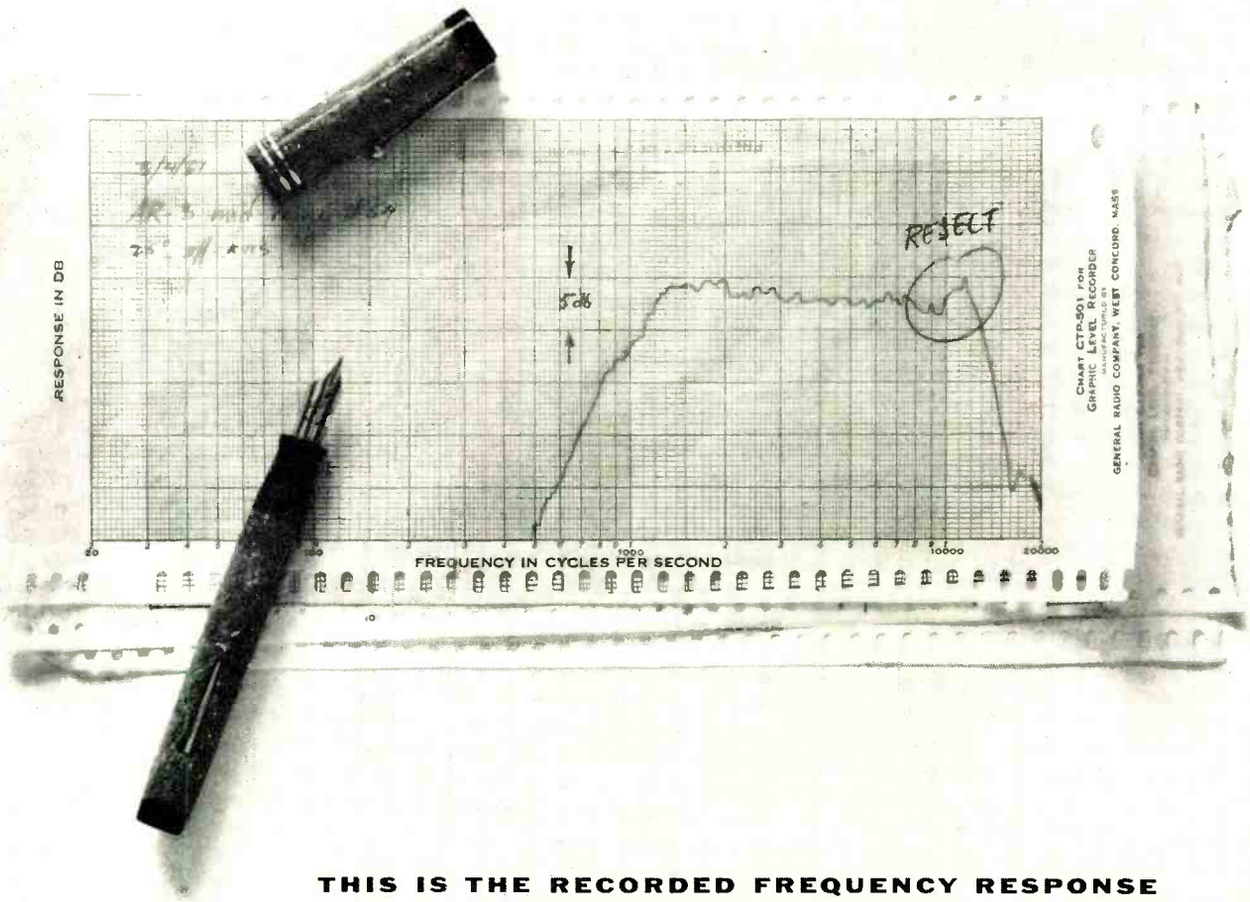
It didn't work too well. It was also headed for a blind alley; getting a symphony at home this way would have involved perhaps 100 instruments, which might have been possible physically, but hiring an orchestra would have been cheaper.

The second main effort was the music-box system. Here, there was no effort to reproduce orchestral performances; instead, a frank departure from conventional music methods was accepted, and a device capable of producing music at home—though not familiar orchestral music—was offered. Some of the music boxes were remarkably fine machines, too, using brass "records" 24-in. in diameter, playing for several minutes, and arranged so they could be changed as readily as a phonograph record.

The third main line of development is, of course, the phonograph. Now the phonograph does *not* seek to duplicate an orchestra; the player-instruments did that. Instead, fundamentally, the phonograph seeks to duplicate not the *performance,* but something quite different—the *sensation of hearing.* The output must "sound like" the original; it need not "be like" the original, but even making it "sound like" the experience of being in a concert hall is exceedingly difficult.

Hearing—a Military Weapon

Reason: the human hearing system was not developed as an aesthetic device. It was envolved strictly under acute



THIS IS THE RECORDED FREQUENCY RESPONSE CURVE OF A REJECTED AR-3 MID-RANGE TWEETER

Although this curve does not depart from the ideal by more than 2 decibels at any point, the sharp peak at 11,500 cycles is evidence of transient distortion.

The frequency response of all AR-3 tweeters and AR-2a super-tweeters is recorded and examined critically before installation. One out of fifteen never makes it to the cabinet.

AR speakers are priced from $89 to $225. They may be heard 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.

Literature, including a list of AR dealers in your area, is available for the asking.

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pressure of military emergencies—the acute emergency of eat or be eaten. For some three billion years, animal organisms have been envolving, and every step of the way camouflage, confusion, and misguidance have been major tactical weapons. The leopard has spots for purposes of misguiding his prey into thinking he isn't there; the fawn has spots for similiar purposes. Throughout the long, long course of evolution, organisms have sought: (1) To fool their enemies and/or prey. (2) To find ways to break the camouflage and concealment systems of their prey and/or enemies.

Shortly after radar was invented, radar-jamming, radar-confusion, and general radar-bollixing devices were invented, and enthusiastically developed. During WW II, the Radiation Labs at MIT in Cambridge were seeking to develop better radar, more jam-proof systems . . . and just up the river, at Harvard, the Radar Countermeasures Labs were trying to cook up gimmicks that would make MIT's equipment tell lies.

After three thousand million years of field-testing—with sudden destruction the penalty for inferior equipment—the human hearing mechanism is *not* very easily decieved. It's enormously more versatile, and more competent, than physicists have appreciated. The only reason hi-fi equipment pleases as well as it does—it doesn't fool the hearing mechanism, of course!—is that the listener agrees to allow himself to be fooled.

In listening to your present hi-fi, and glowing with the magnificence of its reproduction, remember that the early hand-cranked phonographs, with strictly acoustical recordings, gave enormous pleasure. Because the listeners at that time wanted to be fooled, just as you do now. Hearing is subjective; you can control it, and do, without ever being conscious of it!

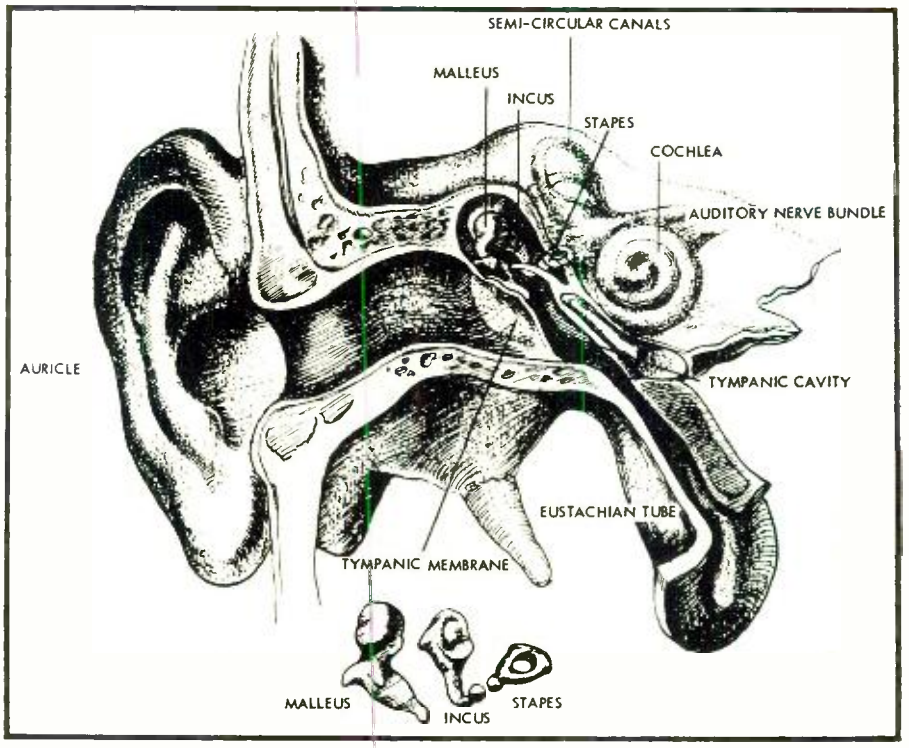

Fig. 1. The three divisions of the auditory system—external, middle, and internal, with details of the malleus (hammer), stapes (stirrup), and incus (anvil).

Phase Shift

Physicists and acoustics people have, for years, said that the human ear is not sensitive to phase-shift in sound. That's still standard theory.

It's false.

But that theory is built into every modern hi-fi installation! Every one of the "tone control" devices now employed is, of course, a phase-shift network. The crossover network used in multi-speaker systems is necessarily a phase-shifting network, too.

The theory that human hearing can't detect phase shift is false—and is very readily proven false. The principle on which sound-source location is based is, as has been shown again and again, the difference in phase of the sound waves arriving at the two ears. Perfect stereo reproduction would, necessarily, be highly critical on phase-angles, for this reason.

But a moments thought will show you that you could not compare the phase-angle of sounds arriving at your two ears if each ear were not, separately, capable of determining phase-angles with great precision!

The ear must, then, actually be highly sensitive to phase-angle; why, under those circumstances, have scientists gone along for years under the impression human hearing couldn't detect phase-angles?

That three billion years of evolution is in there. The ear feeds its information into the auditory nerve, which transmits it to the brain. And what the brain does to it after it gets there is something the biggest computers man has built can't do!

It's easier to understand if you consider what the optical center of the brain does with information from the eye. If you look at an automobile half way down the block and across the street, you see that the wheels of the car are perfectly round. But that is decidedly not what your eyes are reporting; the laws of optical geometry are such that the image in the eye *must* be highly eliptical.

The optical center, however, is not fooled; it knows about the distortion of perspective—thanks to three billion years of experience!—and simply corrects for it, reporting to the conscious mind, "That wheel is round."

The auditory center in the brain is not fooled either; if a sound-pattern comes in skewed sidewise, mangled in half a dozen ways, and hashed up with a bit of noise . . . the auditory center computes what the garbled signal should have been when it started, and reports to the conscious mind what it started out to be, not what it is.

Detect phase shift? Why, heck, the human hearing system not only detects it, but measures it, computes a distortion factor, corrects for it, and reports on what the darned thing should have been before three phase-shifting networks, a misguided recording engineer, and three separate recordings of the same thing piled on top of each other confused the issue!

That doesn't mean that the auditory center enjoys doing all that—but that's what it was evolved to do, and it can do it if it must.

But you can make an interesting little test. Try putting a running-time meter on a super-duper, ultra-ultra hi-fi system, and on a quite ordinary radio-record-player available in the same home at the same time.

How come the cheap little lo-fi gets so much more running-time? Why do people listen to that thing by the hour . . . and the super-job by the minute?

More Perfect Systems

I suggest it's because the hi-fi systems have been getting more and more nearly perfect according to the physicist's theory . . . and further than we realize from what their actual job is!

To reproduce the *sensation of hearing.*

Started by my wife's complaint, I've

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gotten information-theory experts, specialists in instrumentation theory, neuro-physiologists, philosophers, and psychiatrists—all, like myself, sincerely interested in high-fidelity *music*.

One fine clue comes from neuro-physiology; the auditory nerve has 30,000 nerve fibers, each capable of handling about 12 bits of information per second. That means that *each* ear can transmit about 360,000 bits of information per second to the brain.

In the normal adult, the maximum frequency audible is about 15,000 cps. Question: what are the other 345,000 bits of information per second the auditory nerve handles telling about?

The hearing mechanism wasn't evolved for aesthetics; it was evolved for strictly military necessities—and there's no massive larding of unneeded facilities there! What's a 360,000 bits-per-second transmission channel doing?

And, incidentally: why is it that audio amplifiers capable of handling 30,000 . . . 50,000 . . . even 100,000 cps are better than ones capable of 15,000 cps? An audio set-up that could handle a 360,000 cps band would match the band-pass of the auditory nerve. Could that have something to do with it?

But we know for a fact that the ears do not go beyond 15,000 cps normally. What's the meaning of all the other bandwidth?

If you build an oscilloscope to handle all audible signals without distortion, as any electronics engineer will tell you, it should have amplifiers capable of about 250,000 cps. You see, oscilloscopes handle wave *shapes;* to present a 15,000 cps square wave, and do a good job of it, the scope must have amplifiers good to a minimum of 150,000 cps.

How the Ear Hears

Wonder what the ear actually hears, then? Maybe it doesn't hear "frequencies" at all! After all, a "frequency" means a sine wave; all other waves are, properly, said to have a repetition rate, or rep-rate, rather than a frequency. A 15,000 cps square wave is, properly, a 15,000 repetitions-per-second wave, and contains "frequencies" up to 300,000 cps.

All of our physics is tied to mathematical logic—and mathematics simply can't handle discontinuous variables. A square wave can't be represented mathematically as such—but a mathematician finds it convenient to say a square wave "is" composed of sine waves and harmonically related higher frequencies.

It isn't though; it's a square wave. Just because a mathematician can't handle it doesn't make it stop being what it is.

The ear handles sound like an oscilloscope!

The ear starts with a diaphragm (*Fig. 1*) . . . a small one, capable of responding to very rapid changes of air-pressure. It's an organic membrane, with high internal friction, so that it has almost zero resonance of its own. (Excellent design for broadband response!) The eardrum operates a beautifully designed three-unit impedance-transformer . . . three tiny bones, the hammer, stirrup, and anvil, are mechanically so linked as to produce an impedance transformation of about 700 to 1 . . . necessary if the sound-energy is to be efficiently transferred from the low density medium, air, to the high density medium of body fluids. (Designers of phono-pickups might find some new ideas for non-resonant suspensions by studying the shaping of those three tiny bones!)

The low-impedance output of the transformer system drives another, and smaller, diaphragm at one end of the *cochlea*—a magnificent triumph of miniaturization of acoustic equipment. The cochlea is neatly coiled, to get the maximum of equipment in the minimum of space; stretched out straight it would be a conical tube, with a membrane bisecting it lengthwise. The acoustic input reaches the upper half of the bisected tube; the thin membrane separating the two halves is tightly stretched, and embedded in it are thousands of nerve endings. Each microscopic nerve ending is a tiny strain gauge, measuring the stress in the membrane.

With some 30,000 ultra-miniature strain-gauges reporting simultaneously, the instantaneous pattern of stresses in the membrane can be determined. The nerve-fibers don't read out the stress sequentially—they read the stress at all points in the membrane simultaneously.

This point is important.

Consider it this way: Suppose I set up a TV receiver circuit, and instead of feeding the video signal into a standard kinescope tube, I feed it into an oscilloscope tube so arranged that the cathode ray spot stands still, and simply varies in brightness. Now I arrange a long strip of movie film in front of the device, and run the film past the place rapidly. The entire video signal will now be recorded on the film as a single line of rapidly varying brightness.

All the information of the TV video signal is right there on the film sequentially. Let's see you look at that film and figure out what the picture is all about!

It becomes a great deal more meaningful when the variations of brightness are presented in such a form that they are seen *simultaneously*. The whole pattern is seen as a unit.

In studying audio waves, an oscilloscope is helpful because, on its surface, the entire wave pattern is presented simultaneously. (Yes, I know the cathode ray beam scans the pattern sequentially . . . but the persistance of the screen phosphor or of the human retina will cause the entire pattern to be seen simultaneously, as a unit.)

The ear, sensing sounds as it does in a membrane, apprehends sounds as *patterns*, and *not as a series of sine-wave frequencies*. It works like an oscilloscope, studying waveforms, *not* like a harmonic analyzer studying sine-wave frequency distributions.

Now to a harmonic analyzer, any possible combination of fundamental, second, third, and fourth harmonic, each present at, say, a 1-volt strength, is the same. No matter what their phase relationship may be, they're all the same . . . if you ignore waveforms, and consider only frequencies.

But to an oscilloscope, or any other waveform analyzing device, there's an immense difference as the phase-relationships change.

In the course of evolution, the animal that could get the most information from sound-waves was most likely to have similarly gifted offspring . . . in fact, to have offspring at all. If waveform analysis can yield more information than harmonic analysis—the organism that successfully applied that fact lived. And probably lived high, too, on the meat of the organisms that didn't have that ability.

The ear as a waveform analyzer presents a very different sort of problem for the hi-fi designer. No matter how perfectly all frequencies are being reproduced . . . there's distortion if they are not produced in exactly the *form* they had in the original.

Sorry . . . but that means you're introducing real, and important distortion every time you use tone-control! And when you use that crossover network and separate speakers. True, you're getting the frequencies better . . . but what are you doing to the waveforms? And why is it that the running-time meter will show that people listen *more* to low-fi equipment?

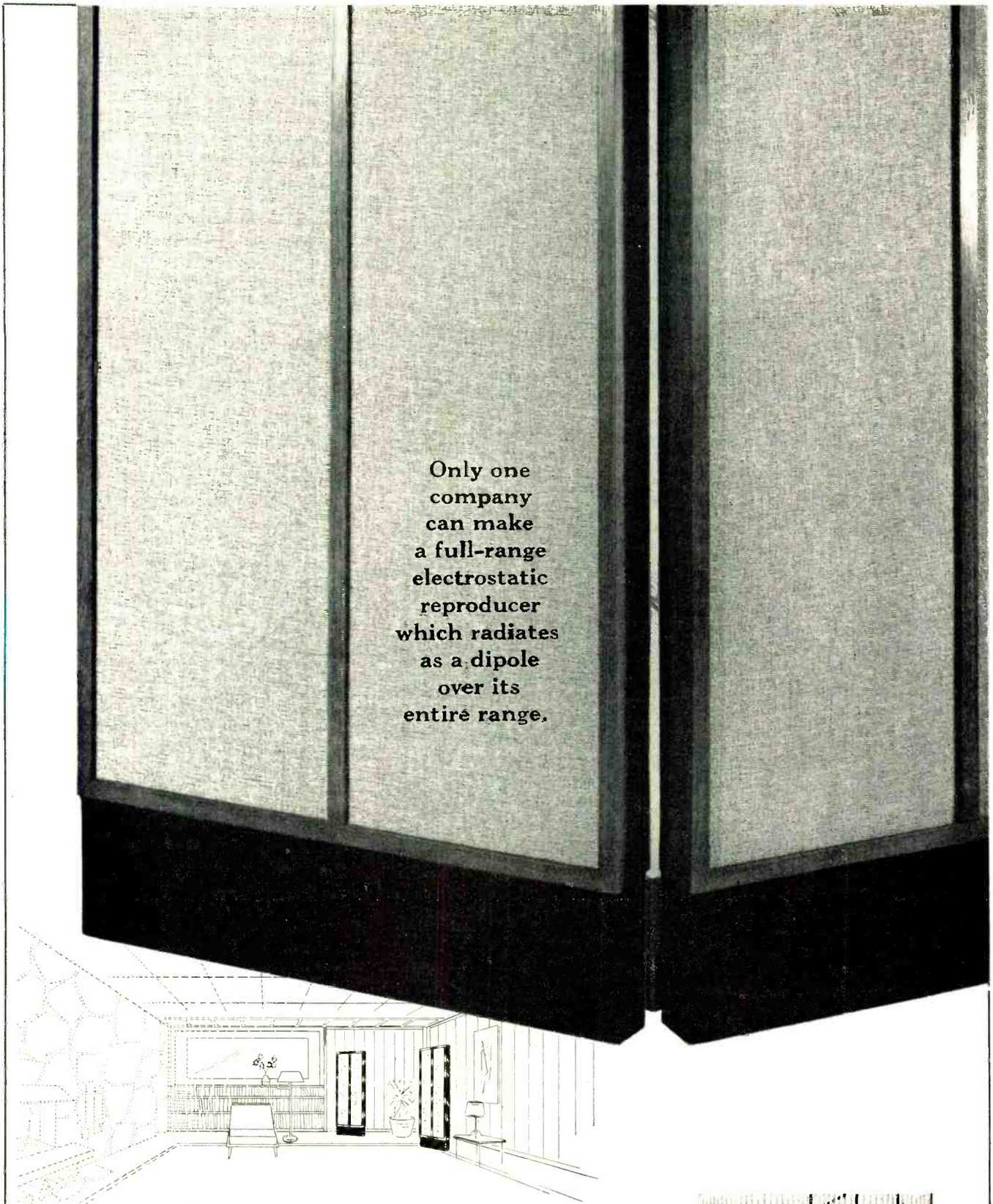
Computing the corrections necessary to get the waveforms back the way they should have been is hard neural work.

We have been so completely sold on the sine-wave theory of sound that as I say, no one has even considered that a sine wave could be a distortion—the idea of "sineward distortion" doesn't even exist in the electronics language.

Once admitted, a whole new field of possibilities for higher hi-fi becomes possible.

The "Razzy" Amplifier

But first; I said I'd built an amplifier that was perfectly flat, and yet wouldn't play music. Unbelievable until proven possible?



The KLH Model Nine is tall, handsome, expensive — requires 30 watts or more.
It separates into two elegant sections for stereo.
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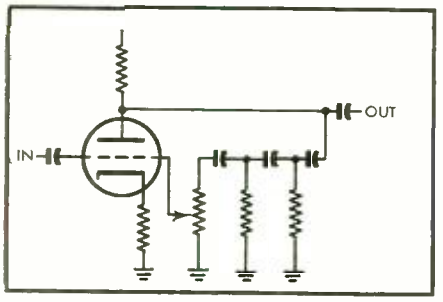


Fig. 2. Familiar phase-shift oscillator.

The system is simple; it's a circuit deliberately designed to have very extreme "ringing," with perfect stability against self-excited and self-maintaining oscillation. If a circuit has positive feedback almost, but not quite, great enough to cause oscillation, it will "ring" when excited by its characteristic frequency—but will not oscillate. If driven by an input signal, it will produce that signal at the proper level—but will continue to yield that signal with decaying amplitude for, say, 0.1 seconds after the signal is cut off.

Now if you test such an amplifier with the usual sine-wave generator, you will never detect any misbehavior—it will be perfectly flat all across the audio spectrum!

It makes a perfect sine-wave amplifier; it just won't behave properly on anything *but* sine waves!

Now if music were what the physicists have been saying—a mixture of sine waves and their harmonics—then such an amplifier would also be a music amplifier.

You should try it once; you would immediately be convinced that, whatever music may be, it is not a system of sine waves—but then, a human being can be chemically analyzed into carbon, oxygen, hydrogen, nitrogen, sulphur, and so forth, but simply adding those elements together doesn't make a human being.

Most oscillators use inductance-capacitance circuits, of course, and that type will not display the characteristics described for the sine-wave amplifier. The type that will do it is the "RC oscillator"—the type that uses only resistance and capacitance.

Start with the familiar "phase-shift oscillator" shown in *Fig.* 2. For simplicity, we'll talk about a triode; in practice it takes a hi-gain pentode to oscillate, because of the attenuation of the signal in those successive RC couplings. However, for some frequency, the phase shift introduced by each of the RC couplings adds up to 180 deg., so that the resultant feedback is, for the frequency, positive. If the potentiometer is adjusted properly, a point can be found where the circuit won't quite oscillate. The system is, then, perfectly stable. It's a perfectly good RC coupled amplifier stage, so it will amplify any frequency put in. If the exact frequency at which it could oscillate is fed in . . . it still will not oscillate, because the positive feedback simply adjusts the system to the exact level of the input signal, and remains stable.

Now the essence of this type of oscillator is simple; three successive RC couplings, with sufficient gain in the loop to provide almost, but not quite, enough positive feedback for oscillation. Triodes won't do in a single tube system, but alternative systems can use triodes. If there were no phase-shift in the RC couplings, the three-triode system shown (*Fig.* 3) should not oscillate; there would be negative feedback, not positive. By using a very low impedance power supply, and careful design, three tubes can be hooked up in this way without oscillation. And they'll show no humps in the response curve if tested as a sine-wave amplifier.

But that doesn't mean they'll amplify anything but sine waves!

The critical point here is that the above three-tube lash-up can be found in many, many high quality hi-fi amplifiers! Neatly concealed, of course—but it's there! That was, in fact, what made my original "razzy" amplifier "razzy"; *V1* and *V2* were the two triodes in the familiar two-tube phase-inverter circuit, while *V3* was one of the push-pull power tubes! The "distortion minimizing negative feedback circuit" from the output transformer was the necessary feedback loop.

The phase-shift circuit shown is just exactly that: it shifts the phase of the feedback with frequency. What that does to waveforms is readily shown on an oscilloscope, provided you make the test with *any waveform other than a sinewave.* On a sine-wave test, it will show absolutely no distortion.

A square-wave test is fine for some things—but of all tests, nothing could be more poorly designed to detect peak clipping. You can't detect peak clipping in a wave that is the most completely clipped wave possible!

Similarly, sine waves are the worst possible test for sineward distortion; they've already gone all the way.

And music, of course, is almost never made up of sine waves. Nothing is less less attractive as a musical instrument than a pure sine-wave generator.

The Nature of Music

If we're to reproduce the sensation of hearing, we must recognize two things:

1. How the ear analyses what it hears.
2. The nature of what the ear is listening to.

And the fact is that the ear practically never listens to sine waves! Pure sine-wave sound is intensely annoying; if you've run sine-wave tests on your equipment, you're aware that nobody else in the house appreciates the importance of "making those awful noises."

Almost no natural phenomenon generates pure sine waves.

In trying to work out the problem of the "razzy" amplifier, my wife and I tried to define what a "musical instrument" was. (If you think you know, you're apt to find that it's one of those "well . . . you know what I mean" things.)

Steel oil drums are musical instruments. So are cowbells, carpenter's saws, inflated rubber balloons, and pebbles rattling in a dry gourd. That is, they are when a musician uses them . . . but not when a carpenter uses the saw, a cow uses the bell, or junior uses the balloon. So . . . what's a musical instrument?

Making things worse, there are many musicians who vigorously, not to say violently, deny that cow bells, carpenter's saws, and so forth, are or ever can be, musical instruments.

I think we have here another example of subjective reality rather than objective reality to handle. A case of "Music is musical to me when I find it musical."

However, the musical instruments that men have, over long periods of time, and over great spans of race and culture, agreed almost universally are musical instruments, do show some features in common. At first glance the objective similarity between violins, cornets, or-

Continued on page 90)

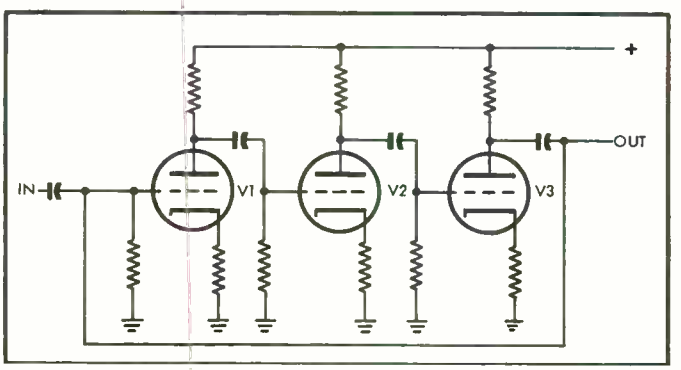
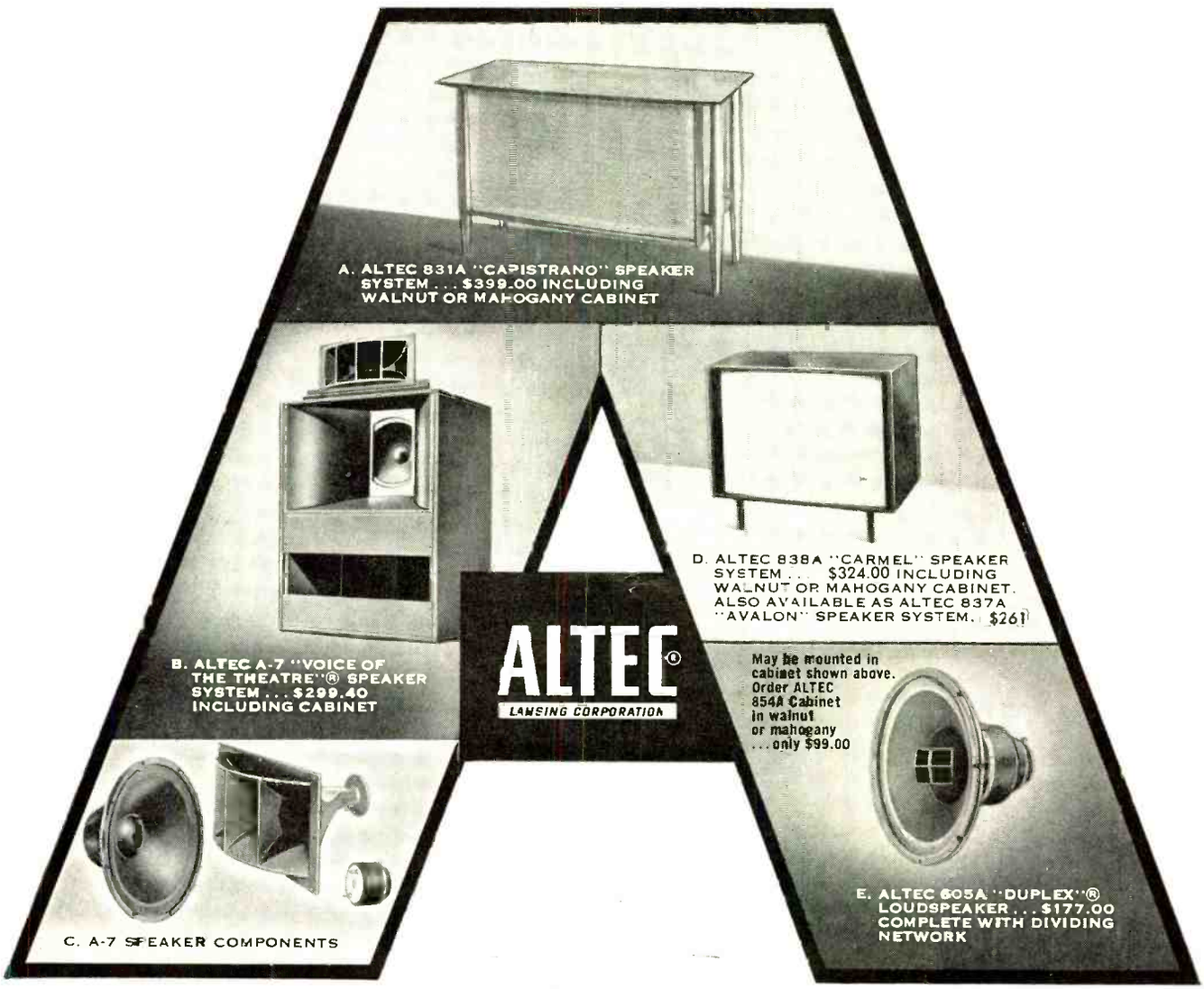


Fig. 3. Three triode phase-shift oscillator.



UNDENIABLE FACTS
ABOUT FULL-SIZE TWO-WAY SPEAKER SYSTEMS

From the birth of high fidelity in the late 40's to the present day, competitive merchandising has inspired many gimmicks, passing fads, and innovations to confuse the loudspeaker system question for serious music listeners. The last decade has seen an endless variety of "trick" speakers and countless midgets known as "compacts." Most of these now have been exposed and have fallen by the wayside and serious music listeners are returning to the fact that only full-size, two-way speaker systems based on solid engineering principles are capable of providing the complete thrill of listening to good music faithfully reproduced at levels approaching the original performance; the kind of reproduction that was responsible for the spontaneous acceptance of component high fidelity at the very beginning.

Professional users of high fidelity equipment—audio engineers of the big-label recording companies, of the broadcast networks and of the theatrical world—use only time-proven, carefully-engineered full-size two-way speaker systems. Altec full-size speaker systems, shown above, are standard equipment in these critical professional applications. Several of the reasons are: *Full-size Altec speaker systems are large enough to house professional-grade two-way speaker components; big "woofers" and a separate low-crossover high-frequency horn with a compression-type driver. Altec low-frequency drivers have the size to move lage volumes of air with short, effortless cone excursions. A single Altec multicellular or sectoral horn provides wide angle sound distribution over the remainder of the frequency spectrum with only one crossover. The result is natural bass freely reproduced, and both mid and high fequency range are reproduced without the distortion hazard of many crossovers. This is the only way that the home listener, with any certainty, can hear the same quality of playback that the musical conductor monitored and approved back in the studio.*

ALTEC full-size speaker enclosures provide the air volume needed to reproduce lowest frequency without impeding or restraining cone movement.

ALTEC full-size speaker systems are efficient. Only a small amount of wattage is required to reproduce the entire dynamic range of the most complex symphonic arrangement.

ALTEC full-size speakers can be played at live-concert listening levels without generating *listener fatigue*. Their large power-handling capacity and higher efficiency allows reproduction of dynamic peaks without driving the amplifier into margins of distortion.

There is no clipping or compression. They are completely free of the mechanical "tightness" associated with the small speaker—an important factor for people who listen to music long and at times want to experience the moving thrill of sound at full live orchestra levels.

If your listening area is of average size or larger and your tastes dictate serious listening, *you will find room enough for a stereo arrangement of full-size* ALTEC *speaker systems.* See and hear them now at your audio specialist store.

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AUDIO ETC

(*from page 14*)

stick your fingernail into it, and your small boy won't have any trouble dislodging hunks of chip with his boy scout knife; but even so, the speaker is plenty strong enough to sit on or stand on. It won't disintegrate nearly as suddenly as some of the plywood products I've seen elsewhere over the years.

The insides of this box are neatly subdivided (more wood-chip blocks) to provide a double port, two 1½-in. slots to the outside world, one at each end. This is another of those new and excellent vented enclosures made practicable by the newer, low-resonance, long-throw sort of speaker mechanism, even in this low price range. The back of the box screws down conventionally with a close fit and my only reservation is that though this lid may tighten up a second time, by the third tightening you will strip most of the threads in the screw holes. The wood-chip stuff is pretty soft. Solution: just don't take the back off. I did, for practical reasons.

My testing of this speaker system involved a bit more than simply replacing my regular speakers with this set, though I began that way. I was so impressed by the sound that I wanted to find out what made it, and in this case I could do so. (Many a speaker system today is sealed up and impregnable; the best you can do is to feel around the grille cloth for holes.) Inside, I found only the one Utah eight-inch, minus tweeters, domed or horned, looking not very impressive to the eye. A real ordinary cheap speaker. But by golly, it has highs as smooth as some of the fanciest systems I know and the lows are excellent for its size.

What I did, after speculating for awhile on the remarkable improvements over the years in these smallish enclosures and cheap speakers, was suddenly to remember that my original R-J bookshelf enclosure was up in my attic and inside it was an old eight-inch speaker that had been generally hailed in its day, around 1950, as the finest of its type on the market. Downstairs came the R-J, off came its back and in a few moments I made a quick trade. One of the new Utah speakers went into the R-J enclosure (with extra padding, to compensate for a lack in the very early R-J boxes). The old speaker went straight into one of the new Cabinart enclosures, the two backs went back on as fast as I could screw them down (see above), and I was in business for a curious sort of two-way time comparison, double AB. I had two identical speakers mounted in enclosures dating a decade apart. I had two identical cabinets with speakers inside them built ten years apart.

Two Speakers, AB . . .

First, the two speakers. Well, the old speaker *was* a good one in its time, as anyone would have said back then, and many did. It was widely sold and widely recommended for many an early moderate-cost hi-fi system. Yet the new Utah job, clearly of simpler and cheaper construction, played rings around it. No comparison! In identical enclosures (the Cabinart), the Utah highs were smooth and unobtrusive. The older speaker's highs were what we used to call "golden"; in present-day terms I would have to rate the sound as rather harsh, grainy, edgy.

As to the bass, things aren't quite so simple, of course. In the Cabinart vented enclosure, more or less a bass reflex, I could not note any marked superiority in the old job's bass, though with its hand-made cloth surround on the cone it had been famous for remarkable bass in its time.

Remember, however, that in those days most 8-in. speakers were stiff little affairs intended for public address enclosures, table radios, open-back phono consoles; there was little attempt to get hold of any real bass. This old 8-in. speaker was, indeed, a pioneer model, one of the first in which a deliberate attempt was made to achieve the finest bass response possible in such a small speaker size. Now, a decade later, the simple little Utah speaker cashes in on the fruits of that pioneer endeavor and on the ten years of refinment that came out of it. Utah can match the old model in bass with little trouble.

(I suspect that in an absolutely optimum enclosure the old speaker might still produce somewhat lower bass than its new and cheaper counterpart, but the difference is really no longer of a musically significant and generally practical sort. Good bass motion is now the common property of vast numbers of small speakers.)

Most readers, I expect, can guess the maker of this old speaker with the famous hand-made cloth surround, though I will not name him here simply because this model is far from the company's current production, and there is always some possibility that the sound has deteriorated at the high end after a decade of semi-idleness, though I'd say this is not too likely. After all, ten years is a lot of time when it comes to improvements, model by model, year by year.

. . . And Two Enclosures

As for the two enclosures, Cabinart's new one and my old R-J, a very early prototype of that first of all bookshelf-style enclosures, I now had identical speakers inside, namely the pair of Utah units. I found again a similar situation. The sound was different, and the difference was of course in the cabinets. But the Cabinart enclosure, simple and practical, again easily matched the over-all musical performance of the older and pioneer low-cost enclosure, its figurative grandparent and the daddy of the type.

The differences in sound were interesting, given the same speakers inside. Cabinart produced a smoother mid-range, less colored —my early R-J was so nearly at the very beginning of production that it still showed some inexplicable bugs, the worst being a kind of mid-range honking cavity-resonance effect that would not remove itself even with extra inside padding. (It never bothered me in the larger R-J box, the one designed for the old 15-in. speakers and for high-quality 12's.)

On the other hand, on close listening, I became aware that the R-J bookshelf definitely produced the lower bass of the two, and it was crisper and cleaner. It should be, what with the R-J's calculated loading for both front and back of the speaker cone. The R-J principle was no mere fillip of the adman's imagination. It did produce boomless and relatively very low bass in a small enclosure, and it was the first to do so.

But that better bass came at a price—efficiency. (Not to mention a relatively complex interior construction). The practical gains in Cabinart's newer and simpler enclosure, were immediately evident. The Cabinart-mounted speaker was startlingly louder than its twin in the R-J. I was really surprised at the difference. My stereo balance control went almost all the way over to one side before I could restore acoustical balance of output between the two cabinets. Most illuminating, shedding a good deal of light upon this crucial relationship between the ideal in principle and the practical in terms of maximum usefulness! That's Cabinart, all right.

* * *

And so, after relocating the pair of Utah speakers back into their intended Cabinart enclosures, I must conclude that this $15 Cabinart complete system is more than the equal of a high-rated low-cost system that was a prime value ten years ago in the same general area. This far have we come with intelligent compromises, constructive simplification, not to mention solid and basic improvements-at-a-price.

As I remember, the original unfinished plywood R-J bookshelf model cost some $20, minus speaker. The speaker I mounted inside it cost about as much, for a total expense of roughly forty bucks, and you did your own mounting. This against Cabinart's present $15 for the works, ready to play. Something to think about.

PHASE COORDINATOR

You can't really be sure about a new gadget until you've tried it. Awhile back I received a thing called a phase coordinator that at first glance seemed to me just one more of those silly contrivances that hi-fi people think up to squeeze more cash out of the gullible souls who must Have Everything. A small box with a meter on the outside, which was supposed to display the operations of your stereo speakers for you in visible form, while you listened to the music.

Humph, said I; I don't look at my music, I hear it, and I have no need for crutches like this to help my well-trained ears. Haven't I been preaching about the importance of proper phasing all these years, and don't I make a point that you must have phasing right if you are to hear good stereo? Well, after all, it works both ways: if you really claim to be a stereo fan why, surely you must be able to tell the proper phase by ear, without meters and stuff to help.

Well, the Stereosonics PH-1 Phase Coordinator and Balance Indicator is now a part of my permanent listening set-up.

The good thing about this gadget is its relative simplicity. It is a passive device. No transistors, no tubes, no current. Just a meter, plus switches and associated ele-

(*Continued on page 80*)

How to get the most out of Radio · Audio · Electronic kit building

A new plan by Milton Sleeper, noted figure in electronics

"For a long time," Milton Sleeper explains, "I felt that a society should be formed for the benefit of everyone interested in kit building. There are clubs and leagues to represent and further the interests of stamp collectors, photo fans, and radio hams. Similarly, there should be a kit builders' society, and it should have its own publication to voice the opinions of the members, for the exchange of experiences, and to provide news and information on this fascinating hobby."

Now, at last, there is such a national society. Here's how it came about:

THE R · A · E SOCIETY

Nearly two years ago, a group of kit builders in the Berkshire Hills area of Massachusetts—comprised of businessmen, lawyers, engineers, and bankers—elected Mr. Sleeper chairman of what they called the R · A · E Society, because the members were all interested in building Radio · Audio · Electronic equipment.

As news of the Society spread, people from far and wide inquired about joining. Letters came from high school and college students, and from men of many different professions. Their enthusiastic interest showed that the Society could be more useful to more people than had been anticipated.

Also, there were many requests for a Society journal to serve a membership growing to national proportions. That posed a problem, however, for it meant setting up offices for the Society, with a paid staff at a cost which could not be met from membership dues.

A SPONSOR FOR THE SOCIETY

Meanwhile, the original members had undertaken to work out their own ideas of components to be assembled from kits. Certainly there was room for many improvements, because no basic changes had been made in kits and instructions over the past 20 years.

They first made a study of the advanced designs and techniques now employed in commercial and military equipment. Then they applied their findings to the design of components to be assembled from kits, and to the preparation of error-proof instructions.

Their undertaking was successful beyond expectations, so much so, in fact, that a company — R · A · E Equipment, Inc. — was formed to produce kits from their unique designs. Then, logically, this Company assumed sponsorship for expanding the Society nationally, and for the Society's R · A · E Journal.

THE R · A · E JOURNAL

Publication of the quarterly R · A · E Journal is important to members of the Society because it provides two much-needed services. First, it is an open forum for the exchange of opinions, suggestions, and experiences. Through it, members can make their views known to the record, tape, and equipment manufacturers, the radio and TV broadcasters, and to the Federal Communications Commission.

Second, the Journal fills a growing need for more specific, less technical information on kit assembly, home workshop projects, plans for stereo and mono record, tape, and radio installations, correct operation of components, and testing methods. Also, since no advertising space is sold, the Journal can carry unprejudiced reports, free of commercial bias, on all new developments.

With Milton Sleeper as editor, you will certainly find the Journal interestingly written from cover to cover, easy to understand, elaborately illustrated, and handsomely printed on fine paper. Please note that only members of the Society will receive the Journal. No copies will be sold.

YOU ARE INVITED

You are cordially invited to become a member of the R · A · E Society, an organization that started from the activities of a dozen kit building hobbyists, and is now growing into a national institution.

Membership is open to high school and college students, to men of all professions, and to hobby-minded women, too. Whether you are a beginner, an experienced kit builder, or an advanced enthusiast, you are welcome to join the Society, and to share in the privileges of membership. By applying now

- You will take part in various group activities and opinion polls
- You will receive accurate, advance information on new radio, audio, and electronic kits
- You will qualify to serve on one of the Advance-Test Panels, and if you are selected you will receive a free R · A · E kit in return for writing a report on it
- You will receive the four annual issues of the R · A · E Journal
- You will receive an official membership card identifying you with the R · A · E Society.

CHARTER MEMBERSHIP NOW OPEN

For a limited time (expires January 31, 1962) you can join the Society as a Charter Member. Dues for the first year are only $1.00. This entitles you to receive the Journal for one year, and to enjoy all the other benefits of membership.

Use the coupon below or your own stationery to apply for Charter Membership.

Milton Sleeper originated the idea of step-by-step kit instructions and picture wiring diagrams in the 20's. A pioneer radio engineer and manufacturer, he is an author and magazine publisher, founder of High Fidelity magazine, and a recognized authority on kit design techniques.

R · A · E SOCIETY (sponsored by R · A · E Equipment, Inc.)
Housatonic Bank Building
Great Barrington, Mass.

Yes, I want to take part in the Society's activities, to receive the R · A · E Journal edited by Milton Sleeper, and I want to qualify to serve on one of the Advance-Test Panels. I enclose $1.00 for Charter Membership dues for one year.

Name .....

Street .....

City & Zone ..... State .....

I understand that I am not required to purchase any R · A · E kit in order to enjoy full membership privileges. I am a
☐ Beginner ☐ Experienced Kit Builder
☐ Advanced Enthusiast

UNCONDITIONAL MONEY-BACK GUARANTEE

If I am not completely satisfied after I receive the first issue of the R · A · E Journal, my money will be refunded on request.

EQUIPMENT PROFILE

EMPIRE "TROUBADOR" MODEL 398 RECORD-PLAYING SYSTEM

The "Troubador" Model 398 is the latest entry by Empire in the record-playing field. For those who haven't heard, Empire is the short name for Audio Empire. There has been a gradual transition from the latter to the former name over the past year, unattended my fanfare or publicity. In any case, in spite of their apparent modesty, they can't really hide a good reputation under a different name.

The "Troubador" Model 398 consists of the well-known Model 208 turntable and base plus the new Model 980 arm. Although the arm roughly resembles previous models, several significant changes have been made. In addition, the arm now incorporates a device for automatically lifting the stylus off the record—a device which is unusually simple and contains no moving parts.

The appearance of the Model 398 is essentially the same as its predecessor, the Model 298. (*Figure* 1 shows the turntable plus an oversized view of the new arm.) Clearly, the Troubador Model 398 is designed to look like what it is; a massive turntable with precise performance.

The Turntable

The Model 208 turntable consists of a 12-in. diameter platter which is made from an aluminum casting weighing 6 lb. and is individually balanced. The truth of the latter may be observed by lifting the platter up and away from the mounting plate and turning it over. Notice the holes drilled to balance the platter in a procedure similar to the way automobile tires are balanced (small amounts of rubber are removed from locations indicated by a special balancing machine).

The turntable platter rides on a ball bearing at the end of an accurately honed 7/16-in.-diameter shaft. The shaft rides in an equally accurate well while the ball bearing rides on a nylon thrust bearing. A spiral oil groove is cut into the shaft to ensure lubrication of the bearing surfaces.

The platter is driven by means of a ground flat belt which rides on the machined outer rim of the turntable platter and the motor spindle. The spindle is three-stepped to provide three-speed operation: 33⅓, 45, and 78 rpm. Each step contains a convex contour to permit adjustment for a stretched belt. This adjustment is accomplished by rotating the knurled nut of one of the motor-mount screws, which tilts the motor spindle to take up the slack. Speed change is accomplished by manually shifting the belt.

The motor is a dynamically balanced hysteresis-synchronous unit of the inside-out variety. The motor is mounted to the plate by means of three soft rubber shock-mounts which prevent the vibration of the motor from being transmitted to the platter. Thus, because of the compliant drive belt, the motor is completely isolated from the record-bearing elements.

The entire turntable system is acoustically isolated by means of ball-shaped soft rubber feet. We tried to induce acoustic feedback by placing the turntable on top of our large speaker system and turning up the gain; we were unsuccessful.

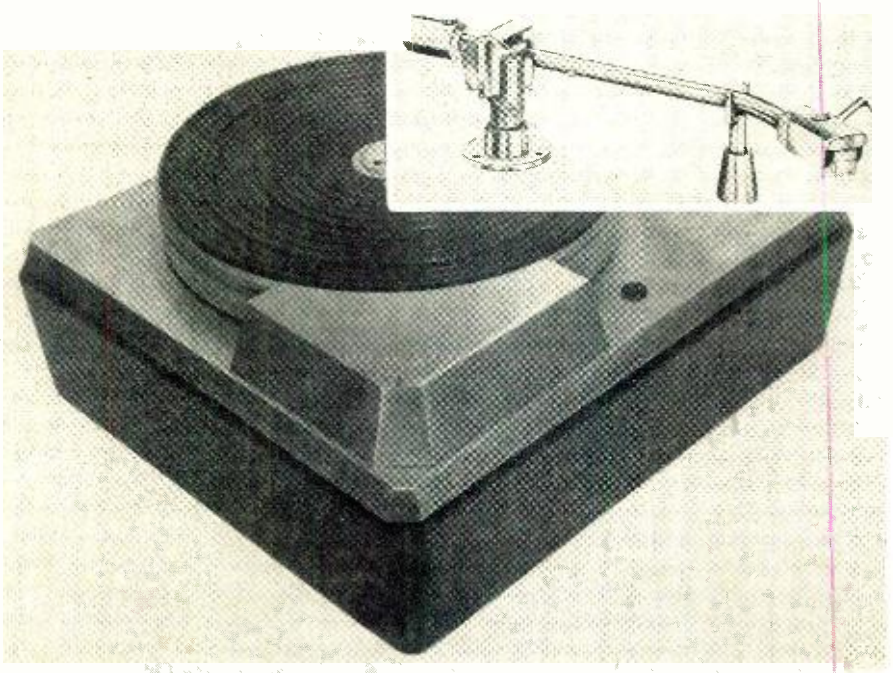


Fig. 1. Empire "Troubador" Model 398 turntable system.

The Arm

One of the most obvious changes in the new Model 980 arm is in the head. Instead of a removable, plug-in head, the 980 mounts the cartridge on a plate, which is then simply screwed into position—electrical contact being made by means of flat metal gold plated spring-fingers. A special 5-wire cable is provided to mate with the plug beneath the arm, the termination of the cable at the amplifier end being a pair of color-coded phono plugs plus a spade lug on the ground wire.

The change of the head was apparently related with the use of a much thicker-walled tubing in the arm to reduce the fundamental resonant frequency, which is now below 10 cps (the lower limit of our test record) and the manufacturer claims that it is about 8 cps.

The method of pivoting the 980 is the same as in the previous model—both the vertical and lateral pivots utilize ball bearings to suspend the pivot shafts. Stylus force is applied by means of a coil spring which acts directly on the vertical pivot shaft (center of mass) so that dynamic balance is unaffected. A counterweight is provided to balance the arm in the vertical plane.

The method for lifting the arm at the end of the record, called Dyna Lift, is a magnet which attracts a square piece of metal placed on the arm. The magnetic field is effective only after this projection enters a slot in a hollow cylinder which is attached to the arm mount. The cylinder is constructed so as to preclude stray magnetic fields. The lift works with any stylus force from one gram up and folds out of the way if desired.

Performance

The Empire "Troubador" Model 398 is precise in appearance and performance. Total rumble measured better than – 62 db, and wow and flutter were less than 0.1 per cent rms. All three speeds were quite accurate.

As a system, the "Troubador" Model 398 is not inexpensive (about $165 less cartridge), but it just reaffirms something we all know; higher quality means higher costs. The Model 398 is an excellent buy for those who want the quality. **L-18**

NORELCO CONTINENTAL "200" TAPE RECORDER

The Norelco Continental "200" is a single-speed tape machine which records and plays back 4-track mono and provides tape-head output for 4-track stereo playback. It also can be used as a portable public address system which will play music from a radio or phonograph while, at the same time, the microphone is "live" for public address. In addition, during monophonic recording, the "200" will mix two

—not only the best, but the most complete line of long-excursion, infinite baffle, precision speaker systems...

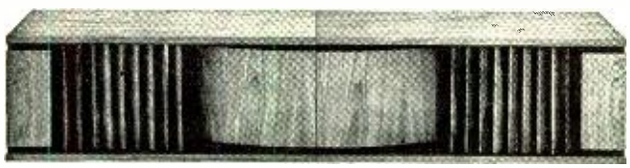
LINEAR-EFFICIENCY SYSTEMS

THE OLYMPUS

infinite baffle system without peer

Sensational sight, sensational sound, remarkable bass, indetectable crossover, incredible transient response, transparent highs, smoothest wide-angle projection... Every superlative ever used to describe a precision transduction system has been applied to the new JBL Olympus. The system includes a new 15" Linear-Efficiency low frequency unit, the LE15; new high frequency driver, the LE85; new slant plate acoustical lens, exponentially-tapered horn, and new dividing network. All unite to reproduce sound so clean, so smooth, so intact that the Olympus is destined to establish a new standard for this type of system. The free-standing, trim, beautifully-proportioned enclosure is available in all JBL wood finishes and with choice of carved wood or fabric grille.

FINEST QUALITY COMPACT LINEAR-EFFICIENCY SYSTEMS



THE JBL MINIGON

Aristocrat of bookshelf-size speaker systems, the JBL Ranger-Minigon provides integrated stereo through radial refraction, the same patented method used in the fabulous JBL Ranger-Paragon. Minigons accommodate either LE8 full-range units or JBL Model S5 two-way systems. Grille may be either the unique louver assembly shown here or fabric.

THE MADISON

THE DALE

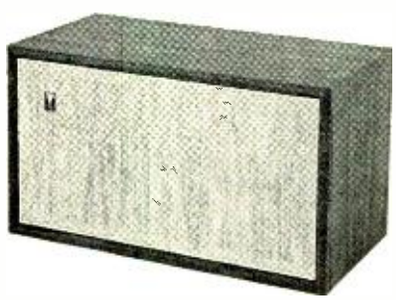
THE JBL MADISON

An exquisitely-styled minimum volume enclosure, the Madison reflects the Danish design influence and is especially popular in oiled teak or walnut finish. Finished four sides and front for vertical or horizontal placement. Takes the LE8 speaker or S5 system.

THE JBL DALE

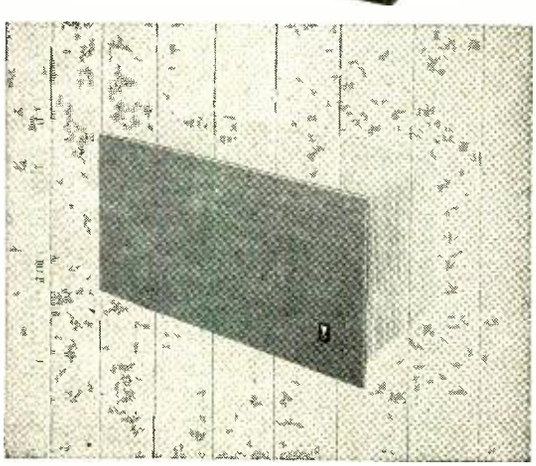
A timeless, elegant, modern design with removable legs and hangers on back (also on Madison) for wall mounting. Finished four sides and front. All finishes and grille cloths available.

HIGH QUALITY, LOW COST COMPACT LINEAR-EFFICIENCY SYSTEMS



THE LANCER 33

It is possible to offer typical JBL precision response, fine cabinet craftsmanship, and lasting-listening satisfaction at a lower price than ever before by making a simplified enclosure, longer production runs, limiting choice of finishes, using one grille, and providing somewhat less flexibility. The Lancer 33 is a ducted acoustical enclosure with an LE8 eight-inch, full range speaker. Lancer finishes are those most frequently asked for—tawny walnut, oiled walnut, dark mahogany, ebony, and pumice. Grille cloth is beige linen-weave.



THE LANCER 66

Similar in appearance to the 33, the Lancer 66 is a "buttoned-up" enclosure with a two-way, dividing network system with an LE 10 and new high frequency unit. Performance is remarkably smooth and transparent. Lancer speakers are factory installed.

and for building in...

THE JBL WILTON

Unfinished, the Wilton is furnished with either the LE8 or S5 system factory installed. Offered with either a flush grille or overlapping grille for use when built into a wall or partition.

Whatever your choice... exponentially-tapered horn, bass reflex or infinite baffle system... you'll find your ideal speaker in the extensive JBL line. Write for complete catalogue.

JBL products are manufactured by James B. Lansing Sound, Inc., and marketed by

JBL INTERNATIONAL Los Angeles 39, Calif.

Fig. 2. Norelco Continental "200" tape recorder.

sound sources because the microphone and radio inputs have separate volume controls. The "200" also has facilities to record sound-on-sound.

The Continental "200" is one of a family of tape machines sold by Norelco and made in Europe. Strangely enough, as we recall it, the family appeared in descending order if one follows their numbering system—the "400" was the first, and it was followed in appearance at the market place by the "300," then the "200," and most recently the "100." Except for the "100," which is a transistorized battery-operated machine, the rest of the family are clearly related, both internally and externally. We mention these relationships for the edification of those who have experience with any one of these machines, and also to indicate the variety of models available with very similar mechanisms.

Single Speed

The Continental "200" is a single speed (7½ ips) machine. To our knowledge, this is the only machine in its price and quality categories to operate at a single speed.

This raises an interesting question, "Is single-speed operation an advantage in a home tape machine?"

In order to answer this we must first know what the machine is going to be used for. If the primary purpose of the machine is to record and play back music, then the single 7½-ips speed is a good choice. Especially considering the fact that the elimination of other speeds reduces complexity and cost of the machine. On the other hand, if the primary function of the machine is to record and play back voice, then a slower speed would be desirable since it would be more economical in use of tape. In reality, however, it would be rather wasteful to purchase a machine of this kind primarily for voice recording; a more logical choice would be the Continental "100"—it costs much less.

Of course, for those who might desire an equal division of function, the decision now revolves about the point of whether to spend the extra amount necessary for a machine with at least two speeds, and equal music recording quality.

In any case, the single-speed operation (7½ ips) is a good money saver for those who want a tape machine for use in a music system.

Operation

Setting and controlling the speed of the "200" is a rather simple affair and is accomplished by means of the four piano-key pushbuttons and the stop bar between them. Thus, the fast forward and normal forward keys are on the right, and the rewind and pause keys are on the left. As noted previously, the stop bar is in the center. An interesting aspect of the stop bar, which is shaped like a piano key for a giant, is the clear window in the center of it through which the recording-level indicator is viewed. The radio-phono and microphone volume controls are behind the rewind and fast forward keys respectively. The radio-phono volume control also controls volume during playback and during operation of the machine as a public address amplifier. A tone control, located behind the pause key, operates during the playback and public address modes.

The Drive

Motion is transmitted in the "200" by means of a square plastic belt. Starting from a pulley on the motor spindle, the belt rides on one side of the take-up reel drive pulley, around a spring-tensioned idler, along one side of the capstan flywheel, around the supply reel drive pulley, and back to the motor pulley. The motion is imparted to the take-up and supply pulleys so that they rotate in opposite directions; the take-up pulley rotates in the direction of tape motion and the supply pulley against it. This provides a predetermined amount of tension on the tape. Motion to the reels is effected through friction clutches which can be adjusted somewhat as to the amount of friction they provide.

The 5½-in. capstan flywheel transfers its motion to the 7/16-in. capstan, which in turn sets the tape in motion when the rubber pressure roller pinches the tape against the capstan. At the same time a pressure pad slides toward the head, pushed in this direction by a spring extending from the pressure roller arm. The "200" handles tape extremely well except for a tendency to loop when motion first starts.

Circuit Description

The circuit of the "200" is typical of many tape recorders; a single-ended output stage utilizing a pentode, which serves as a single-ended bias oscillator during recording. This arrangement, while satisfactory, does not provide the performance potential of push-pull stages. The remainder of the circuit is straightforward and represents good practice.

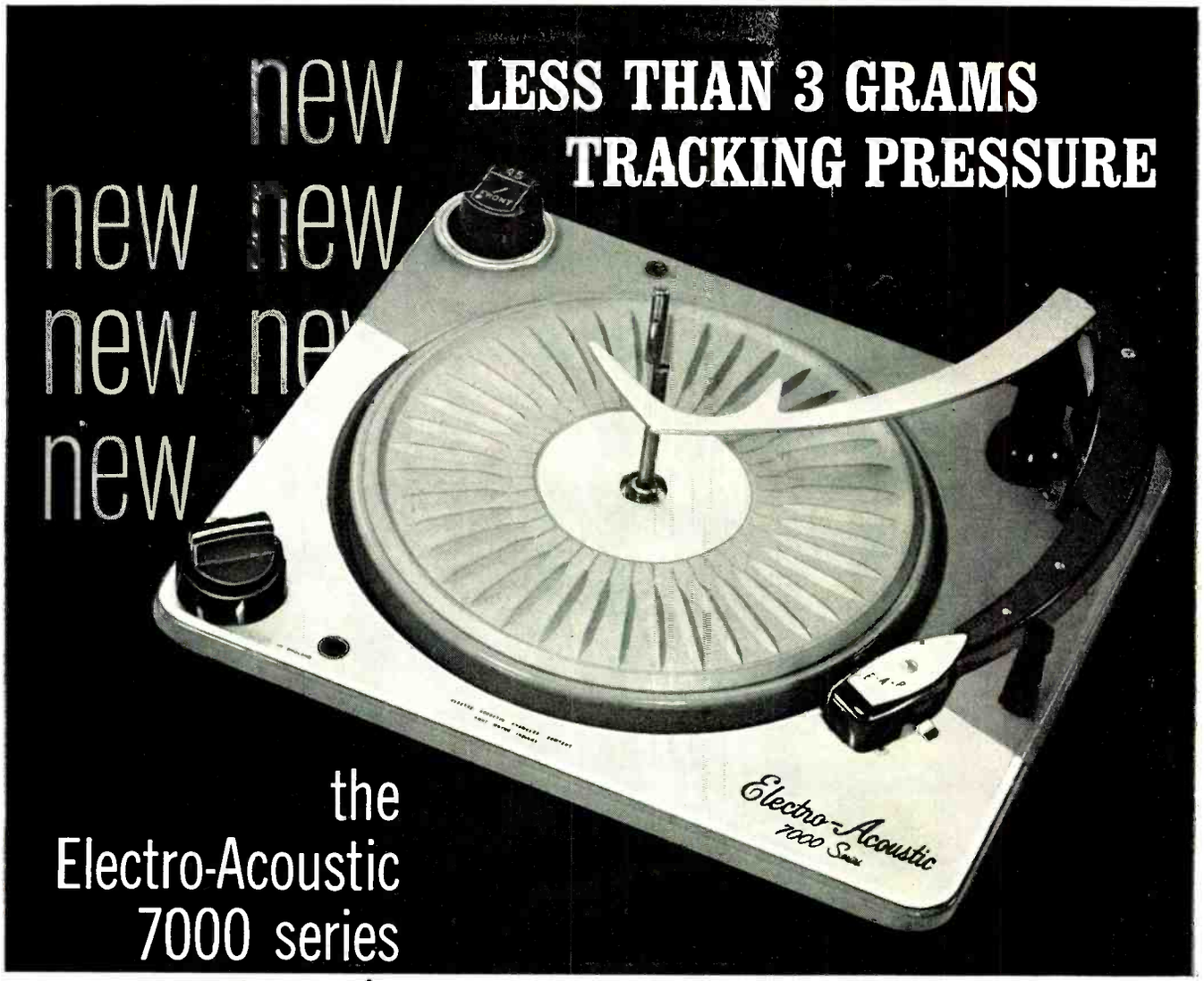
The frequency range of the Norelco Continental "200" is 50–14,000 cps and the signal-to-noise ratio is 50 db. Wow and flutter measure less than 0.3 per cent. Tape handling is good and over-all operation is simple and uncomplicated.

The Continental "200" is ideally suited for the audiofan interested in adding tape to his music system. **L-19**

UNIVERSITY CLASSIC MARK II SPEAKER SYSTEM

For several years University, as well as most of the speaker manufacturers, have been concentrating their best engineering efforts on producing ever better and smaller speaker systems. The advent of

Fig. 3. University Classic Mark II speaker system.



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The selected Diamond Stylus pickup of the 4-speed Electro-Acoustic 7000 Series stereophonic record player, with its high compliance and extremely low stylus pressure combine to extend record life and maintain the original fidelity of your fine recordings.

The dynamically-balanced 4-pole, 4-coil motor and turntable, micro-honed motor spindle, precisely machined bearings, and the custom-fitted turntable drive . . . limit rumble to −40db, wow to less than 0.15% RMS and flutter to 0.06% RMS (better than NARTB standards). Turntable speed is certified to be within ± 1% of absolute.

The Electro-Acoustic 7000 series handles your records more carefully than human hands. It is designed to capture the full beauty of every recording for hundreds of playings.
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CERTIFIED QUALITY

Each record player is laboratory tested and is sold with a written test report coded to the serial number of that particular record player, certifying that performance is within specification limits.

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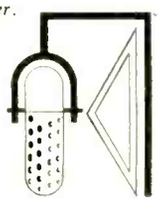

stereo had made it necessary to reduce the size of speaker systems so that it would be possible to fit two of them in the average home. This trend still continues in full force. On the other hand, a new trend has emerged in the past several months—a trend back towards larger systems incorporating the knowledge gained in designing the smaller systems. For example, one of the ideas which was intensively developed in the effort to improve the bass production of small enclosures was acoustic loading. This idea was applied in the form of a sealed or ducted cabinet. The latter form was (and is) the one used by University. Now this approach has been applied by them in their Classic Mark II speaker system so that the benefits of larger speakers could be obtained in a relatively small enclosure. Thus the dimensions of the Mark II are 35-in. wide, 28¼-in. high (with legs), and 17½-in. deep. This is a far cry from the 12-, 15-, or even 20-cubic foot enclosures which were thought necessary in previous years.

In addition to the functional lesson gained from the small-sized speaker systems, the Mark II reflects a style lesson as well; it is designed to emphasize the horizontal, thus giving the impression of being low and smaller than it is. It is just the right height to be useful as a side-table and provides an extremely handsome walnut surface towards that end. Also, taking the cue from the University Medallion speaker systems, the front grille is removable. This makes it unusually easy to get at the speakers, which are mounted from the front (the back of the enclosure is sealed).

Performance

The Classic Mark II contains three speakers in a 3-way system: a 15-in. high-compliance woofer; an 8-in. high-compliance mid-range speaker; and the well-known Sphericon super tweeter.

The woofer is essentially the same as the University C-15HC. The mid-range unit is mounted in a sealed sub-enclosure and, because it is itself a woofer (overhanging voice coil, high compliance), it permits crossover at 150 cps. A deflector board is placed in front of the woofer to improve dispersion. The Sphericon super tweeter, Model T-202, provides high-frequency response well beyond the audible range. Special measures have been taken with the Spherican to improve dispersion since this is almost as important as frequency range in a tweeter. (And some would say it is more important.)

It seems as if the engineers at University have learned their lessons well; the Classic Mark II produces an unusually rich bass. This bass, combined with the solid mid-range and the very wide high-frequency range, provide an over-all sound capability which is a definite departure from the small systems we have experienced in recent years. We must admit a decided preference for large speaker systems. The University Classic Mark II should definitely be considered by the audiofan who can afford the space and cost. **L-20**

FAIRCHILD MODEL 510 COMPANDER

Some 25 years ago there was published in RADIO (AUDIO'S predecessor) the first popular article describing a "Volume Expander," a device which automatically increased the dynamic range of a recording or radio program from the normal maximum of about 30 db to some 10 or 20 db greater. Various types of expanders appeared on the market as the whole idea enjoyed a brief popularity. Then came the LP, with much less surface noise and a consequent much larger dynamic range, and the expander no longer seemed to be necessary. Stereo may possibly have reduced the dynamic range again, so the idea again becomes attractive. On the other hand, the reverse of the expander—the compressor—is in general use in radio stations and in many types of PA systems and the general communication types of radio for commercial use. It is largely because of the use of the compressor in radio stations (and in some recording studios) that the expander is desirable—to restore the dynamic range of the original performance to the reproduction. No practical device of this nature has been on the market for a long time, however.

Within the past few months, Fairchild has brought the expander (and compressor) back into the market in the form of the Model 510 Compander, designed for home use. Milder in its effect than most earlier expanders, it makes a welcome addition to most any system, and puts new life into many recordings which appear to be dull and monotonous in level.

The original expanders employed tubes in variable-gain circuits, with the gain controlled by the signal level itself. Thus if one passage was recorded at, say, 20 db louder than another, it might come out at 30 db louder. The result is that when an orchestra comes up to a resounding finale, it really sounds that way. With tube circuits, however, there was either undue complication for ideal performance, or "thumps" if the equipment were simplified greatly.

The Fairchild Compander utilizes a new principle in which no tubes are used nor is any external power required. The unit is simply connected between pre- and power amps, with a connection to the 16-ohm (preferably) output terminals, and you're ready to go. The principle of operation is that a cadmium-sulphide photocell offers a high resistance in the dark, but the resistance drops to the vicinity of 2000 ohms when it is illuminated. Thus if we were to connect a lamp to the output of the amplifier and direct its light upon the photocell, the resistance would change as the loudness of the sound changed. Now by connecting the photocell across the top resistor of a voltage divider which normally reduced the signal by 6 db, the signal would increase when the cell was illuminated. If the cell were connected across the lower resistor of the voltage divider, the signal would be decreased.

Now there are a lot of interesting facets to the operation of this device. If the signal were to go up 3 db, let us say, thus lighting the lamp slightly and decreasing the loss in the divider, the light would then become brighter and illuminate the cell more, and so on. With a tube device, this was known as "backward feeding" and could not be used satisfactorily in an expander, because the signal would increase the gain, and the greater output signal would increase the gain more, and so on, so that practically any signal would cause the gain to increase to maximum and stay there.

But to more practical aspects of the Compander. Since we were one of the early exponents of expanders, we were especially pleased to find one on the market again, and in such a compact form. There is no doubt that there is considerably greater realism to reproduction using the Compander than there is without—the best way to see this is to listen with the Compander in the circuit for awhile and then to switch it out. Even the 6 db of its range is more than adequate—we normally listened with about 4 db of expansion, as shown by the indicator lights on the panel. Four neon lights are employed, two in each channel. When the lower light is illuminated, the exansion is about 4 db; when both are on, the expansion is 6 db. A three-position control switches the unit to expand or compress, as desired, or switches it off altogether.

The entire signal circuit consists of two resistances, one of which is shunted by a variable resistor—the photocell. Consequently there is no frequency discrimination and no added harmonic or intermodulation distortion. There is an insertion loss of 6 db. The amount of expansion or compression is controlled by two potentiometers, one in each channel, and the device operates perfectly with normal room listening levels.

In the compress mode, the device is ideal for recording from a group of inexperienced musicians or singers—or to put in the circuit from an excitable announcer who can't contain himself under the stress of happenings in sports, for example. Another use is for late-night playing—you reduce the dynamic range as far as possible and you have typical background music.

The small size of the Compander and the fact that for normal hi-fi use one does not need to change the control settings once they are set to the user's satisfaction makes it ideal for fitting into the back of a cabinet, possibly—in itself an advantage since one can't always accommodate all the new gadgets that come along without rebuilding the cabinet.

But for all general listening, we feel that the Compander is a satisfying addition to any good home system, even if we never touched the controls. **F-21**

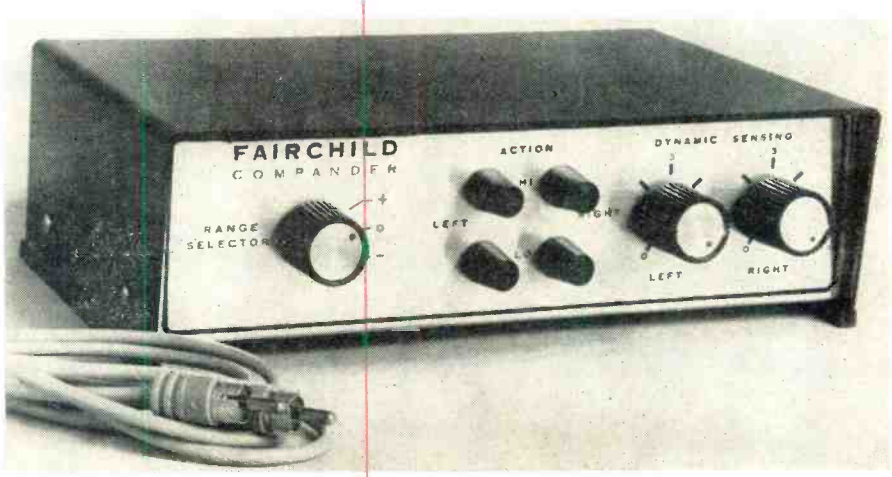

Fig. 4. Fairchild Compander Model 510.

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Just listen to the sound. You'll wonder at the beauty of the tonal quality of the trumpet and the violin. The beautiful tonal quality in the high-range that cannot be reproduced with the horn tweeter of the conventional type is largely due to the equalizer.
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It is of course not the equalizer alone that determines how well the tweeter works. The excellent quality of the special tweeter PT-6 has been achieved through the combination of a strong magnetic circuit, a light and robust diaphragm, the good shape of the horn. The tweeter PT-6 will form an excellent component with Pioneer's effective woofer and mid-range speaker for an ideal three-way system.

Specifications

Voice coil impedance:	16 ohms
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Sensitivity:	108 db/W
Total flux:	32,500 maxwells
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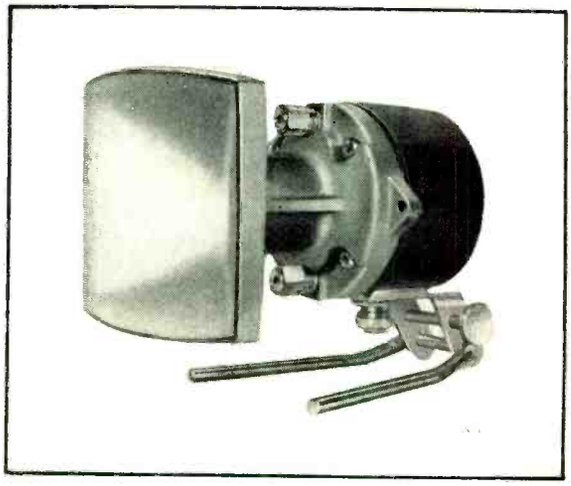

10-inch Woofer
PW-25C

The woofer PW-25C uses a strong and rational magnetic circuit that ensures good efficiency and reproduces the bass-range sound of excellent damping. The tonal quality of sound within the range of 250—1,000 cps that is basic for music is particularly good in this woofer. This woofer thus reproduces with high fidelity the staccato sound of the piano. In the high-range sound, the sound of 3,000 cps and up damps rapidly. Thus, it will form with such an excellent tweeter as PT-6 a two-way speaker system with ideal general characteristics.

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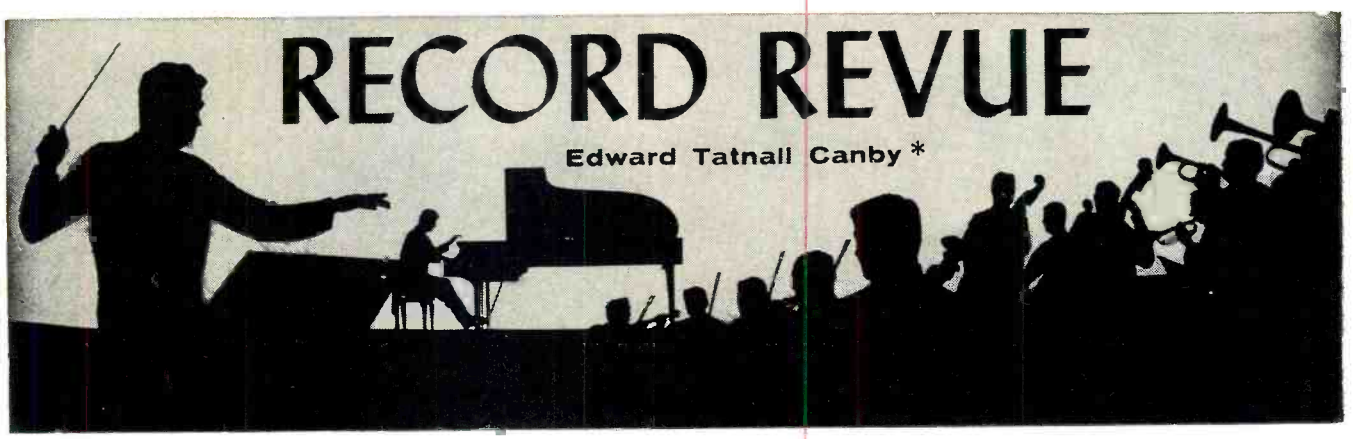

RECORD REVUE

Edward Tatnall Canby *

Sir Thomas' Last

Strauss: Ein Heldenleben. Royal Philharmonic, Beecham.

Capitol SG 7250 stereo

This, we are told, was "virtually" the recording made by Sir Thomas Beecham before he died. That qualifying word would be less cryptic if we did not know of the present-day tape-editing process, which assembles, like the movies, various segments made often over many weeks. Who knows what Sir T. taped in the chronological interstices? Time being thus segmented, this probably won't be his last release (if anything can be dredged up and go past the musical censors), but it is, happily, a fine memorial to the man, and is so presented officially.

The Straussian hero-music has never been of the sort I can myself take with unbroken joy. It has too much of a muchness. Hours of it. Still, one can be bored, or annoyed or distraught by some passages, and yet appreciate the whole and its details—I thus have a suspicion that this is one of the best recordings we'll hear for a good while. Beecham combined two essentials for such a performance of a gargantuan work, an obstinate faith in the post-Wagnerian musical language (which is increasingly difficult for most of us, as time goes by) and a fantastic insistence upon musical accuracy in detail, down to the last tiny phrase. Without the first of these, the faith and understanding of the language, performance tends to become mechanically hysterical, overdoing that which no longer carries conviction. We have had plenty of this sort. Without the second, meticulous musical shaping, a huge, 100-piece score like this, for all Strauss's expertness, easily becomes sloppy and maudlin, overviolent or deadly dull by turns.

The British recording engineers now do the impossible, somehow. They preserve in their stereo sound a conservative sort of concert-hall realism, at stage distance, and yet the impact of the whole is alive and vibrant, the individual solo instruments within the orchestra sounding startlingly real and natural, with a sort of presence that seems enhanced by their very distance as part of the orchestral mass. That's some trick, let me tell you.

BEETHOVEN AND BRAHMS

Beethoven: Piano Concerto No. 4 in G. Glenn Gould; New York Philharmonic, Bernstein.

Columbia MS 6262 stereo
(mono: HL 5662)

I hadn't had a chance before I got to this disc to get down and study the new Beethoven combination of Gould and Bernstein. Amazing! Maybe this isn't the greatest of the great. So what. The thing is—here is a New Day, a New Romanticism, in Beethoven, that takes us back over and beyond all recent history straight to the turn of the century. Not since then, has the peculiar spirit of this kind of Beethoven been heard. Not since—to put it another way—before Schnabel.

Schnabel, the benign and rigorous German master, was the first great piano exponent of the modern classical approach, performance that avoided excesses in detail, that was spare, profound and, above all, architectural. Schnabel was no mechanician, to make up a word. He was humanist all through. But his was the classic ideal and his disciplined performances caught the imagination of a whole era in music. He still lives on in such great younger pianists as Leon Fleisher; his spirit is alive in many of the present middle generation, from Milstein and Stern in the violin category to Serkin and Istomin (the first that come to mind) in piano. We have this spirit among conductors too—it was a part of the age that is now apparently over. At one end there is Bruno Walter, ever the classicist in his own way. In the middle there are the Steinbergs, the Jochums, the von Karajans.

And now—Romanticism again. (Beards, too, as in the last Romantic period, even though these two performers happen to be beardless.) A loving attention to detail for its own sake, for mood, for the special impact of a moment. A sense of timelessness, as though the music could float on forever. (The last generation was ever more in a hurry, played things faster and faster.) A feeling for high drama, but to be savored to the full and at leisure, ever with hardness, always with humanity even in the most "realistic" of horrors. And, of course, an eccentricity, in playing, in mannerism, to heighten the impact!

You can apply all this to Byron, to Keats and Shelley, to Robert Schumann, Berlioz, Paganini. It was inherent in Beethoven, as was the classic aspect—Beethoven, like Bach, was big enough to encompass all movements.

Slow, melodious, grateful, warm, leisurely, eccentric. That's this surprisingly new sort of Beethoven. It's wonderful, I say. (And who ever heard of a piano concerto with vocal accompaniment. Just Glenn, humming along to himself.)

Brahms: Serenade No. 1 in D for Orchestra, Op. 11. Symphony of the Air, Stokowsky.

Decca DL 710031 stereo

Here is one of my own all-time favorite small pieces in a rare recording. For some inexplicable reason, this first of Brahams' works for orchestra is practically never heard in symphony concerts and rarely on records. (My last was an LP, also from Decca, seven or eight years ago.) Maybe it's technical. The printed music may not be easily available; perhaps nobody has got around to making a modern edition of the parts and score. That sort of thing can hold a piece of music back as easily as an obsolete tire-size in an old auto. (The Second Serenade is more often heard; I don't like it as much.)

This is a good recording but not entirely satisfactory, and the reasons are in our complex musical economy. The Symphony of the Air is a worthy, even a heroic organization, the former NBC Symphony Orchestra, dropped overnight by the sponsoring company when Toscanini retired, after continuously playing with him since 1937. This orchestra is independent, tries to run itself and sell itself to keep in business, yet is not really one of those now-prevalent "pickup orchestras" which, often, are more permanent than some outfits with long-standard names. (Two Columbia Symphonies exist, for instance, one for each coast.) The independent orchestra just doesn't fit into the present system. It has to scrape for jobs, it has no glamor-base—no city, no history, no big-shot conductor—and it is constantly losing personnel to fancier playing jobs.

The Symphony of the Air is no longer what it was. But its work, though not good, is still of a kind one must respect. These men do their best, doggedly and faithfully, in a difficult situation that should enlist anyone's sympathy. What happens, alas, is that on the one hand, playing personnel very slowly had deteriorated and—really more important—the jobs the orchestra takes on generally do not allow enough rehearsal under the circumstances, when, indeed, more than the normal rehearsal should actually be provided for the less-than-crack-virtuoso excellence available.

I'm not objecting to Stokowsky here, though his performance is a bit fussy and overly ornamental in spots. He is an old pro and has the music very well in hand. What shows through, though, is simply unfamiliary with the music and with Stokowsky's ideas for it. There is an unevenness of ensemble—slight, but noticeable—a lack of unanimity, a tendency to play the repeats a lot better than the first times, some notable tempo bloopers when "Stoky" slows down and catches some players further off base than others. It all adds up to a potentially excellent performance that needs a couple of really solid rehearsals.

As if to prove it, the last movement of this really lovely and melodious little work "takes off" with absolutely splendid fire. It can happen. Play that, and you'll be glad to go along with the rest.

Klemperer Conducts Beethoven. (Excerpts from the Nine Symphonies.) (Angel SPRO 1844 demo)

Beethoven: The Nine Symphonies. Philharmonia Orch., Klemperer.

Angel S 3619 H stereo

Maybe if I promote the first of these, a promotional single disc, Angel may get around to releasing it for general sale. The big album, all nine symphonies complete in stereo (re-makes of his earlier mono versions) costs around $50, with deluxe packaging and notes, and a lot of people would be willing to invest 8 or 10 per cent in a preliminary sampling before indulging in such a monumental purchase.

It is for me to say here that the $50 investment (this is the suggested list price)

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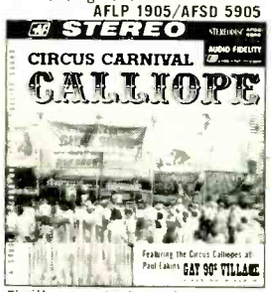

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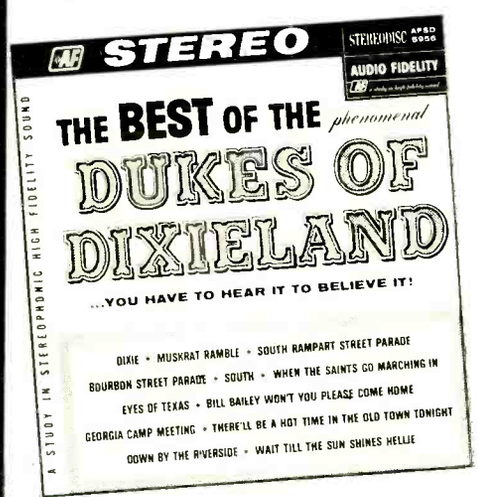

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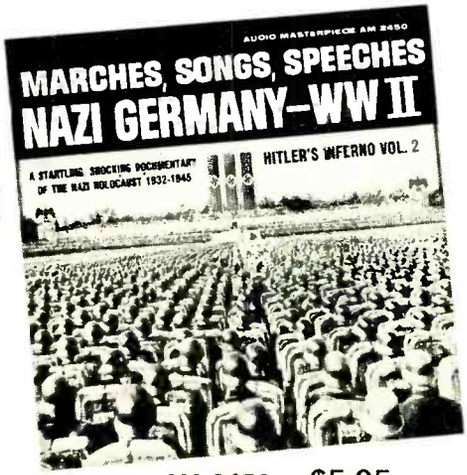

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is surely the best you can make in the field, i.e., in the Beethoven symphonies. My most recent memory is of the new Seventh, here included. I have rarely been so carried away as I was by that record. Breathtaking, and not so much on the first impact of the first side (which begins quietly) as in the cumulative musical and phonographic punch, as the symphony progresses.

After some twenty-odd years of reviewing, I still have a very solid faith in the all-out power of this sort of music, given half a chance, upon anyone brought up within the Western, and specifically the American culture. Just put that Seventh—or one of the others—on a good turntable with a good system attached to it, plus an adequate acoustical situation—then *listen*. I mean, listen in silence, except for the music, reserving all sound for the recording itself. If you will give Beethoven and Klemperer that much of yourself and of your time, if you will listen undividedly and to the end, without interruption, you will find it pays off in kicks, and I don't care who you are.

As I remember, I was having supper as I listened to the Seventh. I got so absorbed in what was happening that I turned away from my meal and simply let it get cold. This particular pinnacle of the recorded art and the musical art combined demanded every bit of focussed attention I could muster, and it got it. You may not hear quite as much in the music, with less lengthy experience—but there's plenty in it for you just the same, if you'll just "lend your ears" as the old phrase goes. Render unto Caesar what is Caesar's!

Brahms: Double Concerto for Violin and Cello, Opus 102. Heifetz, Piatigorsky; Orchestra under the direction of Alfred Wallenstein.

RCA Victor LDS 2513 stereo

The cover here shows two hard-working older musicians in a revealing close-up, a furrowed, gray haired Piatigorsky and a Heifetz with heavy, expressive lines on the forehead, two fingers up and questioning, as though asking, "Isn't twice enough, in this 90-deg. heat?" It is not a glamorous picture but it is a good one. It says eloquently that RCA Victor's prime "stable" of virtuosi is collectively getting along in age these days. So says this performance, too.

It is definitely a late-middle-age version, and mostly for the good, at that. The flamboyant Piatigorsky is far less so now than earlier, at least on most public occasions. The temperamental Heifetz is solid-looking, strong, reaching into his late effective years. Both have put the new-found excitement of public acclaim behind them after dozens of years of continued experience. Both are at the stage where one must show one's real cards at their best, or fade away.

It is that kind of a performance. Lean, wiry, not exactly graceful, yet full of experience in this very kind of music. The two voices are like the voices of men of this age, a bit metallic somehow, not youthful. (Strange how an instrument centuries old can reflect its present owner's very soul, at this given moment, as perhaps it has for a dozen earlier generations or more of owners back to the 1600's!) The architecture is splendid here, the music wholly dominated by its knowledgeable performers; the late-Brahms heaviness of style is easily held in animation throughout the long work.

The anonymous orchestra, probably pickup or maybe under contract to somebody like Columbia or something, is entirely competent for the job if not exactly glamorous as cover materials. And as for Wallenstein, he is an efficient working conductor, who can set off these two soloists with what they need as backing. Needless to say, he does not steal the show. This is a soloists' performance, not a conductor's (as was the famous old 78 set under, if I'm right, that show-stopper Toscanini).

Mellow, productive middle age. And RCA had better turn up a lot of new Heifetzes pretty soon, if youth is to have its say.

Beethoven: Violin Concerto. Zino Francescatti; Columbia Symphony, Bruno Walter.

Columbia MS 6263 stereo
(mono: ML 5663)

Here is Columbia's top classic conductor of German music, notable for his symphonic series of Brahms, Beethoven, Mozart masterpieces, tied in with one of Columbia's available high-rank fiddlers. The combination has all the trappings of a great recording and mostly sounds it. Not entirely, though.

Francescatti was a boy prodigy and has one of the most extraordinay techniques in the business. But behind it is a certain lack of the overwhelmingly forceful personality that must ordinarily go with such equipment—as, for instance, in Heifetz, or even the younger Milsteins and Sterns. In recent years, Francescatti has seemed sometimes to flag for sheer lack of "push", notably in his recent Beethoven with Casadesus where, for whatever reason, he did not even play in tune. A tired sound. Could be exhaustion, boredom, illness or all of them and more—one never knows in recording.

Here, for excellent reasons, Francescatti has girded himself up and put forth his absolute best. This, he surely knew, could be a recording milestone, with Bruno Walter. And it is good. No bad pitch here, no faltering, no absent-mindedness. The first movement has all the graces and most of the force of the best performance, with gorgeous tone and lovely technique.

But in the second movement I found the tell-tale signs of less-than greatness; for this movement, extremely slow, long-drawn-out, falls apart of its own limpid beauty unless the architectural concept is rigidly kept alive. It sags here, and there is not the compensating lushness that a Heifetz could apply, so that you might say, forget the architecture—listen to that man play! Here, even with the architectural-minded Bruno at the controls of the music, Frances-

catti is simply going through the notes, each one lovely in itself but the whole emerging as a high-level routine. The continuously played last movement shares some of this, for it is not the release of long-drawn tension that it should be.

No, this is a lovely performance but by no means a definitive one. I'd put Capitol's old mono version with Steinberg and Millstein far above it in sheer projection of big Beethoven. Alas, that one can never be heard in stereo; Capitol doesn't record the Pittsburgh and Steinberg any more. (But they might catch these performers in England via EMI and the Philharmonia. Let's hope so.)

NOT QUITE BUT ALMOST . . .

Mozart: Symphonies No. 41 ("Jupiter"), No. 35 ("Haffner"). Columbia Symphony, Bruno Walter.

Columbia MS 6255
(mono: ML 5655)

All the Columbia Bruno Walter recordings these days are meant to be definitive, as far as that term may be applied to the ephemeral life of a recording. Definitive in stereo, now that the definitive mono recordings of only a few years ago are already technologically dead.

This one might have been, but isn't. Even the greatest, the most experienced masters have their bad days, or series of days, their blind spots, their inexplicable quirks.

Most of Bruno Walter's work has that serenity of years which is his own proudest possession; it comes through in all his printed and spoken utterances, and Columbia is happy to expatiate upon it whenever there is a seemly opportunity. So it is a bit startling to find that his Mozart, as of these symphonies, comes out relatively harsh, taut, somehow un-serene.

To ascribe the difficulty to any particular aspect of the recording isn't easy. Where other Columbia stereo pickups seemed to me outstanding, for instance, this one strikes me as harsh in itself. Too close, damaging the precarious unity of many players that should emerge from the all-important Mozart string section. Knowing how recording works, I would not at all be surprised to hear that the technical set-up was practically identical to that used in other Walter recordings, the fault lying if anywhere with Mozart himself—for writing like Mozart. This could happen. But if so, it is up to the engineers to do something about it, not Mozart.

Mind you, this is top-level criticism and rating. I am speaking in terms of the best Mozart as played by the best available interpretors of our day, a league which is surely Bruno Walter's by right. On that basis, I was disappointed, and you may be too.

I have a vague feeling that earlier Walter Mozart, the symphonies, struck me similarly. Maybe the intense Mozart music lets loose something in Bruno Walter that has lurked beneath that spiritual serenity for these eighty years and more! A little Mozart-devil, come out of hiding.

It could also be, come to think of it, the natural un-affinity for Mozart geographically inherent in the musical community of West Coast players, far removed from the home-base area of Europe where Mozart is thoroughly indigenous. Even a great European conductor can't re-make his American musicians into a home-style orchestra. An American tenseness? Perhaps this, too. It would show in Mozart.

Bach Organ Favorites. E. Power Biggs, Flentrop Organ.

Columbia MS 6261 stereo
(mono: ML 5661)

"What, another *D Minor?*" That's the way the jacket notes begin, on the back of this record. Yes, another D Minor Toccata and Fugue, and another "Little G Minor," another Passacaglia and Fugue in C Minor —the standard big-Bach repertory here.

Now maybe I'm not in a position to say this is jes' fine, since I don't have to buy all the umpteen versions of this music in order to find which I like the best. I still say it's fine, nevertheless, and for some reasonably good reasons.

First, Columbia's stereo recording of this organ is now very lovely. (It wasn't so good, as I remember, when the new organ was first installed a short time ago.) And the organ itself is a lulu, of its type, a genuine synthetic antique, and it'll play when the power goes off (if somebody is on hand to pump up the air chest) because the entire mechanism is mechanical, via the old-type tracker action of Bach's day that has so surprisingly turned out to be superior to anything the electricians have been able to devise in the way of electrical operation. Low wind pressure, high color in the pipe sounds, copious variety in the many combinations of tone available, lots of *ictus* or "chiff" to give rhythmic emphasis to each note, an out-in-the-open sound, unimpeded by dampening shutters and boxed enclosures —these are the things that make such an organ attractive today, and notably when placed in a well suited architectural enclosure that shapes up the sound with liveness.

Then there is Mr. Biggs, America's organist. Not the world's greatest organist, by any means, and in the faster passages Biggs still tends to fall back into "school work," hard, bouncy staccato playing, originally learned in order to bring out the tunes on the older muzzy, blurry organs of a thousand-and-one street-corner churches. The Biggs phrasing of themes remains decidedly weak—i.e., absent-minded. He never shapes a tune the same way twice, as though it didn't really matter much. Inconsistent. Maybe it doesn't—but a thought-out pattern of phrasing inevitably makes for better rhythm and better musical communication.

Yet (as I've said before), Biggs has had such intimate experience with so many great organs of an older day on his famed playing and recording tours, his enthusiasm for the "authentic" has paid off so well that you really do feel a warmth of

first-hand knowledge and an easy familiarity with very best of the Baroque tradition as we now have it, in printed form and in actual operating organ machinery. It's a pleasure to hear his Bach on this splendid clear and powerful organ, phrasing or no phrasing.

Ravel: Daphnis and Chloë (Complete). Bostan Symphony, N.E. Conservatory Chorus, Munch.

RCA Victor LSC 2568 stereo

Ravel: Daphnis and Chloë (Complete). N. Y. Philharmonic, Schola Cantorum, Bernstein.

Columbia MS 6260 stereo
(mono: ML 5660)

Here they go, marketably at each other's throats, the two big companies each releasing a complete "Daphnis" in the very same month. But even this isn't enough; the RCA Victor version duplicates RCA's quite recent recording of the very same music in stereo, with the same performers, released only a year back. Evidently, the company did the entire operation all over again—if some fairly painstaking comparisons of the two discs on my part are right in indicating that this is indeed a new performance and not merely a reënhanced, recut version of the same master tapes.

RCA was surely the pioneer, on records, anyhow. I enjoyed the earlier version, the first time I had ever heard the entire Ravel ballet-symphony with its wordless chorus. I noted (Oct. 1960) the happy facility of the LP record for bringing us the complete versions of works formerly heard only in excerpted suites—two suites for this particular work. Columbia's later version in New York (a million miles from Boston, of course) was equally hailed as a pioneering effort by the New York music critics, last March—which was true in terms of the New York region. (Do the N. Y. critics ever get to meet the Boston ones? I wonder. And here am I, a *record* critic, holding all three performances, New York *and* Boston, in one of my hands!) Musical provincialism of a harmless sort, here enshrined, by accident or intent, in a single month's record releases.

The competition is indeed close. Munch is at his best in this sort of French music; so is the Boston, long a pioneer in Ravel's music in the past. The Boston performance is peppy, accurate, gorgeous in tone, the semi-youthful student-type professional choir makes a smooth but big sound especially good in the tautly controlled primeval yells that come at the great climaxes. And yet—

—In comparison with Bernstein's version, the Munch performance betrays still a bit of that chill that hits so often in his readings. As usual, Bernstein goes all-out; sincerity bursts all over the place. Every phrase does its best to be expressive; an almost child-like excitement, round-eyed, shows through every measure. And where RCA's new recording is large, tapestry-like, mellow and distant (with an enormous bass drum for the hi-fi speakers), Columbia's is closer, more vivid, a more direct impact in terms of the music itself.

RCA's is a superb recording of a concert sound; Columbia's is the music itself, direct.

I even liked the more mature and wobbly (New York) Schola Cantorum better than the (Boston) Conservatory—in this music they produce a richer texture, and in the short *a cappella* interlude they stay on pitch. New England doesn't.

(Ah—but don't miss that RCA bass drum, if you have big speakers and plenty of pickup-amplifier power.)

The older RCA version, interestingly, is less live, less expansive, seems closer, even though it may well have been recorded in the same place by the same performing groups. The loud parts are pretty heavily cut on the disc and, perhaps, not quite without distortion according to this year's standards, though it could be in the disc alone, probably wasn't in the original tape. Enough reason for a complete re-do, at thousands of dollars' expense? Don't ask me.

The Folksongs of Britain:
Vol. 1 Songs of Courtship
Vol. 2 Songs of Seduction
Vol. 3 Jack of All Trades.
Collected and Edited by Peter Kennedy and Alan Lomax.

Caedmon TC 1142/43/44

If you've been following the pulse of the U. S. folksong movement these last few years, you'll find these amusing discs a commentary in reverse upon it. For here is what folksong used to be, during the several thousand years until, so to speak, the day before yesterday. This is folksong in action, neither preserved nor arranged, and it is folksong in its own bailiwick, at home.

Not that our folksong is something entirely new. But ours is radically altered, combining new elements with the old. We still dig up the old stuff, like antique dealers or archaeologists, out of local singers off in the bush, or out of books. But we also have a new-fangled way of propagation, straight off the phonograph record; and we do the folk stuff in new places, too, something a bit different than the old hayseed, homespun performance. Now it's under the swank night club light. Or rough-style in a big-city coffee house, complete with beards and jeans and black stockings. The old folk singers, passed away, would die again of astonishment if they could see what has happened to their tunes!

With us, the phonograph record has spread the music all over the place, old stuff and new all mixed together timelessly, geography ignored, unto the third generation—school records of the people who listened to the kids who listen to youths who listened to songs 'way back when they were still in-

digenous in their places of origin, or of long time residence, as in the "Kaintucky mountings." Straight from grandaddy up in a Southern valley to a high-school lad in New York City, as authentic as all get out...

Anyhow, England is slower in these respects. Here we have also the old tunes and the relatively new, but on a much more local scale. These have been learned by their singers from other singers not many miles away and of the same region. They are still fairly a part of the local landscape. And they are sung largely informally in pubs and clubs, by non-pros who are entertainers on the side, though a few actually produce a modest living from it. In almost every one of these, the atmosphere is convivial, the voices hearty and untrained, the bystanders in evidence whenever they happen to feel like a bit of noise. Often there are insruments, and the sound is more or less present-day as living folk music always is. These are not the primitive old crones and ancient men from whom the super-authentic folk music is collected. These are just people. What there is of ancient tradition—there's plenty—appears as it should in an entirely up-to-date guise, just as the songs are sung right now, for the sheer fun of it.

Main criticism of the series to date: The excerpts are fairly complete as to story and verse, condensed, but I still feel that more of each performance, or a group of songs from each performer, would help a lot. Too many changes of scene. Following the informative booklet of texts and comment, I found I could barely keep up with the music, reading as fast as possible. The wrench and jump from each singer and locale to the next is too sharp and comes too often for any sort of comfort in the listening.

Much better half as many performers, twice as much from each. After all, records are for listening.

Maestro Segovia

Decca 710.039 stereo

Quit the maestro stuff, Decca. Segovia can stand and play on his own feet (with his own hands) and anyway, he's Spanish, not Italian. Next thing you know, they'll change it to Don Segovia.

The old "master" does his usual sensitive, slightly sentimental, old-fashioned job here, with the usual impeccable ear for harmonies, the fluidly poetic rhythms, the highly Romanticized playing of "ancient" music, as of the early Nineteen Hundreds. Milan (1500–1561), Visée, a dug-up Louis XIV French guitarist, the inevitable Albeniz, the even more inevitable Fernando Sor, the program is as usual, except for a couple of items I hadn't heard the old man tackle before. Two movements out of Haydn string quartet music—I almost fell over with surprise when these two familiar pieces began. Couldn't figure out what they were, in guitar costume! Also a Mendelssohn "Song Without Words." He's a real musician, Segovia, and so these works, within the Segovia styling, are both musical and faithful to the original harmonic and melodic intent.

Ponchielli: La Gioconda Highlights. Callas, Cossotto, Companeez, etc., La Sacal Orchestra, Votto.

Angel S 35940 stereo

Well, I dunno. La Callas has a way of leaving me with a musical chill, while the rest of the world breaks into a high fever. But then, I'm not exactly a Ponchielli fan either, finding the music fulsomely pleasant and in the end sort of a bore. If you are an opera fan, just stop quick and don't go and have a hemorrhage. I apologize—no offense meant, but I just can't help it. I feel this way.

At least, Callas sings here in a manner that will offend nobody. The music really isn't high-powered enough for her to let out all the stops most of the time. Indeed, a lot of it is complete-opera stuff, not just arias for Callas, but excerpts from the whole continuity, with chorus and all. (I say it's not high-powered even though the titles run to such Italianate extremes of healthy enthusiasm as "Suicidio!". How could you have an Italian opera without that?)

As a matter of fact, opera specialists can read me well enough to indicate that from their viewpoint this is likely to be a first-rate recording of the material. Their viewpoint is important, so long as this species of grand opera contineus to exist.

Schubert: German Mass (1827); Kyrie and Salve Regina (1813, 1816). Regensburger Domspatzen Choir, Regensburg Cathedral Choir, Symp. Orch. Bavarian Radio, Schrems.

Deutsche Grammophon 138676 stereo

Unusual Schubert on this record—the "German Mass" (an idea somewhat analogous to that of the "German Requiem" of Brahms in its use of German text instead of the traditional Latin) is a strange piece dating from the year before the composer's death, yet of such a simple nature that it could be the music of his earliest youth—which the other two works in fact are.

Strange, simply, in that this "Mass" is made up of a series of purely hymn-like songs, without counterpart or elaboration, each sung in a number of verses, hymn-style. They are superb songs and longer, more complex, than our standard hymns. But the sense is hymn-like. The two extra earlier pieces are somewhat similar.

I rather suspect that the Sunday church quality of these movements is exaggerated in this recording. For all the world, it sounds like a conventional Sunday service (Protestant, at that!) and was so mistakenly heard by neighbors of mine—who asked me, what was that hymn singing they heard at my house. A big church, a solemn and slow tempo, the organ for accompaniment and for brief interludes between verses (by Schubert), combine to give the churchly impression.

I suspect that a lighter, faster reading might reveal more of Schubert and less of the Sunday-church mood; but even so, this performance is revealing and musically well worthwhile. Like all hymns, a few at a time is plenty. Take a break, part-way through each side, when you come to play the music. AE

CHARLES A. ROBERTSON*

STEREO

First Annual Prestige Swing Festival, Spring 1961: Things Ain't What They Used To Be

Prestige/Swingville Stereo SV4001

Riding herd at jazz festivals and attempting to brand winners of the latest polls are among the regular chores around alert record outfits, but the time when only a handful of companies shared the range is long gone. Things are a lot more crowded these days, and competitive bidding usually places a good deal of talent under contract before the seasonal roundups. Some labels are finding it expedient to open new territory and schedule studio get togethers which feature more stimulating fare than most festivals have offered recently. Candid allows the Newport Rebels to roam over its private domain at will, and now Prestige lets veteran swingsters loose on a double-album spread and promises to restage the event annually.

Since starting the Swingville series a year or so ago, Prestige has corralled quite a few choice performers and exhibited them in choice surroundings. The present project is the most ambitious yet, and it successfully sums up the aims of the entire series as well as marking a highpoint to date. Unlike the recording dates which bring older soloists back to the studios merely to recreate earlier roles, these sessions permit the players to demonstrate how much they have developed over the years. Younger men often fill out the rhythm sections to add the stimulus of fresh ideas, and the practice of supplanting the usual trusted warhorses with original material is encouraged.

This year's festivities are doubly so as they also introduce Prestige's first stereo listing, and any sort of consumer response should see a rapid increase in the supply. All the sessions held at Rudy Van Gelder's studios are taped in stereo, but the label has hestitated to go into the market until now. Because each of the two alternating groups of Swingville All Stars boasts a complement of nine men to swell ensemble passages, the greater dimensions of stereo are well worth an extra investment. No gimmicks disturb the straightforward thrust of the soloists, and the respective presence on guitar of either Tiny Grimes or Danny Barker pleasurably augments the rhythmic backgrounds.

The delegation of Jimmy Hamilton to write arrangements for one session also contributes stereo interest, and the polished interplay between the Duke Ellington clarinetist and tenor-saxist Coleman Hawkins is especially effective on *Cool Sunrise*. Joe Newman, trumpet, Hilton Jefferson, alto sax, and trombonist J. C. Higginbotham join the party on *Love Me Or Leave Me*, and the group's two other tunes are Hamilton originals. Claude Hopkins on piano shepherds everyone through a lively concluding jam session.

The second group awaited the return of Pee Wee Russell, Vic Dickenson and Buddy Tate from European tours before holding its meeting, and the mixture contains even more elements of surprise. Cliff Jackson plays thoroughly seasoned stride piano beside bassist Joe Benjamin, and they unite in a grandly affirmative *I Want To Be Happy*. Jackson also supplements Russell's imaginative clarinet laments during a long ad-lib blues. Joe Thomas delivers a fine open trumpet solo on *I May Be Wrong*, and Dickenson provides his own trombone opening on *Vic's Spot*. Former Ellington star Al Sears summarizes the proceedings with a nostalgic tenor sax revery on the title tune. Things were never this good around recording studios in the old days, and they should get steadily better with each annual celebration of the continued good health of the Swingville series.

"Sweet Emma" Barrett: The Bell Gal

Riverside Stereo RLP 9364

The first volume of the "New Orleans: The Living Legends" series introduced "Sweet Emma" Barrett, who advertises Her Dixieland Boys with a business card inviting everyone to come hear the leader: "RINGING HER BELLS, and Spanking the Ivories with Blues and Dixieland Jazz." Showmanship is part of her stock in trade, and she appears on the stand wearing a red dress, garters and beanie with dozens of tiny bells attached. Aside from bringing in the jobs, her strong business sense enables her to hire and hold the finest sidemen in the city. The band's musical director is Percy Humphrey on trumpet, and the front line also boasts trombonist Jim Robinson and clarinetist Willie Humphrey. With an entire album to itself, the septet settles down to one of the best performances yet recorded of *Down In Honky Tonk Town*. Another high point is the banjo and unamplified guitar playing of Emanuel Sayles on the blues. The three-horn polyphony in the ensembles is clearly defined in stereo, thanks to excellent engineering by Dave Jones.

Quincy Jones: Around The World

Mercury Stereo PPS6014

Firehouse Five Plus Two: Around The World

Good Time Jazz Stereo S10044

Those persons who claim humor is no longer a part of jazz should stop mourning its loss at the thought of a dixieland group and a respected modernist bandleader coming up with identical album titles, based on similar ideas, and in the same month. Anyone trying to keep a band together today needs a sense of humor, and Quincy Jones knows how to laugh off a stereo spectacular without resorting to the usual gimmicks. A good half-dozen assorted percussionists join the regular force for the occasion, but they stay in their own channels and perform with military precision on *Strike Up The Band*, lend exotic coloration to *Baia*, and assume a Latin pose on Tito Puente's *Rico Vacilon*. By way of reward, Jones lets them all go completely berserk on his own *Africana*. Puente, Jimmy Crawford, Stu Martin, Potato Valdez and Olatunji are among those making a safari across the veldt.

Good taste, subtle humor and satisfying jazz solos are enough of a novelty in the world of stereo shockers to win this production a high place on the list. Jones provides distinctive views of Japan on *Hot Sake*, of the bullring on *Manolete De Espana*, and offers a new adaptation of *Dear Old Stockholm*. Clark Terry, Phil Woods, Benny Bailey, Curtis Fuller and Patti Bown of the regular contingent all receive space for standout solos. Bob Fine is the engineer who handled the controls.

The Firehouse Five was a rollicking group long before stereo, and the new medium simply casts a warmer glow around the traditional high spirits. Ward Kimball conducts a lively tour without duplicating any of the titles visited by Jones, and the ambassadors of good will from the Walt Disney studios stop over at *Panama, Isle of Capri*, and *My Little Grass Shack In Kealakekua Hawaii*. Everyone mounts a diesel locomotive to journey home on *California Here I Come*. Banjo King Dick Roberts and George Probert, soprano sax, find time for serious business amongst all the foolery. Lester Koenig's notes *Hindustan*. Anyone with the capacity to enjoy include a short anecdote about the origin of both these albums need not complain about the lack of humor in jazz.

Pee Wee Russell and Coleman Hawkins: Jazz Reunion

Candid Stereo 9020

The only disappointing aspect of this reunion is the failure of the two principals to encore both numbers recorded when they were last together on a historic Mound City Blue Blowers date in 1929. Perhaps the omission is due to Pee Wee Russell's reluctance to stir up memories of the former girl friend who inspired *Hello, Lola*. However, the clarinetist more than remedies matters by appearing with only the rhythm section on *Mariooch*, a beautiful blues serenade dedicated to his wife. Modernists should hunt up a copy of the earlier meeting though, if only to hear Russell accomplishing things thirty-two years ago that Ornette Coleman has yet to try.

Coleman Hawkins erupts once again with an earthshaking solo on *If I Could Be With You One Hour Tonight*, and nearly nine minutes of playing time, along with the extra dimensions of stereo, furnishes a lot more elbow room for his tenor sax than was available on the old 78's. Nat Pierce's arrangements often carry a Kansas City beat, with a lift from Jo Jones' cymbals, and the pianist collaborates with Russell on a down home blues titled *28th and 8th*. Emmett Berry, trumpet, Milt Hinton, bass, and trombonist Bob Brookmeyer complete the septet. The reunion took place at Nola Penthouse Sound Studios, with Bob d'Orleans officiating at the controls.

Al Hirt: He's The King

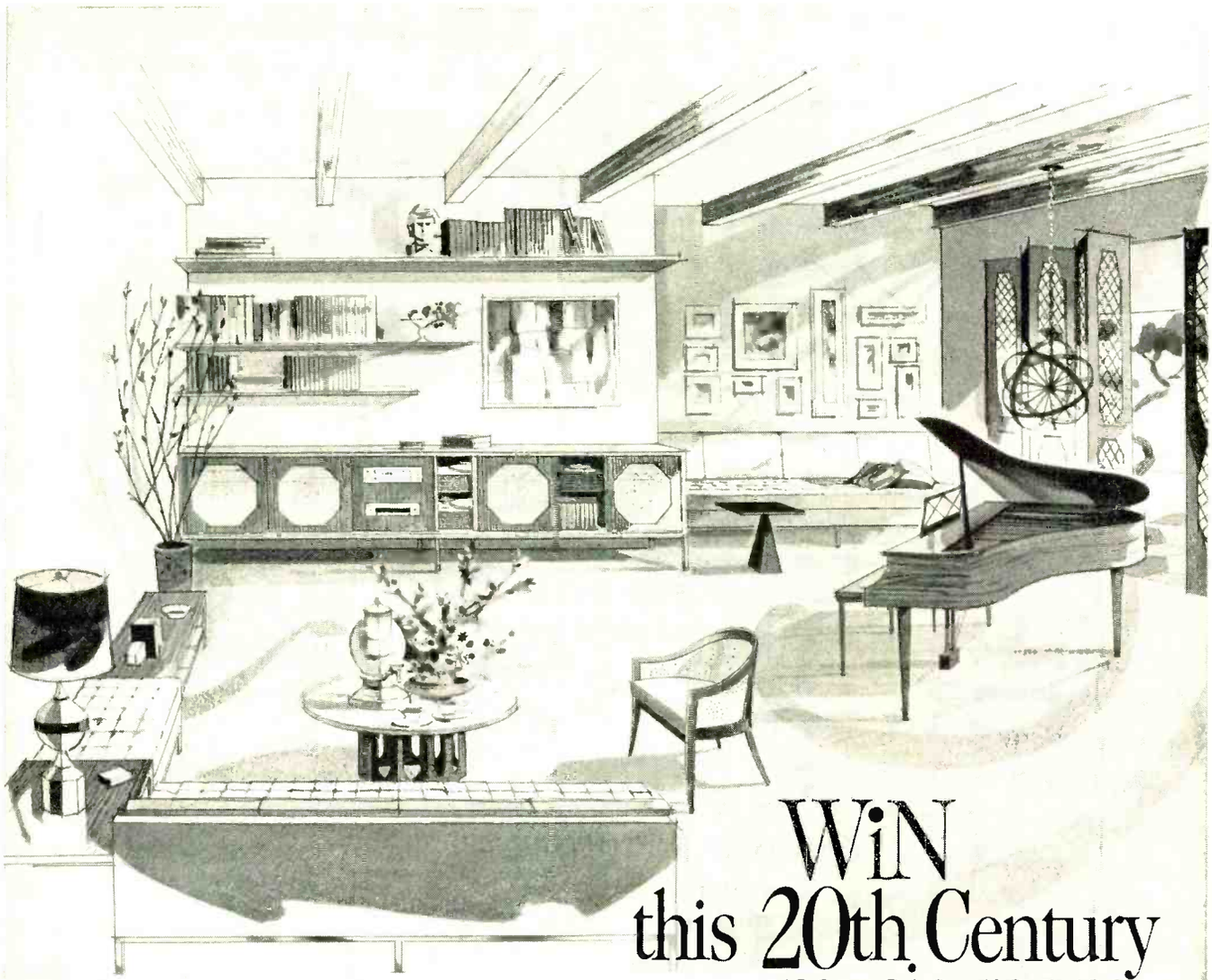
RCA Victor Stereo LSP2354

Maynard Ferguson: Straightaway

Roulette Stereo SR52076

These two trumpet marvels are often censored for indulging in tasteless pyrotechnics, but both can stop generating excitement long enough to exercise restraint if necessary. Now that record companies are engaging in exchange programs, perhaps Roulette and RCA Victor will bring the two high-note virtuosos together for a couple of albums. Despite apparent differences in background and style, they hold enough in common to make the meeting interesting, whether they try to shatter studio walls in a trumpet duel or intimidate each other into a show of good-mannered reserve. Al Hirt mixes up dixieland, swing and a passionate ballad attack on his current release, in keeping with his new eminence on television screens. The fiery sextet from his native New Orleans plays *Cornet Chop Suey, Down By The Riverside*, and introduces *The King's Blues*. Henri Rene's ten-piece studio group lends firm support on *Lover Come Back To Me*, and *The Jitterburg Waltz*. An augmented rhythm section, with Mundell Lowe

* *732 The Parkway, Mamaroneck, N. Y.*



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and Danny Perri holding up the stereo extremities on guitars, paces Hirt's glowing tribute to *Laura*.

Maynard Ferguson is the latest jazz maestro to fashion original themes for a television series, and if the "Straightaway" stories about racing cars are nearly as good as the music, both album and show should catch on with mass audiences. Ferguson's powerpacked trumpet is the ideal choice to underline the sound of speeding engines, but his band also fits in with the quieter moods of *Mambo La Mans, Melancholia,* and *After The Race.* Willie Maiden and Don Sebesky share credit for the arrangements, and the whole crew performs like a finely tuned motor on *Stroking.*

Della Reese: Special Delivery

RCA Victor Stereo LSP2391

Mercer Ellington was recently Della Reese's touring companion, having assembled an admirable big band to support the singer in night clubs and theaters. A cross-country jaunt enabled the entire troupe to get in fighting trim by the time Hollywood was sighted, and some plain and fancy stereo footwork is displayed on this recording from RCA Victor's Music Center of the World. Engineer Al Schmitt referees the match with his usual skill at separating the opposing sections of a big band in the clinches. Ellington's arrangements follow the pattern of the great Harlem show bands, with a bow toward Andy Kirk on *Until The Real Thing Comes Along.* The band alone is worth the price of a ringside seat, and the singer turns in her best performance to date, despite one or two outright imitations of Pearl Bailey.

If Miss Reese would only come home and forget about *Bill Bailey,* she would be much better off. Fortunately, she proves to be part way there on such tunes as *I'm Always Chasing Rainbows, Three O'Clock In The Morning,* and *Have You Ever Been Lonely?*

Curtis Amy and Paul Bryant: Meetin' Here

Pacific Jazz Stereo 26

The combination of tenor and organ is a tricky one that fails to come off more often than not. The first meeting between Curtis Amy and Paul Bryant was highly successful, and the second turns out to be among the best in its class. Bryant plays organ in full-throated fashion, putting down a thick blues carpet for Amy to walk on, and the heady mixture is a pure stereo delight. Ray Brewster, who works regularly with the quintet in Los Angeles, also appears in the studio this time and proves to be a healthy, shouting trombonist in the early style of J. C. Higginbotham. Amy contributes two fine blues line in *Early In The Morning,* and *One More Hamhock Please.* The album takes its title from a new gospel-tinged adaptation of the spiritual *This Train,* and the quintet really moves along the tracks.

Miles Davis: In Person At The Black Hawk, San Francisco

Columbia Stereo C2S820

Prospective investors have a choice of taking a plunger on this two-record set, or separate volumes devoted to either Friday or Saturday of the successive nights that Miles Davis performed for the tape machines at The Black Hawk can be purchased one at a time. There will be little hesitation among Davis fans about acquiring every historic moment of the first recordings their hero has made in a club, even though most of the selections appear on releases by earlier editions of the Quintet. Less avid buyers of single volumes will find information about the condition of the carpeting at the San Francisco emporium on the liner, but a thorough reading reveals only the names of Davis and Wynton Kelly from the Quintet. Hank Mobley, tenor sax, Paul Chambers, bass, and drummer Jimmy Cobb were also on hand. However, the engineers make up for the omission by overrecording the piano and underrecording the leader's trumpet to the point where it sounds like a busy peanut whistle. Mobley walks away from the affair in best shape, and his development since coming into the Quintet is worth noting. Davis presents his latest thinking on such subjects as *Walkin', Oleo, So What,* and *Bye Bye Blackbird.*

Dick Schory: Stereo Action Goes Broadway

RCA Victor Stereo LSA2382

All the electronic gadgetry developed to put movement in stereo spectaculars still works better when a good auditorium helps out, and Chicago's Orchestra Hall is one reason why so many Dick Schory productions lap the field. Not only is it possible to follow the short, quick flash of castanets with the accuracy attained in a good studio, but larger ponderous effects sound completely natural without being fed through an echo chamber. There is ample room in depth and breadth for all the dramatic action outlined in the scores of the dozen Broadway hit tunes picked for Schory's latest percussion and brass extravaganza.

The spotlight shifts from finger cymbals to a huge thunder sheet as a tropical storm dampens *Heat Wave,* and the proprietor's shoes squeak all the way to the peephole at *Hernando's Hideaway.* The parade stretches the length of the hall during *Seventy-Six Trombones,* and wind chimes join the waves washing on the shore on *Bali Ha'i.* Herald trumpets sound as King Arthur rides forth on *Camelot,* and a full-scale barn dance comes to life on *Keep-A-Hoppin'.* Bob Simpson engineered the date, and Richard B. Gardner sorted out the channels to make the master tape.

Salli Terri: I Know My Love

Capitol Stereo SP8556

Ed McCurdy: A Treasure Chest Of American Folk Song

Elektra Stereo EKS205

These programs offer a brief respite from the trios and quartets of yeasty young stal-

warts who seem to appear on every other folk recording of late. Salli Terri's seventh album finds her attention turning to "songs of love portraying the joys and sorrows of the heart," and once again the inimitable Laurindo Almeida assists, with guitar and lute, on the title tune, *I'm Sad And I'm Lonely*, and *I Know My Love*. Just for variety's sake, other accompanying players appear at stated intervals, including Gloria Ramsey and Shirley Marcus on recorders, Jimmie Haskell on accordion, and Gwendolyn Koldowsky at the piano. Miss Terri manages equally well when singing alone, and two of the choicest moments are the plaintive *Old Maid's Song*, and a joyously affirmative *I Know Where I'm Going*.

Ed McCurdy embarks on a two-record survey of the development of American folk music from its beginning among the early colonists to the present day, and the whole set is being retailed at the bargain price of one LP. The thirty-four songs were edited by Lee Haring, who allots one side each to New England, the South, the Westward trek, and a final grabbag of occupational ditties. Erik Darling is the indefatigable accompanist, and many of the titles are comparatively rare. McCurdy works best when revisiting his own Oklahoma territory, and his two-fisted vocalizing presents a sharp contrast to some highly-touted crooners of cowboy songs. Mike Scott engineered the numerous sessions held at the Judson Memorial Church, that haven for embattled folk singers on Washington Square.

Perez Prado: La Chunga
RCA Victor Stereo LSP2379

George Shearing: Mood Latino
Capitol Stereo 1567

New steps always receive a ready response from Latin dance enthusiasts, and the latest to be reported is one called *La Chunga*. Perez Prado developed it, with an assist from the Arthur Murrays, from a game he played as a child in Cuba. Before youngsters in the United States started building model airplanes and launching rockets, they engaged in a similar sport, known in some sections as caddy, and it involved a paddle and small pointed stick salvaged from discarded one-inch lumber stock. The paddle was used to flip the caddy in the air and strike it before it returned to the ground. Scores were tallied by measuring the number of paddle lengths the caddy traveled. Inspired by the rhythmic footwork required in the continuous chopping and swinging motion, the bandleader devised steps to fit both slow and fast tempos, along with a dozen tunes designed to get another dance craze underway. Beginners will find diagrams and a broad stereo platform to work out on, and the Murray dance studios are promoting the album coast to coast.

George Shearing affords dancers the chance to relax between bouts with new steps on his fourth Latin album for Capitol. And those disinclined to cope even with cha-chas, mambos and boleros will find pleasant listening in the pianist's adaptations of such familiar tunes as *Blue Moon*, *Yesterday's Child*, and *You And The Night And The Music*. Armando Peraza fills out the stereo stage with the rhythmic pulse of bongos and congas, and the liquid sound of a flute helps the augmented Quintet create a sultry mood.

Lena Horne: Lena At The Sands
RCA Victor Stereo LSP2364

Las Vegas shows are more noted for brassy humor and unbridled enthusiasm than urbanity of manner, and the usual Sands Hotel production is just as unsophisticated as the rest. Money apparently reaches the gaming tables faster in an atmosphere of hilarious, high spirits. By these standards, Lena Horne must be one of the town's most expensive attractions, regardless of the contracted size of her salary. Her song stylings continue to be as suave and subtle when cast before throngs hopeful of fortune's smile as for patrons of the Waldorf-Astoria, the scene of her previous in person album. Customers able to leave her sexy, velvet-throated purr

for the click of dice in action must be very few.

As always, Miss Horne selects songs with lyrics that are intelligent and require attentive listening. Among the worldly specialities which only she seems to do so well are *Out Of My Continental Mind, Don't Commit The Crime,* and *You Don't Know The Language.* Medleys assigned in turn to the songs of Rodgers and Hammerstein, Jule Styne and E. Y. Harburg adequately cover the more mundane side of show business. Spouse Lennie Hayton conducts Anthony Morelli's Sands Hotel orchestra, and the wide, open spaces of stereo do nothing to detract from his wife's intimate style.

Oscar Peterson: A Jazz Portrait Of Frank Sinatra

Verve VSTC255 (4-track stereo tape)

The idea of presenting a piano portrait of a singer is an exceptionally fertile one, and other keyboard artists would be wise to follow the trail Oscar Peterson blazes here. So many piano albums have paid tribute to one composer or another that a change of pace is welcome, at least until the market is flooded with similar efforts. Actually the danger is slight, as the number of good jazz vocalists nowhere near approaches the supply of excellent pianists. Still, the attempt to emulate Perry Como's airy, relaxed manner should test the reserves of any pianist.

The admiration Peterson holds for Frank Sinatra is undoubtedly reciprocated in kind, as both men swing with the same rhythmic pulse and melodic ease. The pianist recreates the Sinatra format and style expertly, bringing each tune to a stirring climax. Ray Brown is an equal partner in the proceedings, and Ed Thigpen drums with taste and discretion. Anyone who still feels Peterson lacks the ability to swing should sample *It Happened In Monterey,* then follow with *Saturday Night, Witchcraft,* and *Just In Time.*

Some stereo listeners may question the wisdom of confining Brown's bass to one channel, but should have little trouble in adjusting the controls to strike a suitable balance.

MONO

Ann Charters: Essay In Ragtime

Folkways FG 3563

Unpublished copies of some of the finest ragtime compositions are extremely rare, and every ragtime enthusiast knows that recordings of the majority of the music are simply nonexistent. The Missouri Historical Society was recently forced to borrow Knocky Parker's copy of *Treemonisha,* the Scott Joplin ragtime opera, so it could be photostated and preserved in the music collection archives. Any attempt to restore this vast literature to circulation is to be applauded, and Ann Characters uncovers several titles that were never recorded before. As the wife of Sam Charters, set went along on visits to the home of the late Joseph Lamb and helped encourage the ragtime composer to record his work for Folkways. She learned much about the classic style of playing from Lamb and other pianists, and her own solo efforts sound as though she had never heard a jazz pianist. Her insistence upon keeping jazz and ragtime separate is in sharp contrast to the recordings of Roberts, Wally Rose, Ralph Sutton and other contemporary players. Most present day audiences demand a jazz touch and prefer the jazziest rags.

If Mrs. Charters appears pedantic in comparison, her program does include the type of piece none of her peers has ventured to record. Williard Bryant's *Echos From The Snowball Club,* a stately and delicate waltz. is reason enough to recommend this LP to all ragtime collectors. Other novelties are Artie Matthews' *Pastime Rag No. 3,* James Scott's *Rag Sentimental,* and Joplin's *Wall Street Rag.*

Steamin' With The Miles Davis Quintet

Prestige 7200

All good things must come to an end, and this collection turns the last page on the legendary Miles Davis quintet sessions of 1956. The three previous releases from the same marathon performance should be in every jazz library, and this final album deserves a place right alongside. The program is varied and evenly balanced, with all the selections coming from the quintet's top drawer. Davis muses absorbedly once again in wistful ballad style on *Something I Dreamed Last Night,* and *When I Fall In Love.* The rhythm section of Red Garland, Paul Chambers and Philly Joe Jones upholds its reputation on *Salt Peanuts,* and *Well You Needn't.* And John Coltrane's surging tenor sax jousts nobly with the leader's melodic trumpet statements on *Diane,* and *Surrey With The Fringe On Top.*

The sessions kept Rudy Van Gelder's studios busy for two days, and the sound is still pleasantly undated.

Lightnin' Hopkins and Sonny Terry: Last Night Blues

Prestige/Bluesville 1029

Since Lightnin' Hopkins arrived on LP a year or so ago. the number of releases bearing his name has steadily mounted. Only the team of Brownie McGhee and Sonny Terry seems to appear on the lists more often, but their names have been before the public a lot longer. Borrowing Terry's spirited harmonica obbligatos to season Hopkins' second Bluesville effort was a splendid idea, and the extra bit of spice makes this one of the tastiest blues packages yet assembled. Now that the rediscovered Hopkins leaves Houston to travel the folk music circuit, more chances to record with some of his peers will probably arise. This is one of the first, and the Texas guitarist soon finds a common ground with the blind harmonica player from North Carolina on a headlong instrumental called *Lightnin's Stroke.*

The alliance is less close than the one Terry enjoys with his regular partner, and

he joins Hopkins vocally only once for a revealing exchange of autobiographical confidences on an improvised *Conversation Blues*. But his wailing harmonica phrases and wordless whoops and hollers clearly express the language of the blues during the rest of the meeting. They act as a constant spur to Hopkins, who delivers a humorously descriptive account of a trip to Arizona when a youth on *Rocky Mountain Blues*. Leonard Gaskin, bass, and drummer Belton Evans help out, as does Rudy Van Gelder's fine recording.

Sarah Vaughan: After Hours
Roulette R52070

Kitty White: Intimate
World-Pacific WP1406

Hearing these two professionals operate with scant supporting forces only makes the boldness of young lady folk singers who start out to carve a career, guitar in hand, seem more remarkable. The assignment requires all the craft the veterans can muster, yet a good deal of effort is undoubtedly expended in attaining the fresh simplicity which the talented amateur comes by naturally. Sarah Vaughan may never get around to doing a program of folk songs, but her current LP gives a fair idea of what will happen if she tries one. Her able companions are George Duvivier on bass and Mundell Lowe on guitar, and she fully enjoys the freedom from cloying strings and pop backgrounds. Appearing to sing with artless ease, she drifts leisurely through *My Favorite Things, Easy To Love,* and *In A Sentimental Mood*. But anyone naive enough to believe it is all done with mirrors will be brought up short with *Sophisticated Lady*.

Kitty White attended a party in the apartment of harpist Corky Hale and stayed to sing along with her host as sole accompanist. One of the assembled guests was Richard Bock, who invited everyone to return the following week for the repeat performance just released. Bud Shank accepted an invitation to match the harp glissandos with flute obbligatos, and the threesome is certain to be a welcome addition to any similar gathering. Miss White gives sensitive readings of *Glad To Be Unhappy, My Ship, Yesterdays,* and satisfies the folk element on *Black Is The Color*. Æ

AUDIOCLINIC

(*from page 4*)

d.c., and thus acts only to short out the a.c. portion of the signal. An electrolytic capacitor should *not* be used for this test application.) Note if the noise continues each time the short is made. You will eventually come to a stage where the noise will reappear. Because you are working backward through the unit under test, each grid will short out the noise until you come to the grid of the stage ahead of the stage which is producing the noise. This stage is not the one to work on unless the difficulty is in either the plate or the cathode circuit of that stage. Once the defective stage has been located, first check the tubes. Then make routine checks of all other components, especially interstage coupling capacitors. Check the wiring of all cables to make sure that there are no loose connections. Make certain that the shells of all EIA connectors are firmly contacting the ground terminals of the connectors.

The fact that one ground lead was moved to a new position is not significant to the problem *unless the connections to this lead are poor.* Æ

AUDIO ETC

(*from page 60*)

ments—two functions, one using the meter to indicate in-phase and out-of-phase signals to your two speakers, the other centering the meter needle to indicate proper signal balance. The thing connects into the speaker lines, a pair of wires to each stereo channel. That's all there is to it.

Now I'll admit that though I am aware of the very great importance of proper phasing, there are times when I just can't tell which is wrong and which is right. We've been through this before. If you listen too long, try too hard, sample too many records, talk too loud, drink too much, you lose your discrimination; you're just too tired to concentrate. And if your room is not of the ideal sort for stereo, you may have disturbing reflections or standing waves that confuse the phase effect—though not the undesirable "hole-in-the-middle" which comes with wrong phasing.

Yes, you can check phasing in numerous ways, including that trick of placing two (bookshelf) speakers together face to face—if the sound is out of phase, the cones move in tandem, swallowing each other's bass; when phasing is right, the bass is pumped out the crack between the two. You can check best with a mono signal, in any case, and by whatever method, and a speaking solo voice is one of the easiest sounds to phase. . . .

Even so, as I quickly found out, it *is* good to have a quick, definite, unchallengable phase indicator, for an instant reading without effort. That's the clincher in Stereosonics PH-1 and it's a good clincher. If the meter reads wrong, it is because you've hooked it up wrong. There can't be any other reason. It doesn't get tired and it is entirely unaffected by room acoustics.

The general principle is simple. The meter samples voltages from both tracks. When they are in phase they add together. When they are out, they subtract. The meter needle deflects from the center position, to the right for in-phase signals, to the left for out-of-phase. More volume gives more deflection. You turn up your speakers fairly high for a positive reading.

For balance, you flip a switch and the meter centers for signals of equal strength, deflects to right or left when one or the other signal is stronger. For mono signals the position stays put; in stereo, there is some fluctuation according to the changing dynamics of stereo balance, but the indicated "average" is easily noted—and to be sure you can always switch to mono "A+B" at your amplifier control. Either way, the phase and balance indications are easily and immediately determined by a glance of the eye—more easily than by ear. The two together, eye and ear, make both balance and phasing a matter of no argument at all. If you are in balance you know it instantly and continuously. (Except for one condition that I noticed, when speakers of different efficiency are hooked up. Then the meter will show a balance when in terms of actual sound the more efficient speaker is noticeably louder. More fool you and me for using unlike speakers in our stereo.)

Similarly, phasing between the two speakers is smooth and positive in mono, fluctuating, to greater or lesser degrees, in stereo. Occasionally the needle will swing all the way over into the out-of-phase quadrant for a brief moment even when the recording is properly phased. But this merly reflects the actual sound-situation, and, by the very nature of stereo sound, it will clearly indicate a majority of in-phase relationships when the reproduced material itself is properly phased. The needle keeps to the right. When it swings steadily leftwards in its fluctuations, you're out of phase, and no two ways about it.

The Stereosonics people sent me a short list of commercial LP recordings which have been found to be out of phase, or partly out of phase—one record switches over halfway through, evidently when the engineer caught himself. I won't print this fascinating list right now because I haven't tried the records out myself and would not want to blame them by name second hand. But I'll bet you'll be able to find a few on your own if you acquire this handy gadget.

The Stereosonics Phase Coordinator is small and light, only 9-in. by 4-in. by 3-in., with a 1½-in. meter. It costs a lot more than a buck, but for keen ears and analytical minds it can be well worth its price in peace of mind. Decidedly recommended—if you care. **Æ**

NEW LITERATURE

• **Circular Slide Rule.** General Industrial Company makes available a handy circular slide rule for engineers and for other plant and office executives. Any executive who must perform simple calculations will find this convenient pocket-size calculator extremely useful in his work. Operation of the rule is simple and the results are relatively accurate. The slide rule is offered free to readers who are engineers or other business executives. Write on business letterhead to General Industrial Company, 1788 J Montrose Avenue, Chicago 13, Illinois. (Mention the name of this magazine.) **L-1**

• **Speaker Catalog.** For the first time Acoustic Research makes available a speaker catalog which lists its entire line of speaker systems and accessories. This eight-page brochure not only lists speaker systems, but it provides prices and some technical specification. In addition it describes the Acoustic Research speaker rental plan. Acoustic Research, Inc., 24 Thorndike Street, Cambridge 41, Mass. **L-2**

• **European Connector Catalog.** Rye Sound Corp. announces a 62-page illustrated catalog on Hirschmann plugs, connectors, sockets, and terminals that are standard equipment on such well known European brands as Grundiz, Braun, Uher, Korting, Harting, Nordmende, Blaupunkt, Lowe, Telefunken, Siemens, Norelco, and many others. A cross-reference sheet is also included for the most popular types. Rye Sound Corp., 145 Elm Street, Mamaroneck, New York. **L-3**

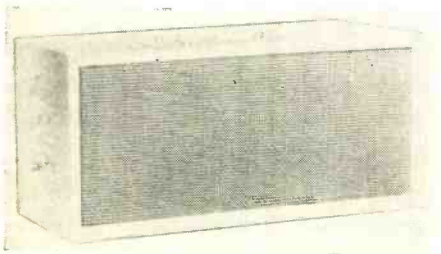
• **Electronics Reference Catalog.** A key reference work in the electronics, radio, television industry is being offered by G. C. Electronics Company. That firm and its various divisions is now offering a 400-page illustrated catalog, No. FR-62, which fully details and describes the thousands of products currently being manufactured and sold under the G. C. banner. The catalog is free. G. C. Electronics Company (Division of Textron Electronics, Inc.), 400 South Wyman Street, Rockford, Illinois. **L-4**

• **Interconnecting Cords Reference Guide.** A reference guide to aid distributors, dealers and customers in the selection of the proper Switchcraft "Mini-Mix" 2-input microphone mixer; "Mix-Amp" transistorized mixer; and interconnecting cords for all types of tape recorders. The reference guide lists all of the American made tape recorders, and appropriate "Mini-Mix" and "Mix-Amp" and interconnecting cords that can be used with a particular tape machine. The guide is available in standard reference page size (8½-in. × 11-in.) and/or as a large wall chart from Switchcraft, Inc., 5555 N. Elston Avenue, Chicago 30, Illinois. **L-5**

• **Wire, Cable, and Tubing Stock Products.** A new 52-page catalog giving complete details on the more than 6000 electronic wire, cable, and tubing stock products, has been announced by the Alpha Wire Corporation. The catalog is completely indexed alphabetically, numerically, and by Government and industrial specification. It also has an "E-Z" index chart with which any catalog item may be located by number of conductors, wire size, and whether it is shielded or unshielded. Alpha Wire's line of 6000 electronic wire, cable and tubing products fills the needs of the electronics, communications, and allied industries as well as of radio and television service men, and hi-fi enthusiasts. It includes military hook-up wire, a complete line of Teflon wire, and magnet wire; multi-conductor cables, communication and intercom cables, power cords, tubing, lacing cord, and a complete television line. This new catalog No. 62, is available from Alpha Wire Corporation, 200 Varick Street, New York 14, New York. **L-6**

NEW PRODUCTS

● **Economy Speaker System.** A well-known manufacturer of high-fidelity equipment enclosures and speaker enclosures for thirteen years, Cabinart now introduces an extended range speaker system for an exceedingly low price. The Mark I speaker system sells for $15.00 and features an 8-in. domestically manufactured loudspeaker with a high efficiency magnetic circuit. Characterized as ideal for medium- and low-level monophonic or stereophonic reproduction, the speaker has a 1-in. voice coil with an 8-ohm impedance. The new-type magnet weighs 3.16 oz. and the response of the speaker is 45 cps to 13,000



cps. Cabinet is made of an extremely dense wood product, ¾-in. thick throughout. It is solidly glued and sanded ready to finish. The speaker is loaded acoustically, which improves the bass reproduction efficiency. Also available at only $22.50 is the Mark II system which features a 12-in. coaxial speaker with a 6.3 oz. Alnico V magnet and a 1-in. voice coil. The Mark II utilizes a specially designed 3-in. Alnico V tweeter. Speaker response is 40 cps to 15,000 cps. A high-pass filter is built in. The cabinet for the Mark II is similar in construction to the cabinet for the Mark I. Cabinart Acoustical Engineering Corp., 35 Geyer Street, Haledon, N. J. **L-7**

● **Stainless Steel Tape Recorder.** American Concertone, Inc. has just introduced the latest addition to its line of tape recorders designated as the Model S505. The Model S505, in stainless steel, is highlighted by the inclusion of black knobs, meters, and hardware. It is available in a large assortment of configurations—from a 2-track recorder to the "Reverse-

O-Matic," a feature which will play tapes from start to finish, reverse automatically and play the other stereo tracks. For further information write American Concertone, Inc., 9449 West Jefferson Boulevard, Culver City, California. **L-8**

● **50-Watt Solid State Amplifier.** Scheduled for its first appearance on the market in the very near future will be Altec's Model 351A 50-watt solid state power amplifier for mono, stereo, third channel or hi-fi music distribution use. The new compact transistorized electronic package has the advantage of smaller size, lighter weight, less power consumption, and less heat generation than any vacuum tube counterpart. It provides 8- and 16-ohm speaker connections, plus an isolated 70-volt line output for distributing sound to

distant speakers. The new amplifier unit achieves the rated power over the entire audio band at extremely low distortion. Common power transistors are known to become inefficient in the upper audio range, however, the 351A incorporates a premium grade high frequency transistor, known as the "diffused-alloy transistor" to achieve its excellent high frequency performance. Specifications: gain is 66.5 db using 15095 line transformer; input sensitivity is .45 v rms; power output is 50 watts music power, 40 watts at less than 1.5 per cent T.H.D. 25 cps to 10,000 cps; frequency response is ±1 db from 20 cps to 20,000 cps: load impedance is 4, 8, 16 and 125 ohms (125 ohms is 70 v line); noise level is 90 db below full output; power supply is 105/128v, 50/60 cps, 55 watts (6 w zero signal, 55 w ⅛ output, 80 w maximum output); transistors used are 1–2N381, 1–2N377, 1–2834, 6–B1272; ambient temperature range is −5 deg. F to +120 deg. F. Price is $215.00 including cabinet. Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif. **L-9**

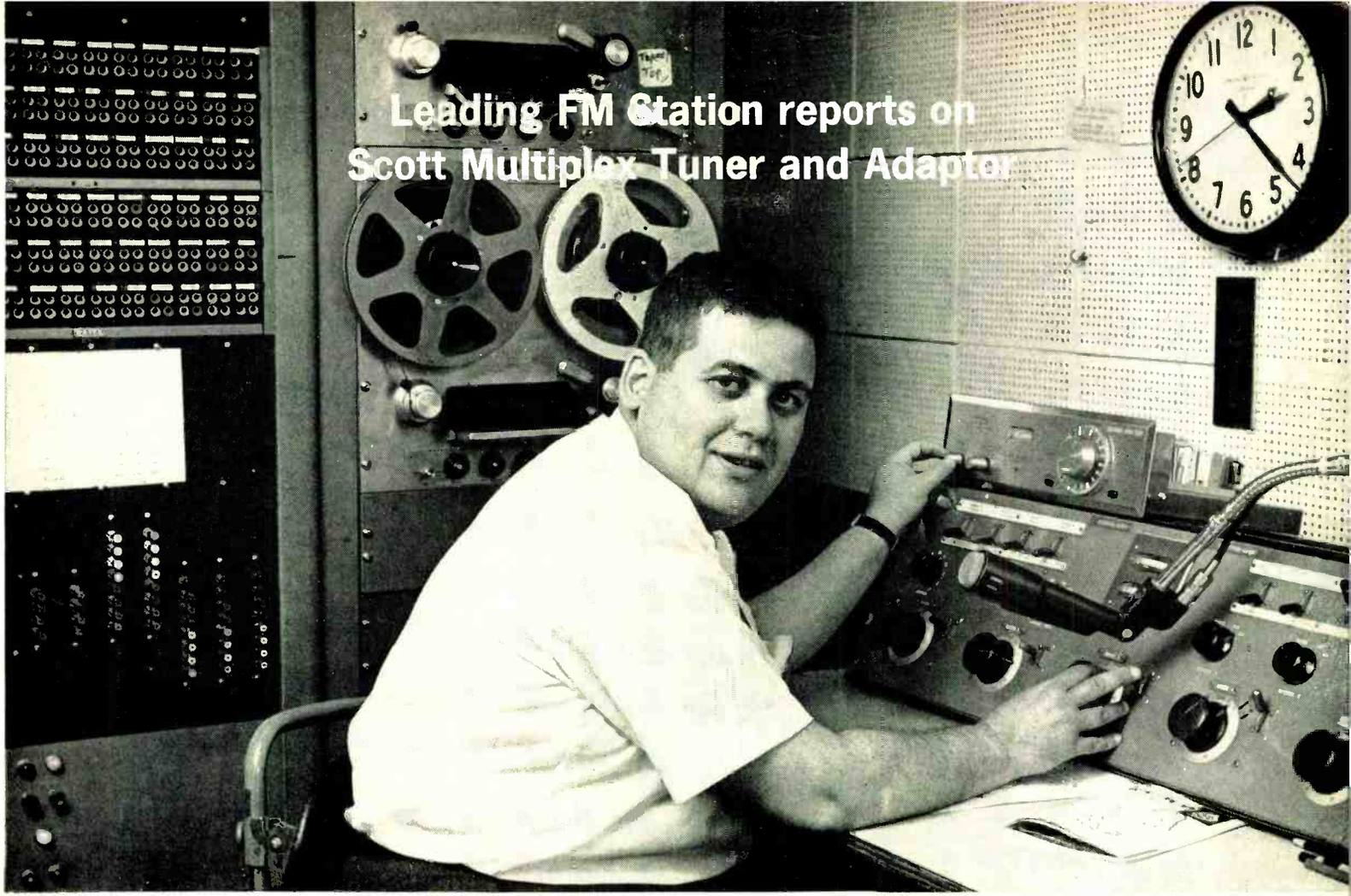
● **Compressor-Amplifier.** A Compressor-Amplifier which permits compression of dialogue or music tracks without introducing detrimental distortion to the program has been developed by Magna-Tech Electronics Co., Inc. Designated as the Model 31, it incorporates a solid state variable gain device and a two-stage push-pull audio amplifier on one chassis. Contrary to the classical compressor or limiter design, the Model 31, does not require balancing. Absolute stability of the solid state variable gain stage eliminates the necessity for "Balance Controls." The unit was designed specifically for use in

stationary installations so that the power supply, meter, and attenuators of an existing console can be employed for the Compressor. A 16-pin connector provides convenient plug-in connection of power, input and output, and meter. The compression ratio is 20:10. In lieu of separate input and output attenuators, an optional accessory, a ganged dual attenuator providing single knob control of input and output levels can be used. It permits an increase in the input level of 2-db per step and simultaneously, a decrease in the output level of 1-db per step. The Model 31 features de-essing equalization from 0 to 10 db at 10,000 cps variable release time from 50 milliseconds to 1 second, and an attack time of less than 1 millisecond. Input and output impedance is 600 ohms; input level is from +2 to +18 dbm; maximum output level is +22 dbm. The gain is adjustable from 12 db to 32 db. Frequency response is 40 to 15,000 cps, ± ½ db. The harmonic distortion at an output level of +22 dbm and with maximum compression is well below 0.5 per cent; the signal-to-noise ratio without compression is 72 db below +22dbm output level; power requirements are 12.6 v d.c. at 0.5 amp and 275 v d.c. at 22 ma. Price for the Model 31 Compressor-Amplifier is $650.00. Magna-Tech Electronic Co., Inc., 630 Ninth Avenue, New York 36, N. Y. **L-10**

● **FM-Stereo Adapter and Systems.** Aptly named the Magic Module, the patent pending stereo system by Karg Laboratories is simple in concept yet bold in approach. Using only six connections, it accepts the composite stereo signal from the station and sends left and right signals on their divergent ways through the amplifiers and speakers. The sidebands denoting the difference between Channel A and Channel B are carefully preserved to retain maximum stereo effect. Basic quality FM reception through Karg's tuners coupled with the Magic Module yields fine stereo reception to accomodate the new era of stereo sound. Karg engineers have redesigned all their tuners to include the

Magic Module as a basic component. The list of Karg FM equipment now includes: A self-powered multiplex adapter (shown), the MX-3, at $79.50; a stereo FM tuner, the SCT-4, at $139.50; the stereo Tunematic, 12 channel crystal controlled tuner, the SXT-1A, listed at $274.50; and the professional model Tunematic, the SXT-3A, 12 channel crystal controlled tuner, priced at $370.00. Both models of the Tunematic are available with remote control, the Mark II, at the additional cost of $29.50. Purchasers of the Karg CT-2 variable tuner before the introduction of stereo can buy the MX-2 plug-in adapter at $44.50. Karg Laboratories, Inc., 162 Ely Ave., South Norwalk, Conn. **L-11**

● **Sensing Tape.** A new conductive sensing tape, for use with recorders having electronic sensing controls, has been announced by Minnesota Mining and Manufacturing Company. The new product,



Richard L. Kaye, Station Manager of WCRB, using Scott Multiplex Tuner for station monitoring.

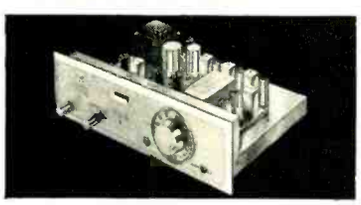
"...Outstanding stereo reception...Scott surpassed our greatest expectations..."

FM Station WCRB, Boston's leading good music station, has been broadcasting in multiplex for several months. During this period they have had the opportunity to evaluate many multiplex tuners and adaptors. Here's what they say:

"This letter is to let you know how pleased all of us at WCRB are with the H. H. Scott Multiplex Adaptor Model 335 and the H. H. Scott Multiplex Tuner Model 350. The Scott multiplex tuner and adaptor have surpassed our greatest expectations. They give outstanding stereo reception. The stereo separation, frequency response and low distortion have proven outstanding."

Richard L. Kaye
Station Manager

Many leading FM stations have chosen Scott for use in their monitoring and testing facilities. If you, too, want the finest multiplex equipment . . . choose H. H. Scott.



350 FM Stereo (Multiplex) Tuner Scott's widely acclaimed 350 FM Stereo Tuner has the multiplex circuitry built right in. You can use it to receive either FM stereo or regular monophonic FM broadcasts. Scott's Wide Band design and unique silver-plated front end assure fine reception without distortion, drift, noise or loss of stereo separation. IHFM sensitivity is 2.5 μv and stereo separation can match exacting FCC transmission specifications. Exclusive filtering circuits on the 350 and all Scott multiplex units permit flawless results when used with any tape recorder. **$199.95***

335 FM Stereo (Multiplex) Adaptor You can instantly convert any Scott tuner, regardless of age or model, to multiplex with the 335 FM Stereo Adaptor. The combination of the 335 and your Scott tuner offers the same flexibility and tape recording features as the 350 FM Stereo Tuner. Optimum performance can be guaranteed only when a Scott tuner and the 335 are used together. **$99.95**

Here's What Happy Owners Say:

"Multiplex comes in beautifully with 350 Tuner. I've heard stereo before, but never like this."
Kazunori Yonekura, Castro Valley, California

"I am 50 miles from transmitter and get perfect reception with just my TV antenna. I had (competing brand) multiplex but it didn't work."
John Flower, Concord, California

". . . Here in Newburgh I am 100 miles from WGFM. I receive them every evening from 8 to 9 PM. . . . My hi-fi equipment is all H. H. Scott. My 310C tuner is 21 months old and has had no maintenance . . . not even tube replacement. My 272 Amplifier and 335 Multiplex Adaptor have been trouble-free. Your quality control must be nearly perfect. In my opinion you offer the finest hi-fi components than can be purchased."
Walter L. Bachman, Newburgh, New York

"Finest separation I ever heard."
Daniel M. Wolfe, Jr., San Francisco, California

"All other equipment is H. H. Scott. Reception 40 miles from station is very good."
W. A. Moss, Mountain View, California

"KPEN stereo terrific on Command Records — perfect channel separation."
L. V. Steele, Belmont, California

H.H.SCOTT

H. H. SCOTT INC., DEPT. 035-11.
111 Powdermill Rd., Maynard, Mass.

Rush me your new Guide to Custom Stereo and complete information on Scott FM stereo tuners and adaptors.

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Address.....

City.....State.....

Export: Morhan Exporting Corp., 458 Broadway, N.Y.C.
Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto
*Prices slightly higher West of Rockies

named "Scotch" brand sensing tape No. 51 is a thin, flexible conductive foil, which is coated with a special pressure-sensitive adhesive for easy application to magnetic tapes. The sensing tape, which has a high current carrying capacity and low resistance, is perfectly suited to operate sensing controls which are incorporated in a number of recorder models. The controls activate relays which can start and stop recorders, reverse tape, or operate auxiliary equipment. It is available in two widths: 7/32-in. for use on standard ¼-in. tapes, and ½-in. for special applications. It can be applied half-width on tapes requiring sensing placement on upper or lower track areas only. The tape has an easily-removed adhesive liner, which keeps the adhesive fresh and clean in storage and simplifies application. The roll for home users is 150 inches long and is packed on a special container card, which is equipped with cutter edge and application guide. Larger 66-foot-long commercial rolls come in individual plastic boxes. Minnesota Mining and Manufacturing Co., 900 Bush Avenue, St. Paul 6, Minnesota. **L-12**

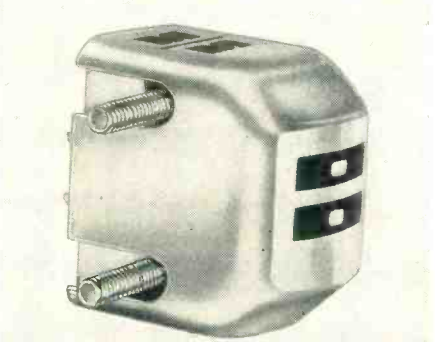
● **Public Address Amplifier.** Introduction of the new Eric 7061 Pageboy amplifier solves the problem of "good-public address

--poor music" or "good music--poor public address" sound reproduction. The new system utilizes high-fidelity circuitry throughout with full range controls to produce fine music reproduction with a 20–20,000 cps range. A separate mike input for paging provides clean, clear paging The Eric 7061 features a low silhouette case which also protects the unit from dust, dirt, and abuse. The Eric Pageboy has two separate microphone inputs, with independent volume controls and provision for mixing either one or both mikes with phono input or tuner. A monitor output is also provided to feed an external amplifier. Rated output is 17 watts, 34 watts peak; microphone gain, 120 db; phono, 85 db; hum and noise level, 65 db below rated output; output impedances, 4–8–16–500 ohm (70 volt line); dimensions are 14⅛-in. × 4¾-in. × 8¼-in. excluding knobs; weight is 14 lb. Price is $69.95, the case is optional. Eric Electronics Corp., 1823 Colorado Ave., Santa Monica, Calif. **L-13**

● **R.F. Signal Generator.** Lafayette Radio Electronics Corporation has announced a new line of low cost wired test instruments. The newest in the line, the TE-20 r.f. signal generator sells for only $27.95. It is completely factory wired and calibrated. Stable wide-range design makes it ideal for i.f.-r.f. alignment, audio signal tracing, TV linearity checks, and so forth. Features include: a 4½-in. etched steel circular dial (vernier tuned) for accurate frequency adjustments: fundamental frequency output is 120,000 cps to 130 Mc in

6 bands plus a calibrated harmonic band of 130 to 260 Mc; built in 400 cps audio oscillator with adjustable output to 8 volts; continuously variable r.f. attenuator and "high-low" r.f. outputs for added flexibility. Frequency accuracy is plus or minus 5 per cent. Power requirements 105–105 v a.c., 50 cps, 112 watts. It is housed in an attractive wrinkle steel case with leather carrying handle and comes complete with instructions and test leads. Lafayette Radio Electronics Corp., 165-08 Liberty Ave., Jamaica 33, N. Y. **L-14**

● **Tapered Head for Cartridge Tape Players.** Michigan Magnetics, Inc., has announced the introduction of a new 4-track stereo record and playback head specially designed for use in tape cartridge machines. The new 5QT17 head has a tapered

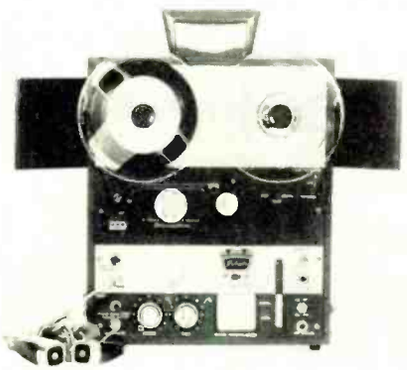


profile which permits smooth insertion of cartridge tape. The taper eliminates corners which often catch the tape and interfere with insertion. Specifications for the new "QT" head are identical to those for the 5Q17. Michigan Magnetics, Inc., Vermontville, Michigan. **L-15**

• **New Record Changer.** Glasers-Steers Company is introducing a new changer, the GS-77T which lists for $59.50, less cartridge and base. This stereo-mono model features an 11-inch professional-type turntable to provide maximum support for records and greater flywheel effectiveness for smooth constant speed. The new GS-77T also features "turntable pause" which eliminates the grinding action which takes place when the records are dropped on a moving turntable or disk. In the GS-77T, the turntable pauses during the change cycle; resumes action only after the next record has come into play position and the stylus is in the lead-in groove of the record. The GS-77T offers

unusual styling. The changer and turntable mat are white with brushed gold trim—and form an attractive contrast when set upon the new walnut base. Other features are: 4-pole hum-shielded motor with balanced rotor; a quick-change cartridge holder which accommodates all leading cartridges; automatic and manual 4-speed operation; double-channel muting switch and RC network; damped, acoustically isolated tone arm; sturdy, die-cast, one piece aluminum tone arm; easily accessible vernier stylus pressure adjustment; provision for 2, 3, or 4 terminal stereo or mono cartridges; and each channel has its own shielded 2-conductor audio cable to avoid hum pickup. Glaser-Steers Company, 155 Oraton St., Newark 4, N. J. **L-16**

• **Stereo Tape Recorder.** The new Roberts 1040 stereo tape recorder is a professional type stereo tape recorder with a "popular" price tag. The 1040 contains features such as the ability to record FM stereo; 4-track stereo and mono record/play; 2-track stereo and mono play; sound-with-sound using either track as a basic track; dual self-contained power stereo amplifiers and dual built-in extended range stereo speakers. Other 1040 features include dual microphone inputs; dual phone-radio inputs;



dual preamp and external speaker outputs; pushbutton function switches; automatic shutoff; automatic muting on rewind; professional edit lever; professional VU meter with channel switch; professional index counter; and dual concentric volume and tone knobs with clutch controlled balance. Tape speeds are 7½ ips and 3¾ ips—and 15 ips with conversion kit. The $299.50 retail price belies the high quality and versatility of the 1040. Roberts Electronics, Inc., 5920 Bowcroft Street, Los Angeles 16, California. **L-17**

ABOUT MUSIC

HAROLD LAWRENCE*

Profiles In Opera Going

DURING THE COURSE of an operatic season, the public attends performances for nearly as many reasons as there are works in the repertoire. One segment of the audience, found mostly among subscribers, goes out of a sense of civic responsibility, to support 'culture' in the community; another may go to see and be seen—what better setting for a low-cut velvet evening gown or an ankle-length fur coat than the lobbies, staircases, corridors, bars and boxes of the Metropolitan or Covent Garden? The desire to be *au courant* motivates others, who would feel left out of things for not having attended the performances "other people are talking about." Some large corporations maintain season boxes to entertain clients or edify their employees, although the government's crackdown on income tax deductions might reduce the size of this expense-account audience. The first-night audience is in a special category; its activities often place in the shadow those on the stage, as flash bulbs pop, Pinkerton guards protect bejeweled matrons, and press, radio, and television reporters swarm around the celebrities, politicians, and other public figures making what is for many of them their sole operatic expedition of the season.

The sociology of opera-going is a study in itself. More important are the purely operatic factors that bring audiences to the opera house. Obviously, the two primary attractions are the work and the performer. Operatic managers are well aware of the enduring appeal of such stage evergreens as *Bohème, Traviata, Rigoletto, Pagliacci,* and *Carmen.* They know that the public will attend these operas as much for the repertoire as for the stars. The manager of a large and expense-laden opera company therefore regards any work that is off the beaten path as a risky business. Even with enthusiastic reviews, a strong cast, a distinguished conductor, and a modern production, some operas fail to draw a good house. *Wozzeck* is a notable case in point: its box office performance last season at the Metropolitan Opera House was disappointing, and Berg's opera was dropped from the repertoire for the coming season.

Fortunately, a singer of exceptional drawing power can sometimes breathe new life into an obscure or rarely heard opera, although the latter's continued survival may depend entirely on the artist's special interpretatoin. Callas proved this in Cherubini's "Medea." Through her performances at the May Festival in Florence, at La Scala in Milan, at London's Covent Garden, at the Dallas Civic Opera, and on recordings, she succesfully revived one of the most exacting roles in the literature, a role which, in recent years, has been tackled by only one other soprano, Eileen Farrell.

While the score and the singer constitute the basic factors in opera attendance, other inducements should be mentioned, which, at certain times, can be equally decisive. A spanking new production, for example, is bound to stir up lively interest. It gives the public something different to look at, supplies the music critic with material for some fresh copy, and often provides the management with the opportunity to venture beyond the confines of the "safe" repertoire. Large sums of money are invested in these productions, hence the extra efforts at ticket sales, and the special attention given to these productions in program brochures and publicity releases. By itself, however, a new production is hardly the guarantee of a full house. When the premiere of a contemporary work is involved, the public has a way of looking in at the first few performances; but after its curiosity has been satisfied, it rarely returns in force. Most new operas have short lives.

The presence in the pit of a distinguished symphonic conductor can sometimes help to swell the ranks of an opera audience. Such was the case when Leopold Stokowski directed Puccini's "Turandot" at the Metropolitan Opera House last season. Judging from the intensity and duration of the applause as the white-maned maestro ascended the podium, one might have though a star singer was taking a curtain call.

To say that anyone would go to the opera house primarily to see the work of a stage director would seem farfetched. Yet that was precisely the case when the celebrated film director, Ingmar Bergman, took over the job of stage director in a Swedish version of Stravinsky's "Rake's Progress.' More space in the reviews and previews was devoted to Mr. Bergman's participation than to any other facet of the production.

Baroque palace courts, ancient Roman theatres, rocks, gardens and other unorthodox settings have been known to steal the show from the music and the performers. The French government employed the Louvre's Square Court a few years ago to stage Berlioz's "Romeo and Juliet." "A second story window in the Louvre," wrote *Time* (July 11, 1955), "on a level with the top layer of the stage, served as Juliet's balcony and the entrance to the Capulets' palace." In the background was a magnificent Renaissance clock tower; the sculptured façade of the palace was a joy to behold; and, to enhance the already lavish "production," a ballet was inserted during the *Love Music.*

* *26 W. 9th St., New York 11, N. Y.*

Reported *France-Soir* the next day, "The Louvre was the biggest success of all."

In southern France and in Italy, Roman ruins provide more austere but equally popular settings for operatic performances. At Les Baux in Provence, where nature offers a spectacular setting, bulldozers leveled the earth at the base of the massive Val d'Enfer to form a stage with a truly awe-inspiring background. The open-air production is especially well suited to operas dealing with classical or Renaissance subjects. For many years, Gluck's operas were produced at Orange, in a well-preserved Roman amphitheatre.

The French, who are weak on voice but strong on spectacle, sometimes turn the Paris Opéra into a sort of pre-Revolutionary Versailles theatre. Two of the most successful productions staged during the Fifties were Rameau's "Les Indes Galantes" and Weber's "Oberon," hardly what you might call staples of the repertoire. "Oberon" lasted four hours, included three acts, twelve scenes, twenty sets, six hundred costumes, and five hundred participants. There was a "flying ballet" in Act II; and not one but two perfumes, especially prepared to blend with Weber's music, were pumped in and out of the theatre at given points in the score. With all this splendor, who can give much thought to the singing? Which may be what the Opéra's former director, Maurice Lehmann, had in mind.

Apart from the spectacle and the outdoor performance, audiences seldom go to the opera with the sets first and foremost in their minds. This does not mean that they are unconscious of decor. They are most aware of it, in fact, when there is a wide disparity between the brilliant voice of a great singer and the antiquated and lifeless sets and costumes which often surround it. More than any other Wagnerian singer during the past decade, Birgit Nilsson made Metropolitan Opera audiences painfully aware of the fact that designer Teo Otto's sets for "Tristan," which he created in the Twenties, looked as outmoded and forlorn," wrote Howard Taubman in the *New York Times*, "as the flapper brought to life." Æ

THIS MONTH'S COVER

Shown across the top panel is a group of three room settings which were displayed at the New York High Fidelity Show in September. Presented by *LIVING for Young Homemakers*, they were intended to show how high fidelity components could be integrated into three types of decor.

The lower part of the page is a closeup of the room at top left, which was decorated by Manashaw and Daggett, A.I.D. It shows a Harman-Kardon T300X tuner and A500 amplifier, Rek-O-Kut N34H turntable, Norelco Continental 200 tape recorder, and two University RL-8 speaker systems.

The right room at the top was decorated by David Eugene Bell, A.I.D., of Macy's, and the center room—a one-room apartment—was decorated by Ethyl Alper, A.I.D.

Further information about the furnishings can be supplied upon request. All photos were made—originally in color—by F. M. Demarest of New York.

We are indebted to *LIVING for Young Homemakers* for these interesting displays.

LIGHT LISTENING

(*from page 10*)

trumpet stylings of Bobby Hackett in those famous recordings with the Jackie Gleason strings. The stereo placement balances the cornet, violas, and cellos against a body of 34 violins. In this setting, "Doc" Severinsen has more than one chance to put across some of the mellow facets of a technique developed in the ranks of some of the truly great bands. Certainly pointers picked up while working with Tommy Dorsey are hardly a liability when a cornet player is called upon to take the spotlight in a mood album.

Eddie Dunstedter: Where Dreams Come True **Capitol ST 1545**

Surprisingly few organ recordings these days contain a sampling of Hawaiian music. Columbia brought out a pleasant album of this type with Ken Griffin at the console. That was back in '58 and the disc is available only in mono. Those listeners who realize how effective a Hawaiian melody can be when played by a good organist will welcome this stereo disc by Eddie Dunstedter. Capitol's engineers have worked out an intimate, warm sounding pickup that, in a sense, was dictated by the choice of instruments heard with the organ. Since the arrangements call for Hawaiian guitar, subdued drums, vibraphone and marimba, it would have been quite pointless to try to place the listener in the vast acoustical setting of a theatre auditorium. Dunstedter plays a 24-rank, 2000-pipe, Robert Morton theatre organ. He stresses just the right exotic colors in *Beyond the Reef, Wailana (Drowsey Waters)*, and *My Isle of Golden Dreams*. A noteworthy feature of this album is the high signal level achieved with no sign of overcutting. In a further gesture of friendliness to organ fans, Capitol assigned the album notes to the editor of *Posthorn*, a theatre organ magazine.

Eric Vaughn: Wine, Women and Waltzes **Medallion MS 7519**

This month's far-fetched novelty item in the percussion department sets its sights on the Viennese waltz. The title looks innocent enough on the album cover. Until one discovers in the lower print that Eric Vaughn leads Medallion strings and Percussion in this list of favorites in ¾ time. Once that fact sinks in, doubt, if not apprehension, may overcome many collectors browsing in record shops. A reviewer's curiosity, however, is supposed to be made of sterner stuff. Upon applying said stuff to this disc, I find the release a little less disturbing than it appears at first glance. In the first place, the strings definitely establish the tempo and carry the brunt of the work. For the most part, the percussion spotlight is occupied by a snare drummer charged with the task of maintaining the business-like pace. We're given to understand at the outset that any resemblance to a Viennese Waltz orchestra is purely a coincidence. The major concession to the percussian enthusiasts is found in the use of vibraphones, chimes, bells, triangles, and woodblocks whenever arrangers Jack Elliott and Emmanuel Vardi feel that strings alone cannot produce the desired effect.

After considering all the points involved, I still find it hard of figure out exactly what purpose this record is meant to serve. If there are people dancing these days to the strains of Strauss' *Emperor* or Lehar's *Gold and Silver* Waltz, it's reasonable to assume that they might prefer the regular treatment of the music. The stationary listener is a in normal guise. The record may well end up prospect—if he's never heard these waltzes as a conversation piece—among people who don't intend to buy it.

British Bandstand: The Music of Gilbert and Sullivan **Angel S 35788**

Angel has been tapping a new vein of music for band. Some months ago they released a

performance by the Regimental Band of the Scots Guards in selections from Gilbert and Sullivan's "Iolanthe," "The Mikado," and "The Pirates of Penzance." This recording offers another opportunity to kill two birds with one stylus. Here we renew acquaintance with a large parcel of tunes from two more G and S operettas and hear one of the basic military instrumental groups in the United Kingdom. The Band of the Royal Military School of Music, Kneller Hall—an important spawning ground for British bandsmen—tackles this assignment with dignified enthusiasm. Main selling point here is the variety of tunes. Unlike the typical band program consisting of eight or ten marches, this release parades a total of thirty selections within the usual time limit.

Eric Johnson: Broadway in Brass
Westminster WP 6126

In former years the instrumental combination featured here—brasses and piano—would have been considered too bizarre for orchestral presentation of show tunes. In today's market, a record producer is considered hopelessly old hat if he doesn't record a show with a combination such as oboes and bongoes. With only a minor concession to those who insist on keeping abreast of current fads, Westminster offers a good sampling of its latest mono sound in this wide-range and gimmick-free exploration of keyboard and brass.

Highlights from Operettas by Lehar and Millöcker **Epic BC 1117**

These excerpts from Lehar's "Schön Ist Die Welt" and Millöcker's "Die Dubarry" serve as a reminder that the European market is still an active one for Viennese operettas that are barely known over here. In all too many instances, the American record fan finds himself in strange territory once you carry him beyond Lehar's "Merry Widow" and "Count of Luxemburg." It is precisely the region beyond the favorites in the catalog that we find covered in this release. Veteran collectors will recall that the lesser-known Viennese shows had quite a vogue on discs back in the days when the "78" was the only record in general use. Yet even that heyday was limited in scope because it was concerned almost entirely with single import 78's distributed by only a few dealers at prices that were out of the question for most record buyers. Anyone who still recalls that era with fond memories will be among the first to wonder how a present-day Viennese cast performs these two operettas in stereo. The upheavals of the Second World War affected the Viennese stage no less than they did everything else in European society. Some of the pre-war musical magic has been diluted and stereo can do very little to restore it. The soloists and chorus of Radio Vienna try hard to preserve the old tradition. The spirit is there but the pitch and the attack of some of the singers would hardly have endeared them to the conductors of former days. The Lehar work, the more recent of the two, makes attractive use of the tango and the rhumba—rhythms once considered pretty exotic stuff in an operetta score.

Perry Como: Sing To Me, Mr. C.
RCA Victor LSP 2390

No matter how much Como may cultivate the appearance of casualness on camera, anyone familiar with his past recordings will hardly be surprised by the pains that obviously went into this session. The Mitchell Ayres orchestra, the Ray Charles Singers, and guitarist Tony Mattola have all been rehearsed to an audible polish. The sound has the easy liveness generally found in Como's recorded performances. The arrangements by Joe Lipman and Jack Andrews never falter in invention or good taste as Perry offers medleys that cover eighteen all-time favorites. If you listen to this stereo recording at a healthy level, you'll notice a demonstration of modesty that is rather pronounced even by Como standards. At times, the volume of some of the instrumentalists is just about on a par with that of Como's voice. I don't imagine that mention of this will get recording engineer Bob Simpson into any sort of difficulty because Perry undoubtedly checked out the playbacks and found them to be what he wanted. The change is a refreshing one in these days of soloist's prominence. The makeup of this Como program is definitely slanted in favor of Lerner and Loewe, Dick Rodgers and Irving Berlin—a good assurance of stable value when listening a year from now.

Merrill Staton Voices: Sounds Broadway! Sounds Hollywood! **Epic BN 604**

Here's proof that very little instrumental assistance is required to produce an arresting album of show songs. Arrangers Norman Leyden and Frank Hunter, working with the mixed voices of the Merrill Staton Choir, have zeroed in on two composers of stage and screen who have specialized in songs loaded with banter. Concentrating on the output of Irving Berlin and Frank Loesser, the choir has at its disposal some of the most ingenious lyrics in the business when it comes to deployment possibilities for stereo recording. If you happen to start this record at Side Two (an unimportant matter in a collection such as this) you'll find yourself caught between two sets of lyrics while they're being manipulated in the *Fugue for Tinhorns* from Loesser's "Guys and Dolls." Most recordings of this type have been content to place the men in one channel and the ladies in the adjacent one, a device that can wear quite thin before the record is over. The arrangers, to their credit, have not been content merely to avoid a trite formula. They have put together a good pattern of mixed placement in the handling of exceptional show tunes. Æ

"SINEWARD"

(*from page 58*)

gans, pianos, and the tympani isn't very obvious. And, interestingly, all the disputed quasi-musical devices show the same fundamentals!

Each is a system comprising:

1. A pure-noise generator.
2. An acoustic filter selecting preferentially certain vibration repetition rates.
3. A resonant system emphasizing certain harmonically related frequencies.

The pure-noise generator is some system that generates all the audio spectrum simultaneously—everything possible, in nearly equal energy intensity.

In the horns, it's the "Bronx Cheer" the player produces with his lips; in the violin family, it's a sawtooth wave produced by the rapidly repeated sticking-and-slipping of the rosined bow on the string. The percussive instruments use a single high-energy transient pip as the input energy. The reed wind instruments generate, essentially, a sawtooth noise to start with. The organ does much the same, using the vibrating column of air as the "reed" which controls the jetting flow of air from the pump.

The resonant chamber is dominant in some instruments, and totally, or almost entirely, missing in others. The only real difference between the cathedral organ and the steam calliope of circus days, is, quite literally, the cathedral; the building itself serves as the resonant chamber for the organ. Moved outdoors, it would sound remarkably like the steam calliope.

In the violins, the tuned strings control the rep-rate of the sawtooth of bow-on-string, while the body of the instrument serves as the resonant chamber.

The horns have the selective filter—the trombone is the clearest indication of that—but little-to-none of the resonant chamber effect.

But . . . notice that *no* successful musical instrument uses sine waves!

Then the present sine-wave approach to hi-fi music can be condemned on two basic counts:

1. It has not recognized that the human ear is a wave-form analyzer, not a harmonic analyzer. It hears rep-rates of wave-forms, not frequencies.
2. It has not recognized that music is fundamentally filtered noise, *not* combined sine waves. The theory has, actually, exactly reversed the situation; music is made by selection from noise and not from combining pure sine waves. Æ

STEREO CONSOLE MODIFICATIONS

(*from page 50*)

catalog diagram, it was actually constructed as shown in the lower diagram of *Fig.* 5—just exactly what was required, and at a considerable saving in cost over a tandem attenuator. There is probably a slight amount of crosstalk between the two channels, but it is not enough to be noticeable. Even with this attenuator, it was necessary to deform the cover slightly on the bottom so the panel would close. It is possible that the BAL-730-G pot, which is a little smaller in diameter, is actually wired in the same manner as the 330 series, but it was felt that the larger unit would be easier to modify with the resistors, and once having it and finding it exactly suitable, no further steps were taken to replace it.

The BAL-330-G has a nominal impedance of 600 ohms, and the bus impedance appears to be about 150 ohms. (The -G suffix indicates the impedance.) It is possible that a 250-ohm attenuator would serve better, but the present one seems to be perfectly satisfactory. A 150-ohm resistor was connected from each bus to the "hot" input terminal on the pot, and amplifier input was changed as described to match the 300-ohm output.

Relay Changes

With a stereo installation, it is necessary to switch two loudspeakers in each location, which necessitates an increase in the number of springs required. In the Studioette, besides switching the monitor speaker off, the relay also actuates the "on air" light and removes from the circuit a resistor which substituted for the relay coil resistance. The operating voltage for the relays derives from the drop across several resistors in parallel from ground to the center tap of the power transformer secondary—a potential of approximately 30 volts. Removal of the monitor amplifier and substitution of a second program amplifier reduces the total current drain from the power supply, so the available voltage for the relays is considerably reduced. Two 1200-ohm, 2-watt resistors—R-101 and R-102—are removed from the circuit, and a 7500-ohm, 50-watt resistor is connected from B+ to ground to simulate part of the overall power supply load, with the slider permitting adjustment of the relay voltage to the required 30 volts. This was mounted vertically on the chassis in the spot where the original monitor output transformer had been located.

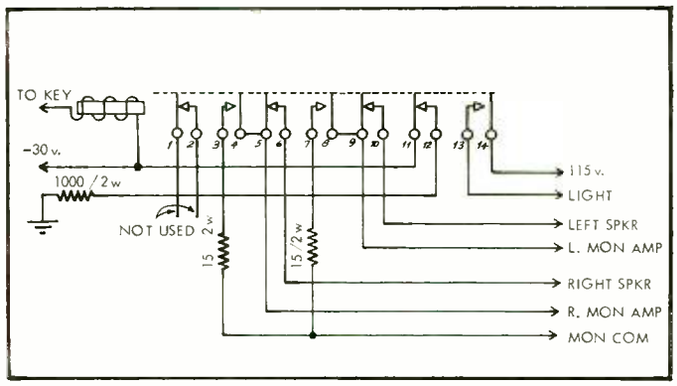


Fig. 7. Wiring to relays K-101 and K-102 with the spring arrangement selected. In K-103, the resistor substituting springs would be a "break" pair such as 11 and 12, and the channel paralleling springs would be a "make" pair such as 13 and 14.

Two new relays were required for switching the monitor and studio loudspeakers. The chassis is already drilled to accommodate four relays, which are known as Type J (Clare) or Type Q (Philtrol), and which have coil resis-

NO. 7 . . . "The PERCEPTION OF STEREO"

The curator of the Bronx Zoo knows of no species of animal which has a single ear. Like all animals and insects, we humans have evolved bilaterally, that is, we are symmetrical to the right and left, thus we have dual sense organs. two ears, two eyes, two hands, two legs, etc. This biological arrangement of duality gives us the perception of space, or sense or orientation.

We determine space with its qualities of breadth, height, depth or distance, or what we call overhead or underfoot, by our dual sensations of vision and dual hearing.

As far as sound is concerned we are made aware of space by a complicated business of acoustic wavetrains, by experience and instinct, and of course by certain integrations formed in the brain. Therefore, consciousness of 3-dimensional sound is not a single phenomenon affecting only a simple organ. Geometric space is formed by our perception of both physical and physiological events. The combination of these reveal the information regarding the sound, such as, its distance, its angle or position. It tells us whether the source is near or far, to the right or left, or whether it is stationary or in motion. This is stereo perception, because we have two ears. Actually we apply all these properties to a sound intuitively, for since infancy our hearing acuity becomes enriched by everyday common experiences. We are a noisy biped and we therefore require a complicated process for sound analysis.

I suppose that we have this acute hearing facility because of biological necessity, adapted out of the instinct for self-preservation. We distinguish between the sound of a large body and the sound of a small body, between the tread of a large animal and a small animal, and we know in what direction the danger lies. Our dual hearing performs a very necessary part in our social and economic existence. We can recognize a particular voice and its location among fifty others at a noisy cocktail party. A single ear or microphone. could not give us all this information. Nor can an elaborate array of microphones and loudspeakers replace the sophisticated analysis possible by two perfect ears.

The brain does not record a sensation of depth or location unless the sounds at each ear convey slightly different sonic stimulii. The sensation of realism or depth of sound is due to binocular hearing, that is, each ear hears two slightly different sounds, so that when combined. the final sound interpreted by the brain appears in a new guise. Our brain, our memory and experiences go to work and we can then spot the location of the sound, identify its nature and so on. We gain the maximum information under these conditions. In other words, it is real.

Let me further define stereo sound. Stereo presents two 2-dimensional sounds simultaneously to our two ears, and they are so related that the brain reacts to these sounds giving us a 3-dimensional sound picture, only if the 2-dimensional sounds are somewhat different from each other.

Stereo reproduction is not just a wide-spread sound, it is not a curtain or wall of sound. It is not merely the formation of an equilateral triangle between two speakers and a listener. It is not a matter of speaker placement alone. Stereo is more than enhanced reproduction, it is more than clarity or smoothness or wide frequency range.

tances of 1000 ohms. Required contacts are: one make, (A), for the on-air light; one break, (B), for removing the substitute resistor from the circuit; and two break-make, (C), for switching the speaker circuits and substituting dummy load resistors. The (C) contact may be replaced by one (A) and one (B), as shown in *Fig.* 7, which was the arrangement chosen because of local availability. Both K-101 and K-102 were replaced with the new types so as to be able to switch both monitor and studio speakers. One of the original relays was mounted as K-103, using one pair of break contacts to remove the substitute 1000-ohm 2-watt resistor, and one of the make pairs to parallel the channels. The coil of K-103, in series with utility key 1 and one pair of contacts in the external pushbutton switch in series is connected across the coil of K-101. After completion of the entire modification, the slider on the 7500-ohm resistor should be adjusted to provide 30 volts for the relay circuits.

Metering

Because of the mechanical construction of the console, it did not seem feasible to install a second VU meter directly, and the over-all channel comparison is facilitated by a differential VU meter (Lafayette Radio, model TM-66) which is mounted on the right side of the console. The left channel is thus normally monitored by the existing VU meter, while the difference is indicated by the external meter. However, spare utility key 3 is wired so that it switches the normal VU meter onto the right channel when desired. This key is adjacent to the meter, and thus logically located for this purpose.

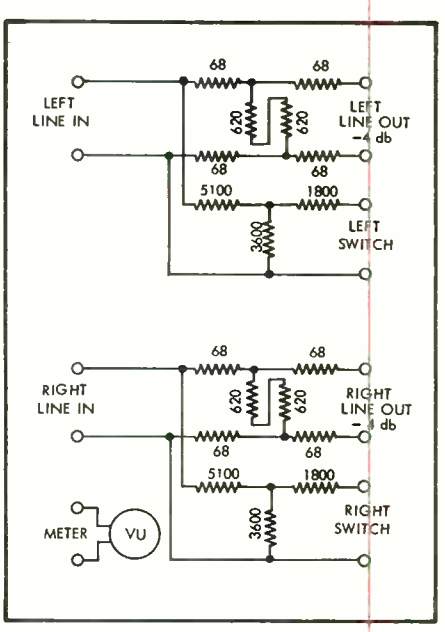


Fig. 8. Schematic of new line pad and VU meter attenuator required for stereo operation with one VU meter.

The line pad, 4 db, and the meter pad in the Gates console are combined on an etched panel which is mounted on the terminals of the VU meter. Duplicating the circuits resulted in the schematic of *Fig.* 8, and another etched panel was prepared to replace the original one. This panel, $2\frac{3}{4} \times 3\frac{1}{4}$ inches in size, is shown full scale in *Fig.* 6, (page 50), with the placement of the resistors and the external connections. The resistors are mounted on the side opposite the etched circuit, and the panel is mounted so the resistors are on the side away from the meter just as in the original panel. Practically any photo-engraver can make the required etched panel directly from *Fig.* 7, provided you furnish him with the laminate. However, explain to him that the diagram should be "flopped" (reversed from left to right) when he makes the negative since you are not going to print with it.

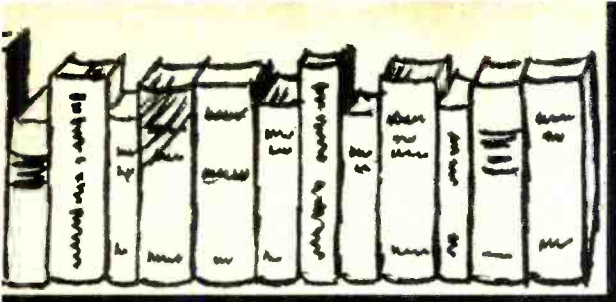
The two quarter-inch holes mount directly over the meter terminals, and for the external connections it is suggested that small right-angle terminals be eyeletted along the two sides of the panel on the side opposite the etched wiring.

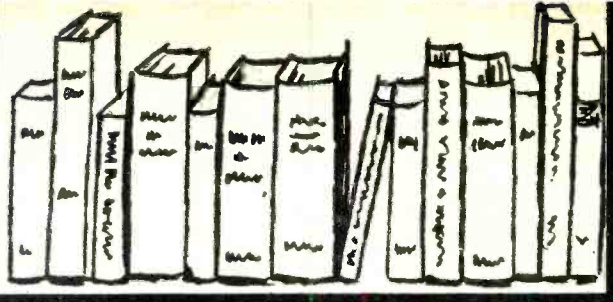
Other Changes

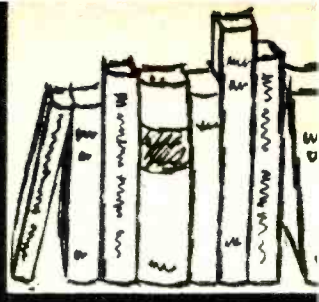
The normal monitor amplifier is equipped with a 40-μf, 450-volt filter capacitor which serves as part of the filtering for the entire amplifier system. When this amplifier is replaced with the second program amplifier, the capacitor should be replaced with another of equal value. Two 20-μf, 450-volt tubulars can be mounted under the chassis for this purpose.

Elimination of the original monitor amplifier also eliminates the 600-ohm source for program cue. To restore this function, a 600/600 line matching transformer was connected from the program cue circuit to the left monitor amplifier output, using a 560-ohm series resistance on the voice-coil side. Phone monitoring for mono remains as in the original console, with the utility jack on the front panel being converted to stereo by replacing with a three-circuit jack. A 2000-ohm resistor from one side of the "right" output line to the ring spring, and a jumper from the mono phone jack on the "left" output line to the tip spring provides the two-channel feed for stereo phones. The sleeve of the jack is connected to system ground.

As mentioned earlier, the peculiarity of the stereo generator is such as to diminish the need for the compressor/limiter which was normally used for mono. To avoid crosstalk into the SCA channel it was found necessary to operate on stereo at approximately 6 db below the normal VU excursions. To simplify the operating procedure, the main "stereo/mono" changeover switch —located between the console and the







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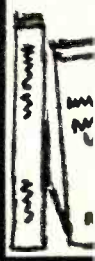

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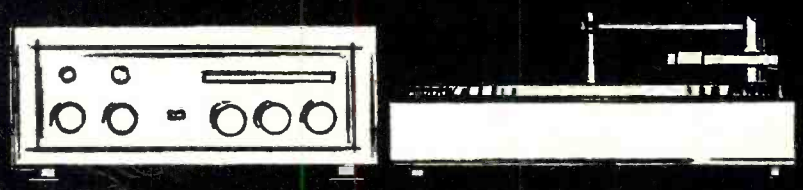

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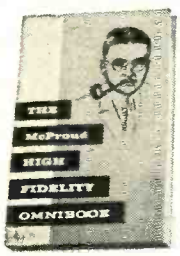

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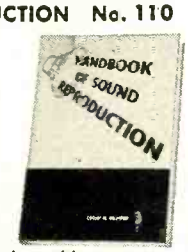

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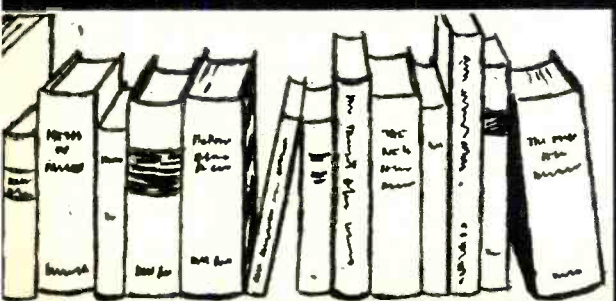

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transmitter and with a third position for Studio B in mono—was wired so that in the stereo position a 6-db pad was inserted in both right and left lines, in addition to turning on the 19-kc pilot oscillator. The reduction of 6 db in the normal line level was sufficient to place the signal well below the point where the compressor amplifier operated. It might be desirable to install another compressor, but it has not yet appeared to be necessary.

Conclusion

While exact step-by-step details have not been furnished in this description of the changes, it is felt that they are not actually necessary. With all the material on hand, it should be possible to make the modification in from 20 to 25 hours, providing the console may be taken out of service completely for the job. At WLIR, however, we worked on a "gradual" basis, never starting until the station went off the air at 1:00 a.m. and finished around 5:00 or 6:00 in the morning with a specific series of steps, after which it was necessary to check out the system in the normal mono mode so it would be ready to go on the air again at 8:00. While this ensures that each series of steps is complete and correct, it does take more time, and such a procedure is not recommended—particularly if the modifying personnel has other work to do during the day following each session. However, it *can* be done that way, even though it is not recommended.

The writer will be pleased to learn of any other similar modifications, or to fill in any details of these changes to any interested station personnel. Æ

ELECTRONIC ORGANS

(from page 40)

the value of the organ. The individual kits vary in complexity and are priced from $6.00 through $350.00. Keyboards, consoles and the like are furnished completely assembled.

Artisan (Electronic Organ Arts) offers the widest catalog listing for kits and completed organs. They furnish organs and kits with many professional features. Artisan also furnishes kits for expanding the existing capabilities of commercial electronic organs and for assembling an electronic organ into consoles salvaged from churches and theatres. They too estimate a minimum saving of 50 per cent. This saving is really impressive when considering an organ in the $5000 class.

Although the techniques for assembling an organ are identical to those involved in any other hi-fi kit, the instruc-

tions are much more compact. If assembling your amplifier or tuner was fun and its use a thrill because you assembled it yourself, then doing an organ will be thirty times as great a reward. Organ kit companies estimate that 120 to 200 hours of assembly time is involved for a typical organ. Rather complete advertising literature and demonstration records can be obtained directly by mail.

Schober and Artisan, offer such accessories as chimes and percussion units which are useful for implementing other organs. Artisan offers an interesting accessory called the Band Box which contains electrically operated drum, snares, bells, castanets, marimba, and so forth. Such a unit can be had either in kit or assembled form. Wurlitzer also sells a Rhythm Box for augmenting organs or pianos.

A word about tuning and service. Unlike the tuning of pianos which necessitates skill in tuning by beats, organs can be tuned by an untrained individual using precision forks—or through the use of tones recorded on an LP record. Such a record can be played through a high-fidelity system. Schober and others furnish such prerecorded tones. Stroboscobic tuning devices for the most accurate tuning of organs are available from Schober, Artisan, and Conn.

Troubleshooting an organ is usually not a problem since failures are rare. When they do occur, it is easy to spot the trouble—over-all failure indicates power supply, preamp or amplifier, or interconnection failure. Individual note failures are associated with the oscillator for that note; whereas, coupler or stop failures are self identifying.

The organ has properly been called the King of Instruments—capable of thrilling and majestic sound. Today, you can own an organ for little more than the cost of a piano. Where else is there the satisfaction of mastering an orchestra of sound, or of many different solo instruments at will? The finest sound that your audio system has ever delivered will fail in comparison to the music that you make for yourself. This music will add a new dimension of enjoyment and satisfaction to your home music system. Æ

CLASSIFIED

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Industry Notes...

• **Backus Joins Roberts.** Reginald Backus, formerly Chief Engineer for Flight Industries, Inc., has been appointed Chief Engineer for **Roberts Electronics, Inc.** Backus will be in charge of engineering of all Roberts tape recorders and negative ion generators, Sonic-Thesia units, and new products currently engineered by Roberts for the medical field.

• **Michigan Magnetics Appoints Assistant Sales Manager. William R. Spackman,** general Sales Manager of Michigan Magnetics, Inc., has announced the appointment of **Bernie L. Killinger** as Assistant Sales Manager. Killinger has been in the Michigan Magnetics sales department for the past two years, and had previously been sales co-ordinator for **Redmond Company,** Owosso, Michigan. In his new capacity Mr. Killinger will correlate all sales programs and, in addition, he will do field contact work in the Ohio, Michigan and Indiana areas.

• **Shure Forms British Subsidiary.** The establishment of **Shure Electronics, Limited,** London, England, as a wholly owned subsidiary was announced by Shure Brothers, Inc. **F. V. Machin,** Vice-President of Marketing for the parent firm, said that the new subsidiary was formed in order to handle the expanding market for Shure products in the British Isles. He pointed out a growing acceptance of high fidelity in England. The formation of the subsidiary included the appointment of **John W. Maunder,** former Shure sales representative for the British Isles, as Managing Director of the new operation. Mr. Maunder has been General Manager of **Vita-Vox,** Ltd., for fifteen years. During that time he was closely associated with industry, technical and export activities in the Radio and Electronic Component Manufacturers' Federation. The British Sound Recording Association, of which he is a council manager. He is an associate member of the Institute of Electrical Engineers and was engaged during the war years with the Admiralty, specializing in naval internal communication systems.

• **Horowitz Builds Empire.** In a move obviously calculated to increase consumer recognition **Audio Empire** has shortened their name to **Empire.** At the same time in recognition of the outstanding services performed by **Herb Horowitz** in gaining consumer acceptance of the Empire line, Mr. Horowitz has been elevated to the post of **President.**

• **Annapolis Electroacoustic and Chesapeake Instrument Merger Approved.** A proposal to merge Chesapeake Instrument Corporation, Shadyside, Maryland and Annapolis Electroacoustic Corporation, Annapolis, Maryland, was approved by the Boards of Directors and will be submitted to the stockholders of both corporations. Chesapeake Instrument will continue to operate Annapolis Electroacoustic as a division. Annapolis Electroacoustic through its division, Ravenswood, markets consumer high fidelity equipment and components.

ADVERTISING INDEX

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Holiday for Strings
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It's All Right With Me
Stella by Starlight
Out of My Dreams
El Choclo
Blues in The Night
Jazz Pizzicato

Gigi

Title Song
Waltz at Maxim's
Thank Heaven for Little Girls
The Parisians
I Remember It Well
The Night They Invented Champagne
Reprise: Gigi

My Fair Lady

On the Street Where You Live
I've Grown Accustomed to Her Face
With a Little Bit of Luck
I Could Have Danced All Night
The Rain in Spain
Wouldn't It Be Loverly
Show Me

★ Original Broadway arrangements of 13 top tunes from both "Gigi" and "My Fair Lady," re-creating the sparkle of opening night for thirty entertaining minutes

★ PLUS "Silk Satin and Strings," a half-hour of all-time favorites including "Blues in the Night," "Holiday for Strings," and ten more memorable melodies...two *current catalog* albums (Concertapes No. 4T-4001, $7.95, and No. 4T-3006, $6.95) combined on one hour-long Tarzian Tape to give you a $14.90 value

★ PLUS a full 7-inch reel of blank Tarzian Tape, factory-sealed in protective plastic and quality-guaranteed.

This entire "Triple Treat" package is now available at leading tape dealers for only the price of two reels of blank Tarzian Tape and $1.49.

Here is music for pleasurable listening, imaginatively interpreted by Caesar Giovannini and the Radiant Velvet Orchestra in true stereo sound. It covers the entire range of popular music at its best...from the romantic "Falling in Love With Love" to the toe-tapping tempo of "The Night They Invented Champagne." This is current catalog music, available now at a price far below the retail cost—and combined on one professional-quality Tarzian Tape to provide a full hour of musical entertainment.

As you listen, your ears will detect a wide frequency response and dynamic range; a smoothness and clarity of sound unusual even in high-fidelity stereo tapes. That's when you should unwrap the blank reel of Tarzian Tape. Use this tape to record a special FM program, or several favorite records. We'll bet that the playback will reveal the same depth and realism that you enjoyed on the studio-produced tape.

Hard to believe? That's exactly why we are making this special offer. More surely than anything we can say, *your* ears can prove to you that Tarzian Tape does indeed make possible a new fidelity in sound reproduction, in your home as in the professional studio.

Try it. Visit your favorite tape dealer today and get your "Triple Treat" package from Tarzian. Better yet, spread the fun...get several packs for Christmas giving.

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The FM-15 (top) and the S-15 (bottom) are available as separate units or in a handsome walnut or teak combined package. How? No heat means the tuner can be stacked with the amplifier without danger of drift.